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Occupational Health and Safety in the Healthcare Sector

Edited by
Alberto Modenese and Fabriziomaria Gobba

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About the Editors

Alberto Modenese

Alberto Modenese is an occupational physician and Post-Doc Researcher at the Chair of Occupational Medicine of the University of Modena and Reggio Emilia (Modena, Italy). He obtained a post-graduate specialization degree in Occupational Medicine in 2014, and a PhD in "Clinical and Experimental Medicine"in 2017. He is the Secretary of the Scientifc Committee "Radiation and Work"of the International Commission of Occupational Health (ICOH). His research is focused on the studying of preventive measures, exposure evaluation methods and epidemiology of health effects related to occupational exposure to various risk factors in workers.

Fabriziomaria Gobba

Fabriziomaria Gobba (M.D.) is Full Professor of Occupational Medicine at the University of Modena and Reggio Emilia. He is President of the Occupational Medicine section of the European Union of Medical Specialists (UEMS), Coordinator of the Post- graduate Specialization School of Occupational Medicine of the University of Modena and Reggio Emilia, past-Chair of the Scientific Committee "Radiation and Work"of the International Commission of Occupational Health (ICOH, up to 2018), Vice-President of the Italian Association of Medical Radioprotection (AIRM) and Member of the National Board of the Italian Society of Occupational Medicine (SIML). He has authored more than 160 publications on topics related to the prevention of occupational risks and work-related health effects in workers, with an h-index of 27 according to Scopus and more than 2000 citations.

Preface to ”Occupational Health and Safety in the Healthcare Sector”

Healthcare workers are exposed to several different occupational risk factors, and they pay an important tribute in terms of occupational diseases and work-related injuries. Currently, the COVID-19 pandemic has focused the attention on the problem of the infectious risk, which is certainly among the risks typically expected and specifically recognized for the health personnel, but also other occupational risks should not be overlooked, as, e.g., the risks associated with work-organization factors and with the exposure to chemical and physical agents. The health consequences associated with the exposure to all these factors have relevant impacts in terms of induced diseases, DALYs, sickness absence from work and costs for the health systems.

According to these premises, this reprint has collected manuscripts addressing topics related to the prevention of the occupational risks in the healthcare sector, including original articles and reviews on the prevention of work-related illnesses and injuries of the health personnel, as well as on the evaluation of the risks in the healthcare workplaces, and on the topics of risk perception and of the knowledge and attitudes of the workers towards the preventive procedures and the use of protections. The themes of the prevention of occupational infectious risk, biomechanical overload of the musculoskeletal system and work-related psychosocial factors are specifically discussed in the papers collected.

Alberto Modenese and Fabriziomaria Gobba
Editors

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Article

Factors Associated with SARS-CoV-2 Infection Risk among Healthcare Workers of an Italian University Hospital

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Abstract: We report the results of a study on the cumulative incidence of SARS-CoV-2 infections in about 6000 workers of the University Hospital of Modena, Northern Italy, in the period March 2020–January 2021, and the relations with some individual and occupational factors. Overall, in healthcare workers (HCW) the cumulative incidence of COVID-19 during the period was 13.8%. Results confirm the role of overweight and obesity as significant risk factors for SARS-CoV-2 infection. Chronic respiratory diseases, including asthma, also proved to be significantly associated with the infection rate. Considering occupational factors, the COVID-19 risk was about threefold (OR: 2.7; 95% CI 1.7–4.5) greater in nurses and nurse aides than in non-HCW, and about double (OR: 1.9; 95% CI 1.2–3.2) in physicians. Interestingly, an association was also observed between infection risk and nightshifts at work (OR: 1.8; 95% CI 1.4–2.3), significantly related to the total number of shifts in the whole eleven-month period. Even if the vaccination campaign has now greatly modified the scenario of SARS-CoV-2 infections among HCW, the results of this study can be useful for further development of health and policy strategies to mitigate the occupational risk related to the new variants of coronavirus, and therefore the evolution of the pandemic.

Keywords: COVID-19; SARS-CoV-2; health surveillance; healthcare workers; risk prevention; occupational risk factors; infectious risk

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1. Introduction

The relevant occupational risk related to SARS-CoV-2 infection in healthcare workers (HCW) is widely recognized [1,2]. This occupational group may have an increased risk of COVID-19, including severe disease, depending on various individual risk factors common to the general population such as male sex, older age, overweight and obesity and the presence of various concomitant chronic diseases [3–7]. The U.S. Centers for Disease Control and Prevention (CDC) indicates that the conditions associated with an increased likelihood of getting a severe illness from COVID-19 are: (i) being an older adult, as more than 81% of SARS-CoV-2 infection-related deaths occur in people over age 65; (ii) the number of underlying medical conditions, including (but not limited to) cancer, chronic kidney disease, liver disease, chronic lung diseases as moderate or severe asthma, bronchiectasis, bronchopulmonary dysplasia, chronic obstructive pulmonary disease, cystic fibrosis, pulmonary embolism, pulmonary hypertension, dementia and other neurological conditions, diabetes (both type 1 or type 2), heart conditions such as heart failure, coronary artery disease, cardiomyopathies, and possibly hypertension, HIV infection, mental health conditions such as depression and schizophrenia, obesity, solid

organ or blood stem cell transplant, stroke, tuberculosis and others; (iii) long-standing systemic health and social inequities, certain ethnic minority groups and disabilities; (iv) smoking habit; (v) pregnancy; (vi) refusal of, or contraindication to undergo, anti-COVID-19 vaccination; (vii) inadequate compliance with the preventive measures for COVID-19 [8]. Moreover, HCW have an additional COVID-19 risk depending on the type of job and on the specific procedures and working tasks they have to perform [9–12]. Various groups of HCW have been recognized for their increased risk of getting SARS-CoV-2 infections, such as, among others, the frontline HCW, those of the emergency and first aid departments, all the staff of the COVID-19 wards in the hospitals and also the general practitioners in the territory [1,2,10–14]. Among the main occupational risk factors are the availability and use of appropriate personal protective equipment (PPE) and of other protections, as well as the performance of specific trainings on the appropriate procedures to reduce the infectious risk [9,13,15–17]. Other work-related factors that may increase the risk of COVID-19 for HCW have been hypothesized in recent studies, such as poor sleep quality, higher working pressure and other psychosocial factors, while less data are available on the performance of nightshifts at work [6,18,19].

The aim of this article is to evaluate the incidence of COVID-19, and the relation with some of the main individual and occupational risk factors for SARS-CoV-2 infection, in a large cohort of HCW from a University Hospital of Northern Italy, i.e., one of the countries of the world after China to be the earliest and most strongly affected by the COVID-19 pandemic, during an eleven-month period up to January 2021.

2. Materials and Methods

2.1. Study Setting and Population

We evaluated SARS-CoV-2 infection rates in the period 1 March 2020–31 January 2021, and a set of individual and occupational factors possibly associated in a cohort of workers of the University Hospital of Modena, the chief town of an Italian province of about 700,000 inhabitants situated in Emilia-Romagna Region, in the north of Italy. Approximately 6000 workers were employed. The study is retrospective and has been performed in accordance with the Declaration of Helsinki and received the approval of the Institutional Review Board.

2.2. Data Collection

According to the current Italian occupational health and safety legislation, University Hospital workers exposed to occupational risks must undergo a regular Health Surveillance (HS) program implemented by the Occupational Health Surveillance service (OHS). All University Hospital workers involved in the HS program were considered potentially eligible for the study. The inclusion criteria were to be a worker of the University Hospital (any type of job contract was included, e.g., employees, freelance collaborators, interns, trainees and resident physicians, etc.), and to be at work between the 1 March 2020 and the 31 January 2021. No age restrictions or other exclusion criteria have been applied.

Considering the specific SARS-CoV-2 risk, a periodic rhino-pharyngeal swab for the diagnosis of SARS-CoV-2 infections was added to the usual HS program, including medical examinations and other health investigations needed. At the beginning of the pandemic, when there was a scarce availability of diagnostic swabs, the exam was proposed only to the operators with suspected symptoms or close contacts with infected subjects. Then, after the 1 April 2020, a biweekly screening with serological immunochromatographic tests was also introduced, and for all the operators, when this resulted in a positive test a diagnostic swab was required. Meanwhile, according to an increased availability of swabs, the tracing of the suspected risky contacts was improved, which involved testing not only symptomatic subjects and close contacts but all the operators with documented inadequately protected exposure to a COVID-19 case. At the end of May 2020, the first swab screening of all the operators of the University Hospital started, and up to the middle of October all the operators had been tested, while the workers of the high-risk

departments, e.g., Pneumology and Infectious Diseases, were screened twice during this period. Meanwhile, the serological screening tests with confirmation of the positivity with swabs and the tracing of the symptomatic subjects and of the risky contacts continued. At the end of October, the serological screening was abandoned, and a screening with a diagnostic swab every 14–21 days was introduced.

We retrospectively collected data relevant for this study stored in the medical records of the OHS of the University Hospital, including socio-demographic data such as age and gender, body mass index (BMI), smoking habit, job task description and comorbidities/pathological anamnesis. The results of the SARS-CoV-2 rhino-pharyngeal swabs were directly obtained from the Service of Clinical Virology and Microbiology of the University Hospital. Moreover, as the vaccination campaign against SARS-CoV-2 infections began in Italy on 27 December 2020 and HCW were involved since its beginning, we also collected the information on the performance of the vaccine during the last month of observation of the study, including the type of vaccine and the dates of the first and, if performed, of the second dose.

The ages of the participants were categorized by decade ($\leq$30, 31–40, 41–50, 51–60 and >60 years). The job tasks were classified as follows: (1) nurses and nurse aides; (2) physicians; (3) other HCW, including, e.g., obstetrics and physiotherapists; (4) non-HCW, including technical and administrative personnel of the hospital. The working units of the HCW (as emergency departments and other surgical and medical units) were also collected, with the objective to analyze the differences in infection rates among the units. Nonetheless, these data proved to be scarcely informative due to a high turnover of the operators across different departments according to the immediate needs, especially during the hardest months of the pandemic, and to the temporary conversion of many units into "COVID-19 departments" for different periods (weeks/months). As a consequence, during the observed period the large majority of the examined HCW worked in more than one different unit, for a variable amount of time, thus making any realistic inference on the differences of the risk impossible. Another aspect of the working activity taken into account was the involvement in nightshifts that, according to some data, possibly induces a higher risk of COVID-19 [6]. Accordingly, the involvement in nightshifts, and the total number of nights worked in the eleven months between March 2020 and February 2021, were collected.

The BMI of the subjects was categorized as underweight (BMI < 18.5), normal (18.5 and 24.9), overweight (25 and 29.9) and obese (BMI $\geq$ 30), and smoking habit as current smoker, ex-smoker and non-smoker. Information on the diseases were collected with an automatic data extraction from the electronic medical records of the workers, searching the records with specific keywords, integrated with a hand search of the medical records of the HS. In particular, the occurrence of the following diseases was investigated: (a) cardio-vascular diseases (including diseases of the cardiac rhythm, ischemic diseases such as coronary syndrome and stroke, and various others); (b) hypertension; (c) diabetes (both type 1 and 2); (d) neoplastic diseases (any type of malignancies diagnosed in the previous five years); (e) chronic respiratory diseases (including asthma, chronic obstructive pulmonary disease, cystic fibrosis, sleep apnea and others); and (f) autoimmune diseases (including various types of syndromes as autoimmune hypothyroidism, Sjögren's syndrome, systemic lupus erythematosus and several others). Even if the active search of the diseases was comprehensive, it cannot be excluded that a quote, e.g., those with a completely therapeutic control and/or asymptomatic, was not captured, and for this reason we decided to categorize the variables as "presence of the disease" vs. "disease not reported".

Finally, the results of the rhino-pharyngeal swabs for the diagnosis of SARS-CoV-2 infection through reverse transcription-polymerase chain reaction (RT-PCR) were also collected directly from the service of Clinical Virology and Microbiology of the University Hospital. We extracted all positive results (indicative of the presence of COVID-19 infection) which occurred in the whole examined group in the period 1 March 2020–31 January 2021. The results were then categorized according to the occurrence of SARS-CoV-2 infection

as "No infection" and "Infection": in any case of at least one positive swab in the whole period the worker was classified in the latter group.

2.3. Statistical Analysis

We calculated the overall frequency rates of SARS-CoV-2 infections that occurred in eleven months and then, using descriptive statistics, we evaluated the differences of the infections' rates across the subgroups of workers identified according to the variables collected and mentioned in the previous paragraphs. In order to evaluate statistical differences, recognized for a p value < 0.05, we calculated Pearson's Chi square tests.

We then performed a multiple logistic regression analysis for the evaluations of the associations between the investigated variables and SARS-CoV-2 infection in the examined sample. Adjusted odds ratios (aOR) have been calculated, with 95% confidence intervals (CI). We considered two different adjusted models, both of them evaluating the possible effects of the variables related to gender, age, BMI, smoking habit, job task and nightshifts at work on the COVID-19 diagnosis. In model 1 we included also the dichotomous variable "presence of any disease", while in model 2 we considered only "chronic respiratory diseases".

3. Results

The total sample involved in the HS program implemented by the OHS of the University Hospital in the observed period included 5,897 workers, mean age 42 ± SD 12.14 years. A total of 70.7% were females; the overweight and obese represented, respectively, 23.0% and 9.0% of the sample; and 18.8% were smokers.

In 765 workers, at least one rhino-pharyngeal swab proved positive during the eleven-month period of observation, showing that 13% of the University Hospital workers were infected by SARS-CoV-2 from 1 March 2020 up to 31 January 2021 (Table 1). Considering only HCW, the infection rate was 13.8%.

Table 1. Characteristics of the studied population with respect to COVID-19 diagnosis during the eleven-month observed period (significant results are marked in bold).

Considered Variables		University Hospital Workers Studied N (% of the Whole Sample)	SARS-CoV-2 Infection Diagnosis		p
			No Infection N (%)	Infection N (%)	
Gender	Females	4168 (70.7)	3650 (87.6)	518 (12.4)	**0.05**
	Male	1729 (29.3)	1482 (85.7)	247 (14.3)	
Age classes (years)	≤30	1312 (22.3)	1153 (87.9)	159 (12.1)	0.11
	31–40	1512 (25.6)	1313 (86.8)	199 (13.2)	
	41–50	1318 (22.4)	1130 (85.7)	188 (12.3)	
	51-60	1329 (22.5)	1150 (86.5)	178 (13.5)	
	>60	426 (7.2)	386 (90.6)	41 (9.4)	
BMI (missing data = 1468)	Underweight	228 (5.1)	209 (91.7)	19 (8.3)	**0.004**
	Normal weight	2784 (62.9)	2445 (87.8)	339 (12.2)	
	Overweight	1019 (23.0)	868 (85.2)	151 (14.8)	
	Obese	398 (9.0)	328 (82.4)	70 (17.6)	
Smoking habit (missing data = 3033)	Non smoker	2864 (74.1)	2475 (86.4)	389 (13.6)	0.51
	Ex-smoker	274 (7.1)	238 (86.9)	36 (13.1)	
	Current smokers	728 (18.8)	641 (88.0)	87 (12.0)	

Table 1. *Cont.*

Considered Variables		University Hospital Workers Studied N (% of the Whole Sample)	SARS-CoV-2 Infection Diagnosis		*p*
			No Infection N (%)	Infection N (%)	
Job category	non-HCW	622 (10.6)	583 (93.7)	39 (6.3)	**<0.0001**
	Nurses & Nurse aides	2603 (44.1)	2129 (81.8)	474 (18.2)	
	Physicians	1790 (30.3)	1587 (88.7)	203 (11.3)	
	Other HCW	882 (15.0)	833 (94.4)	49 (5.6)	
Nightshifts at work	No	4639 (78.7)	4149 (89.4)	490 (10.6)	**<0.0001**
	Yes	1258 (21.3)	983 (78.1)	275 (21.9)	
Presence of reported diseases (any)	No	4707 (79.8)	4104 (87.2)	603 (12.8)	0.47
	Yes	1190 (20.2)	1028 (85.7)	162 (14.3)	
Cardiovascular diseases (including hypertension)	No	5492 (93.1)	4785 (87.1)	707 (12.9)	0.40
	Yes	405 (6.9)	347 (85.7)	58 (14.3)	
Hypertension	No	5573 (94.5)	4852 (87.1)	721 (12.9)	0.73
	Yes	324 (5.5)	280 (86.4)	44 (13.6)	
Diabetes	No	5818 (98.7)	5062 (87.0)	756 (13.0)	0.67
	Yes	79 (1.3)	70 (88.6)	9 (11.4)	
Neoplastic diseases	No	5672 (96.2)	4931 (86.9)	741 (13.1)	0.29
	Yes	225 (3.8)	201 (89.3)	24 (10.7)	
Chronic respiratory diseases	No	5817 (98.6)	5070 (87.2)	747 (12.8)	**0.02**
	Yes	80 (1.4)	62 (77.5)	18 (22.5)	
Autoimmune diseases	No	5435 (922)	4730 (87.0)	705 (13.0)	1.00
	Yes	462 (7.8)	402 (87.0)	60 (13.0)	

Regarding job related variables, of the whole population included in the analysis 89.5% were HCW: nurses and nurse aides represented 44.2%, physicians 30.3% and other HCW 15%; the remaining 10.5% had a different job category, including technical and administrative personnel, and therefore were defined as non-HCW. A total of 21.3% of the workers was engaged in nightshifts at work, with an average number of 38 (±SD 21.9) nightshifts in the previous eleven months (Table 1).

Diseases other than COVID-19 affected 20.2% of the population, which resulted in the diagnosis of at least one of the investigated diseases. The most frequent were autoimmune diseases (mainly thyroid gland diseases), hypertension, neoplasms, cardiovascular diseases, chronic respiratory diseases and diabetes, affecting, respectively, 7.8%, 5.5%, 3.8%, 2%, 1.4% and 1.3% of the population (Table 1).

3.1. Association of SARS-CoV-2 Infection with the Variables Studied

The distribution of the variables described in the Materials and Methods section within the whole group of workers, and in workers with and without SARS-CoV-2 infection is presented in Table 1. A positive association has been found for sex: men showed a SARS-CoV-2 infection rate of 14.3% compared to females (12.4%) ($p = 0.05$). In the whole sample, the workers were almost homogeneously distributed according to the different age classes, with the exception of subjects >60 years of age, representing only 7.3% of the population. The age distribution of SARS-CoV-2-infected workers was similar, with no significant differences observed (Table 1).

In the examined occupational group, no relation was observed between smoking habit and SARS-CoV-2 infection. Considering BMI, within the groups of overweight and obese subjects the percentages of workers with COVID-19 increased up to 14.8% and 17.6%, respectively ($p = 0.004$) (Table 1).

SARS-CoV-2 infections were more frequent in the group of HCW compared to non-HCW: considering, in particular, nurses and nurse aides, this group showed an infection rate of 18.2%, with a significant difference when compared to other groups ($p < 0.0001$) (Table 1). In addition, the involvement in nightshifts at work proved associated with having COVID-19, as the cumulative incidence of infections among nightshift workers reached 21.9% ($p < 0.0001$) (Table 1).

Finally, regarding the presence of diseases (any type), an association with the likelihood of being diagnosed with COVID-19 compared to the subjects not reporting any disease was observed, even if not significant, with a cumulative SARS-CoV-2 infection incidence of 14.3% vs. 12.8%, respectively, in the groups of the subjects with and without reported diseases ($p = 0.47$) (Table 1). Among the specific pathologies considered, the only positive significant association was found for the subjects with chronic respiratory diseases, showing a cumulative SARS-CoV-2 infections' incidence of 22.5% ($p = 0.02$) (Table 1).

3.2. Results of the Multiple Logistic Regression Analysis

In Table 2, we present the results of the multiple logistic regression analysis performed to confirm, after adjustments, the associations with the likelihood of SARS-CoV-2 infection observed in the univariate analysis. As described in the Material and Methods section, we used two different models, both adjusted for gender, age, BMI, smoking habit, job task and nightshifts at work. Model 1 investigated the association of COVID-19 diagnosis with the presence of any disease, while in model 2 we kept only the presence of chronic respiratory diseases, i.e., the only specific diseases significantly associated with SARS-CoV-2 infection in the univariate analysis.

In male workers a positive adjusted odd ratio (aOR), even if not significant, was observed both in models 1 and 2 compared to females. An increased aOR in overweight compared to normal weight workers was confirmed in both model 1 (1.28; 95% CI 1.01–1.62) and model 2 (1.27; 95% CI 1.00–1.61), and in the obese the aORs were even higher: 1.41 (95% CI 1.01–1.95) and 1.38 (95% CI 1.00–1.92), respectively, in model 1 and 2 (Table 2).

Considering job role, the two groups of nurses and nurse aides and of the physicians confirm a significantly increased aOR in both models 1 and 2 when compared to non-HCW: the former occupational group had an aOR of 2.67 (95% CI 1.63–4.37) in model 1 and of 2.74 (95% CI 1.67–4.50) in model 2; doctors show an aOR of 1.91 (95% CI 1.16–3.14) and of 1.94 (95% CI 1.17–3.19), respectively, in models 1 and 2 (Table 2).

The significantly increased likelihood of having COVID-19 in workers engaged in work nightshifts was confirmed in both the adjusted models: the aORs were, respectively, 1.80 (95% CI 1.41–2.30) and 1.78 (95% CI 1.39–2.28) in model 1 and 2 (Table 2). We also calculated the aOR related to the number of nights worked in the previous eleven months, considering the night work shifts as a continuous variable, in model 2: a slightly, but significantly, increased aOR of 1.006 (95% CI 1.00–1.01) for any single nightshift was estimated compared to workers not engaged in nightshifts.

In the adjusted model, no significant association between the likelihood of SARS-CoV-2 infection and the presence of any comorbidity was observed (aOR 1.13; 95% CI 0.88–1.45). While specifically considering the workers with chronic respiratory diseases in model 2, a significantly increased risk was confirmed (aOR 3.15; 95% CI 1.64–6.05) (Table 2).

Finally, smoking habit showed a significant association in the multiple logistic regression analysis: smokers had a significant negative aOR when compared to non-smokers of 0.70 (95% CI 0.54–0.91) in both the adjusted models (Table 2).

Table 2. Results of the multiple logistic regression analysis to evaluate adjusted odds ratios (aORs) with 95% confidence intervals (CI) for the variables gender, age, body mass index (BMI), smoking habit, job task, nightshift at work and the presence of any disease (*model 1*) or the presence of chronic respiratory diseases (*model 2*) in relation to the likelihood of being diagnosed with SARS-CoV-2 infection in the sample of workers of the University Hospital (significant results are marked in bold).

Studied Variables		**Adjusted Odds Ratio (95% Confidence Intervals)**			
		Model 1	***p***	**Model 2**	***P***
Gender	Females	ref.	0.77	ref.	0.76
	Male	1.03 (0.83–1.29)		1.04 (0.83–1.29)	
Age classes (years)	≤30	ref.	0.73	ref.	0.77
	31–40	1.20 (0.92–1.56)	0.17	1.19 (0.92–1.55)	0.18
	41–50	1.06 (0.80–1.43)	0.69	1.07 (0.79–1.43)	0.67
	51–60	1.06 (0.77–1.46)	0.71	1.08 (0.79–1.48)	0.61
	>60	1.06 (0.65–1.72)	0.82	1.09 (0.68–1.75)	0.72
BMI	Underweight	0.76 (0.45–1.26)	0.28	0.75 (0.45–1.25)	0.27
	Normal weight	ref.	0.41	ref.	**0.05**
	Overweight	**1.28 (1.01–1.62)**	**0.04**	**1.27 (1.00–1.61)**	**0.05**
	Obese	**1.41 (1.01–1.95)**	**0.04**	**1.38 (1.00–1.92)**	0.06
Smoking habit	Non smoker	ref.	**0.02**	ref.	**0.01**
	Ex-smoker	0.79 (0.54–1.16)	0.24	0.78 (0.53–1.15)	0.20
	Current smokers	**0.70 (0.54–0.91)**	**0.008**	**0.70 (0.54–0.91)**	**0.006**
Job role	Non-HCW	ref.	**<0.0001**	ref.	**<0.0001**
	Nurses and Nurse aides	**2.67 (1.63–4.37)**	**<0.0001**	**2.74 (1.67–4.50)**	**<0.0001**
	Physicians	**1.91 (1.16–3.14)**	**0.01**	**1.94 (1.17–3.19)**	**0.01**
	Other HCW	**0.50 (0.27–0.93)**	**0.03**	**0.50 (0.27–0.93)**	**0.03**
Nightshifts at work	No	ref.	**<0.0001**	ref.	**<0.0001**
	Yes	**1.80 (1.41–2.30)**		**1.78 (1.39–2.28)**	
Presence of reported diseases (any)	No	ref.	0.34	/	
	Yes	1.13 (0.88–1.45)			
Chronic respiratory diseases	No	/		ref.	**0.001**
	Yes			**3.15 (1.64–6.05)**	

By the 31st of January, 42% of the sample were fully vaccinated with two doses of the COVID-19 mRNA BNT162b2 vaccine, and another 33% were vaccinated with only one dose. During January we observed 195 cases of workers with COVID-19. Of these, only 69 workers were diagnosed after the vaccination: 37.7% within one week after the first dose, 44.9% between one and two weeks and 7.2% during the third week. Three subjects only (i.e., 4.3%) started to have symptoms and were diagnosed during the fourth week after the first dose, and another four workers (i.e., 5.8%) received a confirmation of a positive swab within one week after the second dose.

4. Discussion

Our study, performed in a sample of slightly less than 6000 workers of a Northern Italian University Hospital, found an eleven-month cumulative incidence of SARS-CoV-2 infections of 13 cases per 100 workers (13.8% considering only HCW). For comparison, in the whole of Italy about 145,000 cases of COVID-19 have been diagnosed in HCW [20], out of a total number of 1.3 million HCW according to EUROSTAT [21,22], i.e., about 11%.

This slight difference can be possibly explained considering that, especially during the first phases, North Italy, and in particular the Emilia-Romagna region, was one of the Italian areas most impacted by the COVID-19 pandemic. In the same period, the cumulative incidence in the general population in Modena province was 5.4% [23]. In Figure 1 we show a comparison of the monthly incidence of COVID-19 cases in the workers of the University Hospital and in the general population of the province of Modena (Figure 1).

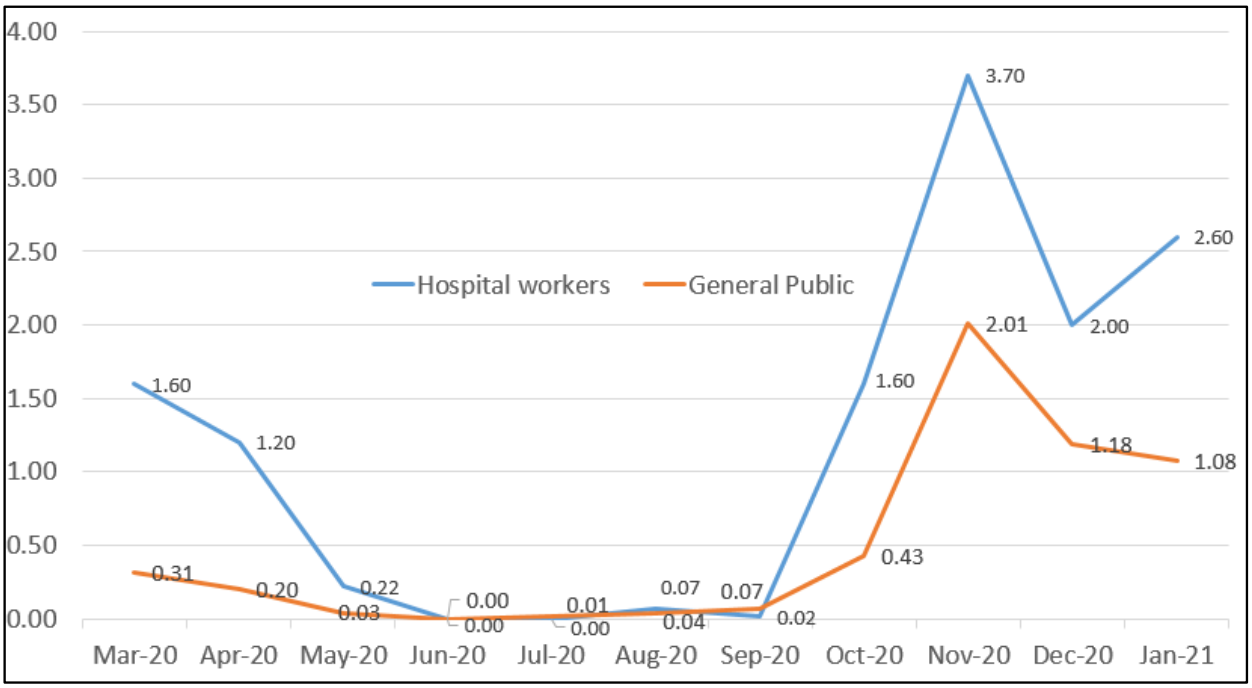

Figure 1. Trends of the SARS-CoV-2 infection rates per 100 subjects per month from March 2020 to January 2021 in the hospital workers vs. the general population of the province of Modena.

The higher incidence is largely expected considering that, especially during the first period of the COVID-19 pandemic, the HCW were at increased risk compared to the general population [1,2]. Moreover, during the period observed in this study they regularly underwent periodical rhino-pharyngeal swabs detecting also asymptomatic infections, at variance with the general population and other occupational categories [24]. In Italy, the vaccination campaign of HCW started in January 2021, while the period of observation considered in this study is between the 1st March 2020 and the 31st January 2021: the temporal overlapping with the vaccination campaign is very limited, and only part of the workers was vaccinated during January, and had the possibility to complete the two doses before the end of the month. Accordingly, the impact of vaccination on the infection risk in the examined group of workers is likely to be very limited, especially considering that only a minority of SARS-CoV-2 infections occurred in January in vaccinated workers, and in 83% of the cases the COVID-19 diagnosis was posed within two weeks after the first dose, i.e., in a period when the immune reaction was probably not adequately developed to effectively prevent the infection [25,26].

Among the general risk factors for SARS-CoV-2 infection, in our sample of HCW the known role of being overweight and obesity was confirmed: we found a significant adjusted odds ratio of 1.3 for the former and of 1.4 for the latter. These increased aORs are in line with the results reported by Gao et al. who found in a big cohort of slightly less than 7 million individuals significantly increased adjusted hazard ratios per unit increase in BMI, respectively, of 1.04 (95% CI 1.04–1.05) for COVID-19-related hospital admission, 1.09 (95% CI 1.08–1.10) for admission in intensive care unit (ICU) and 1.04 (95% CI 1.04–1.05) for COVID-19-related deaths [4].

No significant adjusted association between the increased rate of SARS-CoV-2 infections and male sex and higher age categories was observed. This is partially in contrast with the recognized role of male gender and age as risk factors for symptomatic and severe COVID-19 [8]. On the other hand, other Italian studies conducted among HCW showed similar results [6,14], and in particular Vimercati et al. found no associations between the diagnosis through swabs with increasing age, and nor with gender. While considering the anti-SARS-CoV-2 IgM seroprevalence, they found a significantly lower mean age of the subjects with antibody positivity compared to the negative group [14]. In any case, when interpreting these Italian data obtained in HCW it should be considered that the large majority of the samples are composed by females, and in particular in our study, women were 71% of the whole population, and moreover about 90% of the operators were aged less than 60 years old.

A multiple logistic regression analysis shows a significant negative OR for smokers of being diagnosed with COVID-19 compared to non-smokers. In interpreting this result it should be considered that, for a technical problem, in quite a high number of workers the information regarding the smoking habit was missing, and in any case the information was subjectively reported by the workers. On the other hand, the results of previous scientific studies are not totally coherent, and some available studies showed a reduced risk of SARS-CoV-2 infections for current smokers, even if smoking seems associated with a negative progression and adverse outcomes of COVID-19 [27,28]. As an example, Simons et al. found that the former compared with non-smokers were at significantly increased hospitalization (Relative Risk—RR = 1.20), severe disease (RR = 1.52) and death (RR = 1.39) risks, but the data for current smokers were inconclusive [27]. We, quite paradoxically, found a significantly decreased likelihood of SARS-CoV-2 infection in current smokers vs. non-smokers with an aOR of 0.7 (95% CI 0.5–0.9).

Other factors that have been specifically considered in our analysis are those related to a possible role of comorbidities/other diseases in influencing the risk of SARS-CoV-2 infections: a significant positive OR was observed for subjects diagnosed with chronic respiratory diseases, including asthma, compared to workers with no respiratory diseases. In general, the cases of respiratory chronic diseases in our sample were quite a few, i.e., 1.4%, and in more than 70% of these cases the diagnosis was that of asthma; other studies reported an association of various chronic bronchopulmonary diseases with a higher severity of COVID-19 [8,29], while the role of asthma seems less clear [29–31]. Gülsen et al. in their systematic review and meta-analysis calculated a pooled odds ratio based on a random effect model for severe vs. non-severe COVID-19 in subjects with chronic respiratory diseases of 2.1 (95% CI 1.7–2.6), while in those with asthma the pooled OR was not significant (OR = 1.1; 95% CI 0.8–1.6) [29]. Regarding the possible role of other diseases such as hypertension, diabetes and neoplasms, no significant associations were found in the examined group. This is different from data reported in other studies [4,6,8,32,33]. As an example, Rizza et al. calculated an aOR of 4.4 (95% CI 1.5–12.7) for subjects with hypertension, while they found no associations for other comorbidities [6]. Gao et al. found a significantly increased adjusted hazard ratio for subjects with type 2 diabetes of 1.6 for COVID-19-related hospital admission, of 1.9 for ICU admissions and of 1.6 for COVID-19-related deaths [4]. Considering cancer, in a recent meta-analysis having a neoplasm was significantly associated with the occurrence of severe COVID-19 cases (pooled OR = 2.2; 95% CI 1.5–3.2) and deaths (OR = 3.0; 95% CI 1.5–6.0) [33]. We cannot exclude that due to the method applied, based on the automatic data extraction of specific keywords from the electronic medical records of the workers integrated with a hand search, even if any effort was done to systematically pick-up all these diseases, some cases, especially well-controlled cases with mild or no symptoms, went unnoticed.

The results of our study confirm that frontline HCW dealing with COVID-19 patients are at a significantly increased risk when compared to non-HCW: the risk is higher in nurses and nurse aides and other HCW having direct contact with patients [9–14,34–37]. Physicians are at a significant increased risk too compared to non-HCWs, but the risk is

lower compared to nurses, in line with the results reported by Poletti et al. [12], while another recent report did not find significantly increased risks according to the job role of the HCW [35]. The different risks for doctors can be possibly explained by the differences in the type of close contacts with the patients and in the duration of the contact in the examined sample; a possible role of a higher education level and training, influencing the appropriate use of the PPE [37], cannot be excluded. Interestingly, in the category of "other HCW", including a heterogeneous group of health personnel such as obstetrics, physiotherapists and various others, the odds of having COVID-19 were not significantly increased compared to non-HCW. Similar results, possibly related to the re-organization of some activities limiting direct close contacts with at risk patients during the period considered, were reported also in other studies [12,35].

Another result of our study worth mentioning is the increased likelihood of being diagnosed with SARS-CoV-2 infection in HCW performing nightshifts: the adjusted odds ratio for these workers was almost double (1.8; 95% CI 1.4–2.3) compared to day workers, and we found also a significant increase in the odds per each single nightshift at work (OR = 1.006; 95% CI 1.00–1.01). Similar results in HCW were recently reported in a paper by Rizza et al. [6], that also found an association of COVID-19 infection risk with obesity. This result may be related to different causes such as a higher job demand, longer working hours and poorer sleep quality of the HCW during the pandemic, possibly increasing the occasions for contagion, the risk of carelessness in following prevention procedures and therefore the risk of being infected [18,19]. However, a possible dysregulation of the circadian rhythm affecting the immune response against infections cannot be ruled out [38]. Moreover, some data suggest lower vitamin D levels [39] and higher BMI [6] in nightshift workers: both conditions have been reported to be associated with an increased risk of SARS-CoV-2 infection [5,6,40,41].

Limitations

Our research has various limitations that may influence the results and their interpretation. First of all, considering the study population, we retrospectively investigated all the workers undergoing the mandatory occupational health surveillance program of the University Hospital. We cannot exclude that some of the workers have not been captured for various reasons, e.g., the high turnover, in particular during the hardest months of the pandemic, or long work absences due to pathological or other conditions, and therefore the unavailability of results related to the rhino-pharyngeal swabs, or temporary interruption of presence at work for non-HCW and for the fragile workers, such as those in the older age group. In any case, the number of subjects lost is most presumably low. Another limit is the impossibility of a proper classification of the HCW according to the working units and departments at presumably different risks, due to the high turnover of the operators across different departments and the temporary conversion of many units into "COVID-19 departments", especially during the hardest months of the pandemic. Furthermore, even if specific data on individual PPE use, including the type, availability and regular use, are not available, it should be considered that from the very beginning of the pandemic, all the workers have been adequately trained on the correct use of PPE to contain the biological hazard, and PPE have been regularly provided.

Another type of limitation is intrinsically related to the modality of the data collection, based on an automatic extraction of data stored in the archives of the Occupational Health Surveillance service. Even if the electronic search was integrated with a hand search of the medical records, the capture of some variables, such as smoking habit and BMI, was incomplete due to data missing. Likewise, the systematic electronic extraction using specific keywords of the diseases included in the pathological anamnesis was integrated with a hand search, but it cannot be excluded that, especially in the case of well-controlled mild diseases, or asymptomatic diseases, some cases were lost. Due to the special attention devoted to minimizing these losses of information, we assume the overall results reported are not significantly influenced.

5. Conclusions

This study was performed in a sample about 6000 workers of a Northern Italian University Hospital during the eleven-month period from March 2020 to January 2021, including the first phases of the COVID-19 pandemic, and ending at the very beginning of the vaccination campaign of HCW in Italy. We found that 13.8% of the HCW had been infected during the whole period: this cumulative incidence is more than double compared to the general population of the same area, but is coherent with those reported in other studies performed in the same period. The possible relation with some relevant individual and occupational factors was retrospectively investigated using data derived from the Occupational Health Surveillance records. Overall, the results confirm overweight and obesity, as well as chronic respiratory diseases, as risk factors for COVID-19 occurrence. Regarding the occupational factors, the risk of COVID-19 was about threefold in nurses and nurse aides compared to non-HCW (aOR 2.7; 95% CI 1.7–4.5) and about double (OR 1.9; 95% CI 1.2–3.2) in physicians in the multivariate logistic regression analysis. Furthermore, a strong association was observed between infection risk and the performance of nightshifts at work, significantly related to the total number of shifts in the whole eleven-month period.

Even if the vaccination campaign of HCW started in January 2021 has greatly modified the scenario of SARS-CoV-2 infections in hospital personnel, especially considering the progressive appearance of the new and more transmissible virus variants, the data of this study can be relevant for the further development of health and policy strategies to mitigate the evolution of the pandemic.

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Informed Consent Statement: Informed consent was obtained from all the available subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to privacy restrictions.

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Loneliness, Complaining and Professional Burnout of Medical Personnel of Psychiatric Wards during COVID-19 Pandemic—Cross-Sectional Study

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Abstract: Background: Professional burnout in the medical community has been present for a long time, also among mental health professionals. The aim of the study was to examine the links between loneliness, complaining and professional burnout among medical personnel in psychiatric care during a pandemic. Loneliness and complaining of the medical staff are not documented in the literature well enough. Methods: Oldenburg Burnout Questionnaire, the Loneliness Scale, the Complaint Questionnaire and author's questionnaire. The respondents: 265 medical employees—doctors (19.2%), nurses (69.8%), paramedics (4.9%), medical caregivers (5.7%). Results: Loneliness and complaining are significant predictors of exhaustion. The model explains 18% of exhaustion variance. Loneliness, complaining and job seniority are also predictors of disengagement; the model allows to predict 10% of the variance of disengagement. Women are more prone to complain. Complaining significantly correlates with direct support from management. A high rate of loneliness correlates, in a statistically significant way, with worse work organization, less management support, worse atmosphere in the team and with more irresponsible attitudes of colleagues. Conclusions: Loneliness and complaining can be used to predict occupational burnout. Women and people without management support complain more often. Loneliness is connected with bad work organization and bad cooperation in a team.

Keywords: complaining; medical staff; psychiatric; loneliness; occupational burnout

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1. Introduction

The speed and extent of the spread of the pandemic COVID-19 has caused health and life threats to medical professionals on an unprecedented scale [1]. Numerous studies conducted since the onset of the presence of the virus indicate many factors that are a source of stress for staff. These are, among others: fear for their own safety, the risk of infecting members of their family and loved ones, but also team members [2,3], anxiety about the availability of personal protective equipment, and lack of adequate support [3,4].

An element that significantly enhances the intensity of the impact of the above factors on the mental health of employees is the chronicity of the situation. Functioning in such difficult conditions for a long period of time poses a very high risk to both physical and mental health of all people, in particular health care employees, who are probably more than before exposed to the phenomenon of occupational burnout.

Professional burnout is a response to the long-term effects of interpersonal stressors at work [5] and a form of occupational tension resulting from the buildup of work-related stress [6]. Work burnout commonly understood as a syndrome consisting of exhaustion

defined as a consequence of intense physical and mental stress and disengagement from work as a result of long-term stress at work [7]. Work burnout is one of the major problems among mental health care employees [8] also among mental health professionals. A recently published meta-analysis shows the presence of exhaustion in 40% of medical staff in this sector, while 19% could be described with low levels of personal accomplishment related to disengagement from work [9]. Due to the worldwide pandemic, those numbers will probably grow.

An element that is significantly related to burnout is loneliness. Loneliness occurs when people experience a sense of loneliness and when, regardless of the number of contacts, they begin to lack meaningful social relationships. This subjective feeling of loneliness depends more on the quality of the relationship. It is a kind of dissonance between real and desired social relations [10]. The current epidemic situation and the related need to maintain social distance has worsened interpersonal relations, thus limiting social support, which may also contribute to the growing feeling of loneliness.

The problem of the presence of loneliness in the professional life of medical employees is not described in detail in the literature. In the last few years, there have been studies on the existence of loneliness mainly among doctors, where the authors state that loneliness is common in the work of doctors and is associated with burnout [10]. In a study involving 401 family doctors, the incidence of loneliness was 44.9%. The analysis of the results showed that physicians who experienced a greater sense of loneliness more often reported at least one of the symptoms of occupational burnout [11]. In other studies, loneliness has been identified as one of the leading stressors in the work of nursing managers [12].

The most common intention of complaining people is experiencing a sense of relief by expressing dissatisfaction, which, as most people seem, should have a soothing effect on unpleasant emotional states [13]. However, there are reports linking the phenomenon of burnout and complaints. Burnout is not just complaint, it is a much more serious condition, but it might be related to complaining [14].

Nowadays, protecting the health of medical employees providing services in the field of psychiatric services requires a high priority. Without it, it will not be possible to help those in need. Working in extremely difficult conditions, in a sense of high risk, additionally reinforced by many stress factors, indicates an urgent need to provide mental support, which should be implemented both by the management of the entities and the external environment. An important element of it is social support, which is a significant work resource [15] and has a positive impact on mental health. Support from friends and co-workers can reduce burnout by mitigating loneliness [16]. Support should be organized in such a way that employees try to constructively discuss problems, avoiding negative forms of communication. Psychiatrists themselves report that factors of the work environment, more than personal factors, play a greater role in the development of burnout [17]. This clearly shows that employees expect effective labor resources. Loneliness is related to seniority. Doctors with more experience were less likely to see themselves as lonely [11]. The aim of our study was to look at the phenomenon of occupational burnout in connection with the loneliness and complaining.

We stated a hypothesis that loneliness and complaining contributed to burnout. We assumed that some of the staff experience the problem of burnout. In our study, we hypothesized that there was no association between burnout and sociodemographic variables.

Loneliness and complaints of medical personnel in psychiatric practice are not well documented in the literature. There is no evidence of whether, and if so how, they are related to burnout. This problem appears especially when hospitals are overloaded with COVID-19. Our study is an important attempt to establish the correlation between loneliness experienced by psychiatric employees and individual tendency to complain and professional burnout. Results of our research can provide a valuable guidance for management improving the work in case of the environment of psychiatric care professionals.

2. Materials and Methods

2.1. Study Participants

A total of 265 medical employees from two psychiatric hospitals in the Pomeranian Voivodeship participated in the study. These were: the Provincial Psychiatric Hospital in Gdansk and the Hospital for the Nervous and Mentally Ill in Starogard Gdanski. The management of the institutions obtained consent to conduct the study. The total number of health professionals working in the two hospitals included in the study was 860. In the first hospital, out of 265 medical workers, 93 people applied for the study, of which 11 questionnaires were rejected due to incomplete answers. In the second hospital, out of 595 medical employees, 207 employees expressed their willingness to participate in the study, 183 of whom were finally qualified. All employees working in the hospital wards took part in the study. A written invitation was forwarded to the ward managers and then given to the employees. Afterwards, we contacted the employees who expressed their willingness to participate in the survey. The questionnaires were left in each ward. Only those willing took part in the study. An invitation to participate in the study was enclosed with the questionnaire. The subject of the study and information on the anonymity of the participants were given. All the participants gave their informed consent to participate in the study.

2.2. Study Questionnaire

The study was designed as a questionnaire survey and consisted of 4 sections with a total of 66 questions. The following is a detailed description of part of the questionnaire:

(1) Self-designed questionnaire—concerning socio-demographic data (gender, profession, work experience, education), and 6 questions concerning issues related to the organization of work during the pandemic of COVID-19 (assessment of the degree of organization of work in a team, assessment of team relations, the amount of support received from direct management, the amount of support received from the management of the facility and the degree to which teammates comply with the procedures and guidelines related to protecting health against COVID-19). The questionnaire consisted of 10 questions.

(2) The Oldenburg Burnout Questionnaire—OLBI is a tool that allows you to measure occupational burnout [7]. The questionnaire uses the two-factor concept of occupational burnout. The first factor is broadly defined exhaustion (taking into account its emotional, cognitive and physical components). Example of questions in this section are: "There are days when I feel tired before I arrive at work" or "During my work, I often feel emotionally drained". The second component is distance from work, called disengagement, for example, in a form of a statement such as: "I feel more and more engaged in my work" or "Lately, I tend to think less at work and do my job almost mechanically". The questionnaire consists of 16 questions. The questions were answered on a 4-point scale (1—I strongly agree, 2—I agree, 3—I disagree, 4—I strongly disagree) [18]. The questionnaire, both in its original and Polish version, is characterized by good psychometric properties. Cronbach's alpha coefficient was calculated to assess internal consistency of the questionnaire in our study. Cronbach's alpha was also good ($\alpha = 0.81$).

(3) The De Jong Gierveld scale for measuring the sense of loneliness [19] and its Polish adaptation [20] allows to measure the perceived loneliness both in individual diagnosis and in scientific research. The scale contains a total of 11 items, most of which are formulated negatively, i.e., it allows to measure the dissatisfaction with social contacts (e.g., "I lack other people's company"), and some positively, i.e., it measures satisfaction with social contacts (e.g., "on friends whenever I need it "). The responses were rated on a 5-point scale (1—definitely yes, 2—yes, 3—neither yes nor no, 4—no, 5—definitely no). This questionnaire is also characterized by appropriate psychometric properties in both versions (original and adapted to Polish conditions). In this study, Cronbach's alpha for this scale could be described as satisfactory ($\alpha = 0.72$).

(4) The questionnaire of the content of daily conversations (Complaint Questionnaire) was designed by Bogdan Wojciszke and Wiesław Baryła [13]. We received it from the

authors with permission to use it and their description of satisfactory psychometric characteristics. The Cronbach's alpha for this questionnaire in this study was also good, $\alpha = 0.89$. The questionnaire consists of 29 items and allows to measure the tendency to complain by answering the questions about how often the respondents talk about the mentioned topics. Some of the topics presented are positive, e.g., in the question about the frequency of talking about human kindness. Most of them deal with topics that are commonly associated with complaining: increasing crime, the heartlessness of officials and human indifference. Responses were rated on a 5-point scale (1—never, 2—rarely, 3—sometimes, 4—often, 5—very often). The questionnaire produces one overall score that is an indicator of a person's propensity to generally complain.

2.3. Statistical Methods

All statistical analyses were performed with the Statistica 12.0 (StatSoft, Kraków, Poland). The study used parametric methods due to appropriate size of the study group, normal distribution of values and the continuous character of the variables. The Pearson correlation coefficient was used to measure the interrelationships between the variables. Differences between groups were tested using the Student's *t*-test or one-way analysis of variance. Regression analysis (multiple regression type) was also performed.

3. Results

The completed questionnaires were returned by 265 (88%) respondents. Our study included medical personnel who have direct and closest contact with the patient on a daily basis. The detailed division of respondents by occupation is as follows: doctors (19.2%), nurses (69.8%), paramedics (4.9%), medical caregivers (5.7%). Most of the participants were female (82%) with long professional experience. Almost 60% of the studied group had higher education. The socio-demographic characteristics of the group are presented in Table 1.

Table 1. Socio-demographic characteristics of the study group.

Socio-Demografic Variables	Employees (*N* = 265)
Gender (*N*; %)	
Women	217 (82%)
Men	47 (18%)
Profession	
Doctor	51 (19.2%)
Nurse	185 (69.8%)
Paramedic	13 (4.9%)
Caregiver	15 (5.7%)
Other	1 (0.4%)
Job seniority	
Up to 2 years	14 (5%)
2–10 years	51 (19%)
10–20 years	53 (20%)
Over 20 years	147 (55%)
Education	
Secondary vocational education	106 (40%)
Higher	158 (59.6%)
Other	1 (0.4%)

There were no statistically significant connections between the group of socio-demographic variables and occupational burnout. There were no significant statistical differences between men and women in terms of exhaustion ($t = 1.93$, $p = 0.06$, $df = 262$), also in terms of disengagement ($t = -0.42$, $p = 0.67$, $df = 262$). Additionally, in the area of education, no statistically significant differences were observed between the two main groups

in our study, one with higher and one with secondary education in terms of exhaustion (t = −0.84, p = 0.4, df = 262), or disengagement (t = −1.67, p = 0.09, df = 262). There were also no statistically significant differences in the context of exhaustion (F (5, 259) = 1.79, p = 0.11) and disengagement (F (5, 259) = 1.18, p = 0.32) between people working in different professions (doctor, nurse, paramedic, caregiver) within the unit of a psychiatric hospital.

The performed regression analysis (multiple regression type, all predictors entered simultaneously) allowed to obtain two statistically significant models, thanks to which it is possible to identify variables that are predictors of fatigue and disengagement. The regression model for exhaustion is presented in Table 2.

Table 2. Regression model for the exhaustion variable with significant predictors in the group of employees of psychiatric wards.

Coefficient	Estimate β	t	*p*
Job seniority	−0.09	−1.69	
Loneliness	0.20	3.63	*
Complaining	0.35	6.32	*

* $p \leq 0.001$.

Loneliness (β = 0.20, $p < 0.001$) and complaining (β = 0.35, $p < 0.001$) proved to be statistically significant predictors of exhaustion. Work experience was the only non-significant predictor of fatigue. The whole model is statistically significant (F (3.261) = 20.12, $p < 0.00001$) and allows explanation of about 18% of the exhaustion variance (adjusted R^2 = 0.178). The presence of a feeling of loneliness and complaining about many different topics allows us to predict severe exhaustion in psychiatric wards.

Another model containing predictors of disengagement is presented in Table 3.

Table 3. Regression model for the variable of disengagement with significant predictors in the group of employees of psychiatric wards.

Coefficient	Estimate β	t	*p*
Job seniority	−0.13	−1.69	**
Loneliness	0.13	3.63	*
Complaining	0.25	6.32	**

* $p \leq 0.01$, ** $p \leq 0.001$.

The model is also statistically significant (F (3.261) = 10.37, $p < 0.001$) and allows to predict approximately 10% of the variance of disengagement (adjusted R^2 = 0.96). In this case, significant predictors of disengagement turned out to be work experience (β = −0.13, $p < 0.001$), also loneliness (β = 0.13, p = 0.01) and complaints (β = 0.25, $p < 0.001$). In this case, the feeling of loneliness and intense complaining also allow to predict the lack of commitment to work. In the case of this model, it is possible to predict the lack of commitment based on the length of service—the longer the employee's work experience, the smaller the chance of disengagement (employees with shorter work experience are less involved).

Further analysis involved establishing associations between loneliness and complaining and other variables. Significant statistical differences were revealed between women and men (t = 1.98, p = 0.04). Women (M = 2.86, SD = 0.57) are more likely to complain than men (M = 2.67, SD = 0.57). In case of this difference, we achieved Cohen's d = 0.33, which means that the effect size is small. Additionally, complaining correlates in a statistically significant way with direct support from management (the less support, the greater the complaint).

Loneliness turned out to be related to organizational and team variables. High loneliness correlates in a statistically significant way with worse organization of work, also less support from administration management, management, worse working atmosphere (team

relations) and surprisingly with more irresponsible attitudes of colleagues in relation to compliance with procedures and guidelines related to health protection against COVID-19. All results are presented in Table 4.

Table 4. Correlations between loneliness and complaining and organizational and interpersonal variables related to the syndrome (Pearson's correlation coefficient).

Variables	Loneliness	Complaining
Organization of team work	0.14 *	0.06
Relationships in the team	0.24 *	0.06
Administration support	0.19 *	0.18 *
Management support	0.23 *	0.22 *
Staff attitudes towards COVID-19	0.20 *	0.16

* $p < 0.05$.

4. Discussion

Our research aims to examine the relationship between loneliness, complaining and lack of engagement, and to show their impact on burnout. We examined the relationships between socio-demographic variables (gender, occupation, seniority, education) and the phenomenon of occupational burnout. The analysis showed that these variables did not affect occupational burnout in the respondents. Gender was not significantly related to burnout. Confirmation of the lack of relationship between gender and the studied aspects can be found, among others, in the Bijari [21] and Dinibutun studies [22], which confirm the comparable level of burnout in both men and women. On the other hand, different results confirming the relationship between gender and exhaustion are given by Adam, who stated that women experienced higher emotional exhaustion [23], and Schadenhofer, who showed that gender had a different effect on the frequency of exhaustion [24]. Our study indicates that education did not affect exhaustion and lack of engagement, which is consistent with Oyefeso's research [25]. Tan presents a different position on the subject, explaining the result with probably higher responsibility at work [26].

This study found no correlation between occupation and exhaustion and lack of engagement. Different positions can be found in the literature. A study of 200 employees showed that burnout was worse in nurses than in physicians, with both nurses and physicians having a higher level of burnout compared to other employees [27]. Mental health professionals may be more at risk of burnout than colleagues in other fields [28]. A study of psychiatrists in Milan confirm this assumption. A total of 49% of respondents [29] obtained a high level of emotional exhaustion.

The results of the current study showed that loneliness and complaining were important predictors of exhaustion. An employee who experiences exhaustion begins to feel more and more lonely. They begin to isolate themselves from others, their workshop slowly deteriorates and their professional activities become more and more difficult. When there is no support in the immediate surroundings, the feeling of loneliness grows, leading to even greater exhaustion over time. Experiencing more and more discomfort, they begin to critically evaluate situations that have so far been positive or indifferent. Criticism increases. They begin to complain. The more tired they are, the more they complain. Loneliness in the workplace is noticed by colleagues and significantly affects the efficiency of work and relationships in the team by weakening social relationships in the group. Thus, loneliness leads to withdrawal and reduction in job productivity [30]. In process of time, a person experiencing loneliness begins to feel worse, which is a negative consequence of loneliness [31]. In their research, Killgore and colleagues show that loneliness is getting worse during the current pandemic [32].

The results of the study are confirmed in the Ofei-Dodoo research, which indicates the correlation of a high level of exhaustion with a sense of loneliness [10]. In another study, Rogers confirms the relationship between loneliness and burnout, indicating that higher levels of loneliness were significantly associated with higher burnout [16]. It should also

be remembered that the emotional exhaustion experienced by the employee will have an influence on their private life, over time impeding the fulfillment of Zhang's family tasks and roles [33].

Dinibutun, in his work, states that there is a significant difference in exhaustion between nurses and doctors [22]. It may be because of the nature of the job. It is the nurse who is closest to the patient, spending a lot of time with them in direct contact. When the patient is agitated, the nurse must act quickly, trying to ensure the safety of both herself and the patient. It is very difficult, it causes a lot of emotional tension and ultimately leads to exhaustion.

Complaining means focusing on the negative aspects of the surrounding reality; more importantly, communicating using such a pattern. In a long-term complaining process, it may happen that the subject of the complaint is anything for the sake of the idea of complaining.

An extremely important issue is the impact of the behavior of people experiencing burnout on the relationships in the team. This problem is highlighted in Maslach's research, emphasizing that employee burnout may have a negative impact on other team members; consequently, leading to their distance from work and worsening social relations in the team [5]. Therefore, both difficult emotions and a lack of commitment to work are spilled to some extent. It does not take a long-time perspective for the quality of care to deteriorate.

Loneliness is naturally associated with a tendency to withdraw. The employee starts to move away from others, communication and performance of tasks may deteriorate. The fact that we work as a team in hospitals may turn out to be beneficial in this case. You can quickly notice a person who starts to move away from the group. The first source of support for an employee may be a group of colleagues at work. They are important in providing support. The research of many authors indicates the important role of social support as an element preventing burnout. The support offered by both colleagues and friends is of great importance, as confirmed by their research by Aronsson [34] and Mohindra [2].

Patients with mental health problems may not be able to comply with a sanitary regime. Poor self-care capacity and insufficient insight are factors that significantly hinder cooperation in this regard [35]. Many of the existing rules must be changed. The long-term promotion of group activities of patients should be currently slowed down by proposing to keep social distance. The problem, however, is that this is the opposite course of action. According to Arango, we have never encouraged patients to distance themselves [35]. Studies of patients experiencing psychosis show that they badly need emotional support from their loved ones. This need is confirmed by 91% of respondents in the Lahera study [36]. Due to the pandemic, large visiting restrictions are, as it were, going against. Additionally, although patients, understanding the necessity to introduce restrictions, try to comply with them, it is very difficult for them because of the separation from their loved ones.

The presence of all these difficulties and their mutual penetration, strengthened in the pandemic era, with care for their own health and safety, causes employees to gradually show an increasing lack of commitment at work. The superior goal of helping the patient may turn out to be disastrous for the helper. Significant predictors of disengagement are seniority, loneliness and complaining. The length of the work experience allows to forecast the level of disengagement. Employees with longer experience show less disengagement. We can find confirmation of seniority in the literature, where younger people are more likely to be exhausted [25]. In other studies, the author shows that greater age and experience were associated with less burnout [37]. More experience goes hand in hand with more practice and some kind of distance, which can be important when dealing with minor problems and failures at work. Another analysis was to establish the links between loneliness and complaining and other variables. According to the results, women are more prone to complaining. This may be related to greater sensibility to stress [38]. Women are more sensitive. As mothers, they strive for the proper development of their children and the safety of the whole family. Bearing in mind that human resources are the most valuable

asset of an organization [39], management should make every effort to provide a supportive work environment. The key importance of support from the employer is mentioned by many authors in their research. Belfroid et al. emphasize the importance of the quick availability of a superior in a difficult situation [40]. In turn, Kang et al. emphasize the importance of clear communication in the process of supporting employees [41].

A clear division of duties, application of procedures and compliance with the rules contribute to shaping a proper and safe atmosphere in the team. The support needs of employees are individual and depend on many factors. Nevertheless, employer support seems to be a key element in the fight against burnout.

Caring for a safe work environment includes various aspects, both physical, in the form of providing personal protective equipment, and emotional, in the form of supporting employees and paying attention to their needs [33]. The control also contributes to reducing tension, and thus burnout [42], as it allows obtaining substantive information on the tasks performed. Our analysis is confirmed by studies by other authors showing that a high level of support protects against exhaustion [34]. In times of a pandemic, concern for the psychological safety of employees becomes of particular importance. Wu, in his research, shows that if workers feel that they will be supported in case of a disaster, they will be more resilient [43]. Looking at this issue from the other side, it should be stated that if we do not provide support to employees, the degree of complaining and the feeling of loneliness will increase. Additionally, this can lead to leaving the profession. Interesting results on this topic were presented by Shah, who showed that among nurses who reported resignation from the profession due to burnout, a high percentage indicated a stressful work environment as the reason [44]. Our study has some limitations. One of the limitations of our study is that it was conducted on a small group of regional employees. The study covered the staff of psychiatric hospitals in the Pomeranian Voivodeship. In the future, it is worth extending the survey to at least the entire country to make comparisons with surveys carried out in other countries. Another limitation of the project is the fact that the study was carried out during a pandemic, i.e., a time when health care staff was particularly burdened. However, it seems to us that psychiatric staff will long struggle with overload, also in a post-pandemic society.

5. Conclusions

Our study shows that loneliness, complaining and disengagement are significant predictors of psychiatric staff exhaustion. It is very important to create a friendly work environment. Support should take into account both an individual and a team approach. Loneliness, complaining and disengagement may be changed by organizing team meetings and staff training sessions to create a community. Such meetings could be enriched with psychoeducational elements indicating the psychological consequences of complaining and various affirmation techniques. It is important that it is systematic and allows flexible adaptation to the employee. The management of the institutions should take into account the prevention of infodemia, taking care of the substantive and safe transmission of information. Strong leadership and a clear management structure are a protective factor in this case. Moreover, it is essential to systematically monitor the phenomenon of burnout in individual professional groups.

Our study shows that loneliness and complaining are important concepts that predict significant outcomes in the area of occupational burnout in mental health care employees. It is worth undertaking further research on this issue in order to better understand the various interactions between loneliness, complaining and burnout. The obtained results will allow for taking effective measures in the field of burnout prevention. Problems with recruiting and maintaining medical staff, present in most facilities for many years, require management to pay attention to the employee's satisfaction, health and job satisfaction. Professional activity means that we spend a significant part of our lives at work. Therefore, it is necessary to ensure that the time spent there is fully satisfactory for the employees, which will translate into the satisfaction of our customers.

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Data Availability Statement: The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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MDPI

Protocol

A Protocol for a Systematic Review and Meta-Analysis of Mind–Body Modalities to Manage the Mental Health of Healthcare Workers during the COVID-19 Era

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Abstract: The coronavirus disease 2019 (COVID-19) pandemic has become an unprecedented threat to humanity worldwide, including healthcare workers (HCWs). Mind–body modalities have been used to improve the mental health, well-being, quality of life, and physical health of clinical and general populations, and may also be used to improve the mental health of HCWs during COVID-19. The objective of this review is to analyze the effectiveness of mind–body modalities for the mental health of HCWs in the COVID-19 era. Six electronic bibliographic databases were comprehensively searched to find intervention studies using mind–body modalities, including meditation, mindfulness-based intervention, autogenic training, yoga, tai chi, qigong, breathing exercise, music therapy, guided imagery, biofeedback, prayer, and faith-based techniques for HCWs. All intervention studies conducted from December 2019 to August 2021 will be included. Quality assessment will be performed according to study type, and Cochrane Collaboration's Risk of Bias tool will be used for randomized controlled clinical trials (RCTs). If sufficient homogeneous data from RCTs exist, a meta-analysis will be performed. Dichotomous data and continuous data are presented as risk ratios and mean differences with their 95% confidence intervals, respectively. The results of this systematic review will be disseminated through the publication of a manuscript in a peer-reviewed journal or by presentation at a conference.

Keywords: healthcare personnel; mental health; mind–body therapies; COVID-19; pandemics

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1. Introduction

The coronavirus disease 2019 (COVID-19) pandemic has become an unprecedented threat to humanity worldwide, widely affecting the physical and mental health of people around the world [1]. In particular, healthcare workers (HCWs) have been exposed to the threat of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) since the early days of the pandemic [2,3]. In the early stage of the pandemic, the lack of personal protective equipment (PPE), undiscovered etiology, strict isolation, high-intensity work, insufficient rest, fear of infection, and lack of a vaccine were major stressors for them [2,3]. Since then, some vaccines against SARS-CoV-2 have been developed and PPEs have been distributed, but HCWs' mental health is still threatened by a prolonged COVID-19 outbreak. According to a recent meta-analysis, HCWs exposed to stress from COVID-19 had significantly higher levels of anxiety (13.0 vs. 8.5%) and depression (12.2 vs. 9.5%) compared to experts in other fields [4]. Accordingly, the importance of improving the mental health of HCWs has emerged [5].

A wide range of mind–body modalities designed to facilitate the mind's capacity to affect health has been used for a long time to improve mental health, well-being, quality of life, and physical health of clinical populations, and the general population in various

occupations [6]. Previous studies have reported that mind–body modalities such as yoga [7], mindfulness-based interventions [8,9], and tai chi [10] can benefit the health of HCWs. Today, mind–body medicine has re-emerged for its mental health benefits in the context of COVID-19 [11,12], and some health systems use mind–body modalities to build strategies to improve the mental health of the public, patients with COVID-19, and HCWs [13,14].

Recently, due to COVID-19, some hospitals have reportedly introduced mind–body modalities to improve the mental health of frontline HCWs, including perceived stress [15,16]. Moreover, mind–body modalities are generally considered safe and can also be delivered non-face-to-face in combination with information and communications technology (ICT), making them a promising mental health improvement strategy in the COVID-19 era [17].

However, there has not been a comprehensive review of how mind–body modalities benefit the mental health aspects of HCWs in the context of COVID-19. The objective of this systematic review is to investigate the roles of mind–body modalities in managing the mental health of HCWs during the COVID-19 era. Our findings will help establish better public mental health strategies to improve the mental health of HCWs according to each situation and the available medical resources during this pandemic.

2. Materials and Methods

The protocol of this systematic review was registered in the Open Science Framework registry (https://osf.io/tudbw; registered on 13 August 2021). Any amendments to this systematic review will be tracked using this registry. This protocol was reported in accordance with the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) 2015 statement [18] (Supplementary Table S1). We will report our systematic review according to the PRISMA 2020 statement [19].

2.1. Data Sources and Search Strategy

One researcher (B.L.) will search the following six electronic bibliographic databases from December 2019 (when the first case of COVID-19 was identified [20]) to September 2021: MEDLINE via PubMed, EMBASE via Elsevier, the Cochrane Central Register of Controlled Trials, Cumulative Index to Nursing and Allied Health Literature via EBSCO, Allied and Complementary Medicine Database via EBSCO, and PsycARTICLES via ProQuest. In addition, we will review the reference lists of the relevant literature and manually search Google Scholar to find potentially missing literature, including gray literature. Since our study will include gray literature and literature published in peer-reviewed journals, we will not evaluate the journal reliability of additional literature identified through manual searches in Google Scholar. However, we will indicate the source of the search for all included articles. The search strategy for Medline via PubMed is presented in Table 1.

Table 1. Search strategies for the Medline via PubMed.

#1. COVID-19[MH] OR SARS-CoV-2[MH] OR COVID-19[TIAB] OR SARS-CoV-2[TIAB] OR (wuhan[TIAB] AND coronavirus[TIAB]) OR 2019-nCoV[TIAB] OR 2019nCoV[TIAB]
#2. Nurses[MH] OR Nursing[MH] OR nurs*[TIAB]
#3. Physicians[MH] OR physician*[TIAB] OR doctor*[TIAB]
#4. Health Personnel[MH] OR "health personnel*"[TIAB] OR "healthcare worker*"[TIAB] OR "hospital staff*"[TIAB] OR "health manager*"[TIAB]
#5. "Mind–body Therapies"[MH] OR Meditation[MH] OR Mindfulness[MH] OR Relaxation[MH] OR "Relaxation Therapy"[MH] OR "Autogenic Training"[MH] OR Yoga[MH] OR "Tai Ji"[MH] OR Qigong[MH] OR "Breathing Exercises"[MH] OR "Music Therapy"[MH] OR "Imagery, Psychotherapy"[MH] OR "Biofeedback, Psychology"[MH] OR mind–body[TIAB] OR meditation[TIAB] OR mindful*[TIAB] OR relaxation[TIAB] OR "autogenic training"[TIAB] OR yoga[TIAB] OR "Tai Ji"[TIAB] OR "Tai Chi"[TIAB] OR Taichi[TIAB] OR qigong[TIAB] OR "qi gong"[TIAB] OR breathing[TIAB] OR music[TIAB] OR "guided imagery"[TIAB] OR biofeedback[TIAB] OR prayer[TIAB] OR faith[TIAB]
#6. #1 AND (#2 OR #3 OR #4) AND #5

2.2. Eligibility Criteria

The inclusion criteria for this systematic review are as follows. (1) Types of study: Although randomized controlled clinical trials (RCTs) are a type of clinical study with the highest level of evidence to evaluate the effectiveness and efficacy of the intervention, given the urgency of COVID-19, meaningful results can be found not only in RCTs but also in other intervention studies besides RCT. Therefore, this systematic review will allow for all types of quantitative intervention studies. That is, all original clinical studies, including RCTs, non-randomized controlled clinical trials (CCTs), and before-after studies will be included. However, retrospective studies, including case reports/case series and qualitative studies, will be excluded. For mixed-method studies, if quantitative data can be extracted separately, the data will be included. No restrictions will be imposed on the publication language or publication status. (2) Types of participants: All types of HCWs, including physicians, nurses, hospital staff, and health managers, will be allowed. No restrictions were imposed on the participants' sex, age, or ethnicity. However, even in studies published after the discovery of SARS-CoV-2 (i.e., December 2019), studies that did not describe whether participants were directly or indirectly affected by COVID-19 will be excluded. (3) Types of interventions: In this systematic review, mind–body modalities will include meditation, mindfulness-based intervention, autogenic training, yoga, tai chi, qigong, breathing exercise, music therapy, guided imagery, biofeedback, prayer, and faith-based techniques. (4) Types of controls: No treatment, wait-list, sham control, attention control, and active comparators will be allowed. (5) Types of outcome measures: The primary outcome was the level of perceived stress. Validated perceived stress evaluation tools such as the Perceived Stress Scale will be preferred [21], but a newly developed assessment tool reflecting the COVID-19 era will also be accepted. Secondary outcomes will include any mental health-related outcomes, such as depression, anxiety, and burnout. Safety data of the intervention used are also considered to be a secondary outcome of this review (Table 2).

Table 2. The inclusion criteria of this review in PICOS format.

Population	All types of HCWs, including physicians, nurses, hospital staff, and health managers
Intervention	Mind–body modalities, including meditation, mindfulness-based intervention, autogenic training, yoga, tai chi, qigong, breathing exercise, music therapy, guided imagery, biofeedback, prayer, and faith-based techniques
Comparison	No treatment, wait-list, sham control, attention control, and active comparators
Outcome	Primary outcome: level of perceived stressSecondary outcome: any mental health-related outcomes
Study type	All original clinical studies, including RCTs, CCTs, and before-after studies

Abbreviations. CCT, non-randomized controlled clinical trials; HCW, healthcare worker; RCT, randomized controlled trial.

2.3. Study Selection

In the first screening process, two independent researchers (C.-Y.K. and B.L.) will screen the titles and/or abstracts of the searched studies to identify potentially included articles. Second, potential reports will be sought for retrieval. Third, the same researchers will independently review the full texts of the retrieved reports. The final inclusion of the study will be decided through a three-step screening process. In the screening process, any disagreements between researchers will be resolved through discussion. We will evaluate the suitability of the literature according to the study design, population, and intervention eligibility criteria, and we will cite studies that appear to meet the inclusion criteria but are excluded and explain why they are excluded according to the PRISMA 2020 statement. The study selection process is presented in a PRISMA flow diagram (Figure 1).

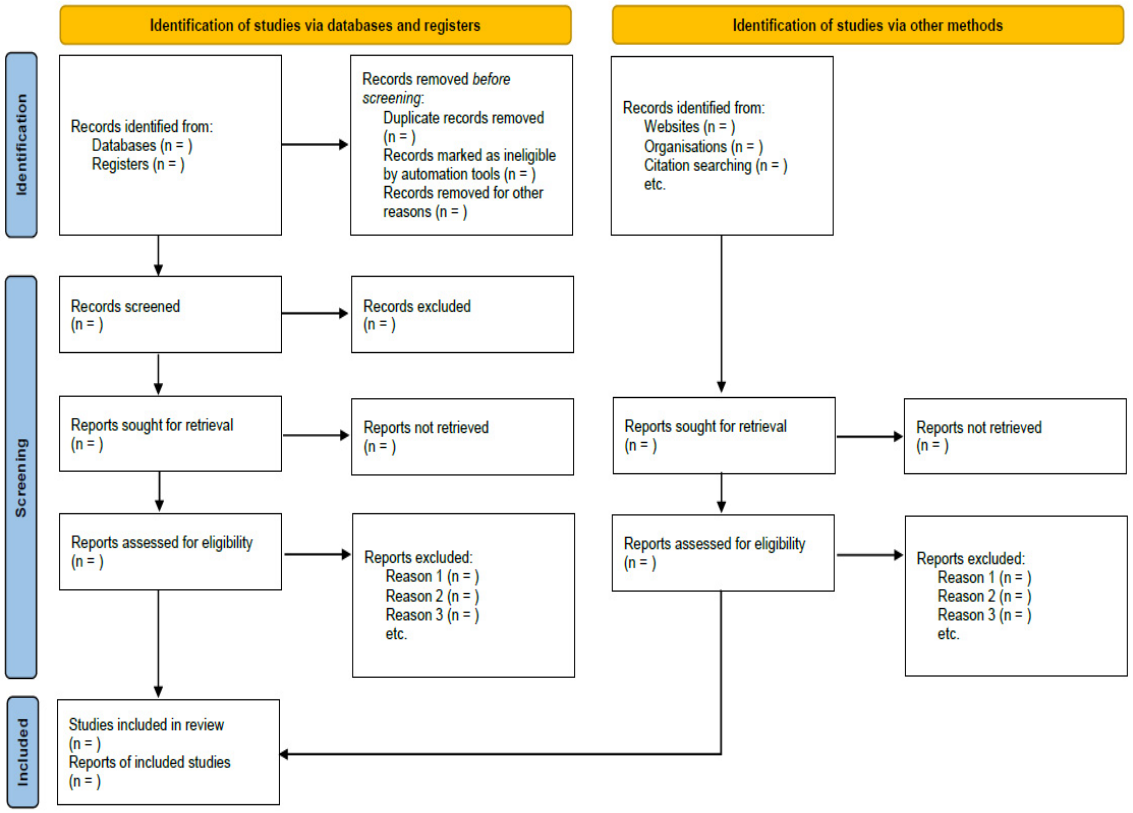

Figure 1. PRISMA flow diagram of the literature screening and selection process.

2.4. Data Extraction

The following information will be extracted by two independent researchers (C.-Y.K. and B.L.) using a standardized, pre-defined, pilot-tested excel form: the first author's name, year of publication, country, study design, sample size, details of participants, treatment and control interventions, duration of intervention, outcome measures, results, and safety data. Additionally, information for assessing the risk of bias (RoB) will be extracted. Discrepancies will be identified and resolved through discussion. When the data are insufficient, ambiguous, or missing, we will contact the corresponding authors of the original studies via e-mail. To prevent potential reporting bias by researchers, we will first perform data extraction on three studies by two researchers as a preliminary step and evaluate whether they agree. In addition, the suitability of data extraction will be evaluated by systematic review experts unrelated to the subject of this study.

2.5. Methodological Quality and Risk of Bias Assessment

Depending on the type of study, methodological quality will be assessed using the corresponding Critical Appraisal Skills Programme tools [22]. Additionally, to assess RoB, the Cochrane Collaboration RoB tool will be used in RCTs [23]. Using this tool, it is possible to evaluate RoB by classifying it into seven domains for the included RCTs. Accordingly, the methodological quality of included RCTs will be assessed in random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, selective reporting, and other domains with an assessment of "yes," "no," and "unclear." In the case of other domains, if the demographic and clinical homogeneity between the treatment and control groups is presented at baseline, it will be evaluated as "low risk." The Cochrane Handbook for Systematic Review of Interventions will guide the use of this tool [24]. The Quality Assessment of Controlled Intervention Studies by the National Heart, Lung, and Blood Institute (NHLBI) will be used for CCT [25]. The Quality Assessment Tool for Before-After (Pre-Post) Studies with no control group by

NHLBI will be used for before-after studies [25]. Two independent researchers (C.-Y.K. and B.L.) will perform the methodological quality and RoB assessments of the included studies, and any disagreements between the researchers will be resolved through discussion. To prevent potential reporting bias by researchers, we will first perform a risk of bias assessment on three studies by two researchers as a preliminary step and evaluate whether they agree. In addition, the suitability of quality assessment will be evaluated by systematic review experts unrelated to the subjects of this study.

2.6. Data Analysis and Synthesis

Descriptive analysis will be used for all included studies. If sufficient homogeneous data from two or more RCTs exist, a quantitative synthesis (i.e., meta-analysis) will be performed using RevMan 5.4 (the Cochrane Collaboration, London, UK). Whether the data are sufficiently homogeneous will be judged based on the clinical homogeneity of the participants, interventions, controls, and outcomes in the included RCTs, assessed by two independent researchers (C.-Y.K. and B.L.), and resolved by consensus in case of disagreement. In the meta-analysis, dichotomous data will be presented as a risk ratio with 95% confidence intervals (CIs), and continuous data will be presented as mean differences with 95% CIs. Statistical heterogeneity between the studies in terms of effect measures will be assessed using both the χ^2 test and the I^2 statistic. The I^2 values of $\geq 50\%$ and $\geq 75\%$ will be considered substantial and considerable heterogeneity, respectively. In the meta-analysis, a random-effects model will be used if the included studies have significant heterogeneity (I^2 value $\geq 50\%$). However, the fixed-effect model will be used when the heterogeneity is not significant, or the number of studies included in the meta-analysis is small (less than five).

If the necessary data are available, subgroup analyses will be conducted according to the following criteria: (a) type of HCWs and (b) type of mind–body modality. When a sufficient number of studies exist in the meta-analysis, sensitivity analyses will be conducted to identify the robustness of the results by excluding (a) studies with high RoB and (b) data outliers.

2.7. Reporting Bias

If sufficient studies are available (i.e., more than 10 RCTs in each meta-analysis), evidence of publication bias will be evaluated visually by using funnel plots.

2.8. Patient and Public Involvement Statement

The present review protocol did not involve individual patients or public agencies.

3. Discussion

The COVID-19 outbreak poses an unprecedented challenge for HCWs, and their mental health concerns are in the spotlight [5]. In particular, nurses, female workers, front-line HCWs, younger medical staff, and workers in areas with higher infection rates have been reported to have mental health vulnerabilities in the COVID-19 era [26]. Maintaining the mental health and increasing the well-being of HCWs could be considered as a promising strategy to improve humanity's capacity to cope with potential short- and long-term effects during and after the COVID-19 pandemic [5].

Mind–body modalities such as yoga, mindfulness-based intervention, and tai chi have been used to improve mental health and wellness in various populations, including HCWs [7–10]. In addition, mind–body modalities have recently been delivered in a non-face-to-face manner in a combined form with ICT, so mind–body modalities can be considered as a useful mental health strategy in the context of COVID-19, where social distancing is being emphasized [17].

However, for these mind–body modalities to be officially recommended for use in managing the mental health and well-being of HCWs in the COVID-19 era, their evidence base must be critically evaluated. For example, a UK research team suggested recommen-

dations for guideline development for the mental health of HCWs using a qualitative study based on interviews with front-line HCWs in the UK and a systematic literature review methodology [27]. Importantly, as the team pointed out, guidelines for improving mental health and well-being in HCWs should provide evidence-based recommendations [27]. Portella et al., who analyzed relevant systematic reviews and controlled clinical studies, found that traditional, complementary, and integrative medicines, including mind–body modalities, could be useful, especially in the field of mental health, in the face of the COVID-19 pandemic [28]. In other words, despite the literature reporting the possibility of mind–body modalities being used in mental health problems related to COVID-19, the quantity and quality of the evidence in HCWs have not yet been comprehensively and critically evaluated. This, in turn, may hinder the consideration of mind–body modalities in developing mental health promotion guides for HCWs.

Therefore, this systematic review will comprehensively analyze the effectiveness of several mind–body modalities on the mental health of HCWs in the COVID-19 era. Although the primary outcome of this review is perceived stress, the outcomes to be considered will not be limited to this. The findings of this review will help establish public mental health strategies to improve the mental health and wellness of HCWs, which could potentially help humanity in the fight against the COVID-19 pandemic and improve the quality of care and conserve health resources.

Supplementary Materials: The following are available online at https://www.mdpi.com/article/10.3390/healthcare9101320/s1, Table S1: PRISMA-P 2015 Checklist.

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Institutional Review Board Statement: Ethical review and approval were waived for this study, as this study is a systematic review of previously published studies.

Informed Consent Statement: Patient consent was waived, as this study is a systematic review of previously published studies.

Data Availability Statement: The data presented in this study are available in the article and Supplementary Materials.

Conflicts of Interest: The authors have no conflict of interest to declare.

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A Study of Leisure Constraints and Job Satisfaction of Middle-Aged and Elderly Health Care Workers in COVID-19 Environment

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Abstract: The purpose of the study was to examine the leisure constraints and job satisfaction of middle-aged and elderly health care workers. The study employed a mixed research method, utilizing SPSS 22.0 and AMOS 23.0 statistical software to analyze 260 questionnaires using basic statistical tests, *t*-tests, ANOVA tests, and structural equation models, and then interviewed medical and public health workers and experts in the field, and the results were analyzed using multivariate verification analysis. The results showed that there was a significant low correlation between leisure constraints and job satisfaction among middle-aged and elderly health care workers ($p < 0.01$); interpersonal constraints and external job satisfaction factors were the main influencing factors; improving promotion opportunities and receiving appreciation increased job satisfaction; poor working environment and facilities, as well as the lack of achievement, were the main factors that reduced satisfaction; health factors, a lack of family support, no exercise partner, and a lack of extra budget are the key to leisure constraints. If the organization can provide nearby sports facilities for middle and high-age medical workers, improve welfare, and increase willingness to participate in leisure activities, physical and mental health can be improved. Finally, interpersonal interaction in leisure obstacles is the main reason for improving job satisfaction.

Keywords: discussing pressure; on-duty mechanism; motivation; friendly workplace environment; high-level medical personnel

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1. Introduction

In the severe COVID-19 environment, countries around the world are facing serious challenges to their overall economic, social, and environmental development, due to the uncertain infection risk in their living environment, which has led to overall social unrest and has had an impact on industrial development [1–4]. In order to strengthen national security, governments have adopted quarantine policies, planned epidemic prevention measures, monitored the physical and mental health of their populations, and provided facilities and human resources to treat confirmed patients and assist people with nucleic acid testing to strengthen the national epidemic prevention frontline. However, the epidemic has not yet been alleviated. Although vaccines have been successfully developed, they are not yet widely available and effective [5–7]. The cumulative number of confirmed cases has reached 106 million, with more than 2.31 million deaths [8], and the epidemic has not yet been officially alleviated. Since the outbreak, not only has the epidemic not improved, but mutations of the virus have also emerged [9], continuing to impact the development of governments and interfere with the life quality of the population. For health care workers,

treating patients with COVID-19 and other variants of the virus, in addition to the existing medical care, has greatly increased their burden and pressure.

The health of medical personnel is crucial to the effectiveness and quality of medical care [10]. Although young people are the main source of manpower in the workplace [11], middle- and high-level workers play an important role in the command and control of the medical field [12]. In particular, middle-aged and elderly health care workers have accumulated years of health care expertise and have perfect practical experience [13,14], which is an important cornerstone for constructing a sound medical defense system and service quality. However, the daily working hours of medical workers can be divided into morning, afternoon, evening, and large inter-day night shifts. The shift duration is 8–10 h per shift, often up to 12 h when necessary. The duty schedule also requires weekly rotations [15]. Plus, the pressure of the COVID-19 epidemic and the existing medical patients has impacted the original medical work pressure [16], resulting in a health crisis among medical personnel [17] and the occurrence of burnout or resignation [18–22]. In particular, middle-aged and elderly individuals do not have sufficient leisure time, due to work and life pressures [23], and the job rotation mechanism and job responsibilities of health care workers impose tremendous occupational stress [24], resulting in health care workers suffering from burnout and even leaving their jobs, which will affect the overall health care quality and epidemic prevention effectiveness of the country [25–27]. Therefore, we believed that helping health care workers to find ways to resist stress in the COVID-19 environment, to preserve the physical and mental health of health care workers, to maintain the employment willingness of health care workers, to stabilize workplace manpower, and to uphold health care quality are important research issues at present [28,29].

Job satisfaction is the key to stabilize the employment willingness of workers, and job satisfaction can be explored in terms of personal factors and work environment. A good working environment can make employees feel more comfortable at work, and this process can be considered as an external non-reward motivational incentive [30]. An individual's job satisfaction is based on the extent to which the work environment meets the individual's needs and the individual's ability to cope with the job requirements [31]. Income, job characteristics, autonomy, stability, respectability, contribution, supportive attitude of supervisors, and better working conditions all have direct positive effects on job satisfaction [32], among which job content, salary, promotion, relationship with supervisors and peers are the main key influences on job satisfaction [33,34]. The higher the level of fatigue, the lower the job satisfaction [35], and the higher the job stress, the lower the job satisfaction or organizational commitment, and the higher the tendency to leave [36]. Therefore, we believed that improving the physical and mental health of the middle-aged and elderly health care workers would be the key to increasing work engagement and concentration, enhancing job satisfaction, and improving job performance and quality of care.

Engaging in leisure exercise can improve personal health [37], develop good leisure exercise habits, relieve psychological stress, enhance physical and mental health [38,39], maintain work performance and quality, and ensure job satisfaction of employees [40]. However, participation in leisure activities is critically influenced by the internal and external environment. Middle-aged and elderly health care workers may not develop regular exercise habits [16,23,24], due to spatial and physical constraints [41], as well as internal factors such as location, time, and cost [42], thus creating obstacles for leisure participation. The obstacles to leisure participation can also be explored in terms of personal, psychological, and time factors, as well as a lack of knowledge, facilities, accessibility, companions, and interests. Leisure constraints also affect the frequency of participation in leisure activities [43,44]. Although previous studies have suggested that removing leisure obstacles can lead to consistent participation in leisure sports and greater job satisfaction [45,46], given the high influence of middle-aged and elderly healthcare workers in upholding the healthcare system [13,14], it may not be easy to completely eliminate leisure constraints, improve the physical and psychological stress of middle-aged and

elderly healthcare workers caused by the pressure of work and social environments, reduce the willingness to leave, and maintain the quality of healthcare [47,48].

In conclusion, people's inability to engage in leisure activities may result in ineffective relief of personal stress [37]. Empirical evidence suggests that increased stress affects people's life and work performance [43,44]. The failure to achieve job satisfaction tends to make companies dissatisfied with their employees [32], affects employees' emotions at work [36], accelerates the decline in job performance, and affects employees' willingness to stay in their jobs. Thus, there is a significant correlation effect between leisure constraints and job satisfaction [45,46]. In addition, after reviewing the literature on COVID-19, medical personnel, physical and mental health, leisure constraints, and job satisfaction, it was found that medical devices and facilities [45], the physical and mental health of doctors and nurses [28,29,49–51], followed by physical and mental health and job satisfaction [49], were the most frequently studied issues related to medical personnel in the COVID-19 environment. Fewer researchers have explored job satisfaction [52], and almost no studies have examined the relationship between leisure constraints and job satisfaction.

Therefore, this study was conducted to identify the most important factors between leisure constraints and job satisfaction among middle-aged and elderly health care workers, so that the smallest magnitude of adjustment in leisure behaviors could lead to the largest increase in job satisfaction, and suggestions for improving the current leisure activities of middle-aged and elderly health care workers can be made. The major goals of this study are to help health care workers find ways to resist stress in the COVID-19 environment, maintain the physical and mental health of health care workers, maintain the employment willingness of health care workers, stabilize workplace manpower, and uphold the quality of health care.

2. Literature Discussion

2.1. Leisure Constraints

The perception of dislike when an individual is prevented from participating or engaging in leisure activities by one or more factors [53], especially in the COVID-19 environment, where the threat of an epidemic makes it impossible to regularly engage in any leisure activities and recreation [54] and creates a negative feeling when people cannot participate or engage in leisure activities, can be considered as leisure constraints [55].

Leisure constraints can produce internal, interpersonal, and structural obstacles [56]. Spatial obstacles, physical obstacles [41], and intrinsic factors, such as location, time, and cost [42], are the main keys to not developing regular exercise habits [16,23,24], while learning institutions, psychological factors, and curricular factors are leisure constraints in middle-aged and elderly populations [57].

Leisure activities can improve the physical and mental health of individuals and maintain a good physical and mental state [38,39]. However, under the threat of the COVID-19 epidemic, people feel alienated and worried about their surroundings, which leads to changes in lifestyle habits [58]. The lower immunity of middle-aged and elderly adults [57], the high intensity of medical work, and the requirement to comply with professional ethics [23–25] increase the barriers for health care workers to participate in leisure activities. Therefore, exploring leisure constraints can help identify the factors that prevent middle-aged and elderly health care workers from engaging in leisure activities and identify ways to promote leisure activities to maintain health.

2.2. Job Satisfaction

Job satisfaction is a positive affective orientation [59–61] that occurs when individuals have a pleasant and positive emotional state [60] about their work or work experience in terms of their workplace or work content. Job satisfaction is very important for health care workers, especially in the COVID-19 environment, and good job satisfaction affects their performance and is the key to the quality of health care and the effectiveness of epidemic prevention [47].

Job satisfaction involves comparing the expected job content and rewards with the actual ones in a specific environment, and positive satisfaction occurs when the actual rewards or feelings received are higher than expected; conversely, dissatisfaction occurs [62]. Job satisfaction can be considered in terms of personal emotions, work environment, benefits, and organizational expectations [63], where the facility environment, salary, promotion opportunities, supervisor recognition, self-actualization, gaining a sense of accomplishment, and personal recognition of the job and corporate values [64–67] are the main subtle keys.

High-quality job satisfaction is the key to maintaining employee performance and the quality of corporate services [68]. In particular, the rising epidemic of COVID-19 has led to soaring stress in the healthcare environment, which has exacerbated the physical and mental health of middle-aged and elderly healthcare workers, and poor physical and mental health status plays a major role in influencing individual performance and the overall quality of healthcare [35,36]. Therefore, it is the second focus of this study to identify the inadequacies of middle-aged and elderly health care workers in the workplace to help improve the working environment and conditions to meet their workplace needs, improve their work performance, and maintain the quality of health care.

2.3. Relevant Research on Leisure Constraints and Job Satisfaction

Advances in technology have raised the standard of medical care. However, there are still many different types of illnesses and frequent accidents and injuries. Medical workers have a great responsibility to treat and restore people's health. The combination of heavy workload and aging increases the stress of middle-aged and elderly health care workers [24], making them feel rejected by the content of their work [37,43,44] and decreasing their willingness to work [45,46].

Research confirms that leisure exercise can effectively help employees relieve stress, improve physical and mental health, maintain work performance, and maintain stable job satisfaction [37–40]. Enhancing personal commitment to leisure activities and lowering leisure constraints can improve the feelings of investment in activities or work [69], improve employees' leisure experiences, reduce the conditions that prevent them from engaging in leisure, and help alleviate the negative emotions of work restrictions arising from the work process [70]. In particular, in the current severe medical and epidemic prevention environment, the work pressure of healthcare workers is gradually increasing. Compared with younger workers, middle-aged and elderly healthcare workers lack opportunities to relieve stress, due to work, time, and environmental factors [41,42], and their mental and physical health defense mechanisms are deteriorating [59].

Moreover, although there is a wide range of factors that affect job satisfaction [32], the level of stress during work is the key to job satisfaction or organizational commitment [35,36]. An enthusiastic work attitude helps to maintain positive employee behavior, improve concentration, and further stabilize work performance [71], and one of the best ways to maintain personal enthusiasm, such as work or activities, is to keep one's physical and mental health [38].

According to the above literature, the work of healthcare professionals is delicate and complex, and carries a high degree of risk and responsibility. For middle-aged and elderly health care workers, the pressure further increases as they age. Without proper adjustment to relieve work pressure over time, the effectiveness of work will be affected. This can lead to frustration, increased stress, and decreased willingness to practice. Therefore, the present study believes that understanding the main causes of leisure constraints among middle-aged and elderly health care workers, reducing the conditions of leisure constraints, and improving leisure awareness and behavior will help to relieve work stress, mediate personal emotions, improve job satisfaction, and ultimately increase their desire to stay. Therefore, this study aimed to identify the main key factors that influence the relationship between leisure constraints and job satisfaction, and to help middle-aged and elderly health care workers to improve their physical and mental health, enhance their job performance,

obtain the greatest job satisfaction and stabilize the quality of health care with the least adjustment of leisure activities, which will be the main focus of this study.

There are few studies on leisure constraints and job satisfaction among middle-aged and elderly health care workers. Nevertheless, it is believed that physical and mental health can be maintained by engaging in leisure activities [71], and that good physical and mental health affects the efficiency of life or work [38]. Work efficiency affects the evaluation of employee performance by supervisors in the workplace [35,36]. In order to improve the evaluation of the workplace, employees become more engaged in their work and even feel burned out [70], which eventually can affect job satisfaction [69].

The data composition was observed using measurement and structural models from the structural equation modeling theory. Confirmatory factor analysis (CFA) [72] and path analysis were used to investigate the relationship between potential variables [73]. We believe that the structural equation modeling theory can be used to obtain answers to the effects related to the leisure constraints and job satisfaction of middle-aged and elderly health care workers.

3. Methodology

3.1. Study Design, Population, and Setting

The study analyzed the current status of leisure constraints and job satisfaction among middle-aged and elderly health care workers by investigating the effects between leisure constraints and job satisfaction, and attempted to identify the smallest changes in leisure behaviors to obtain the largest improvements in physical and mental health in the workplace, as shown in Figure 1.

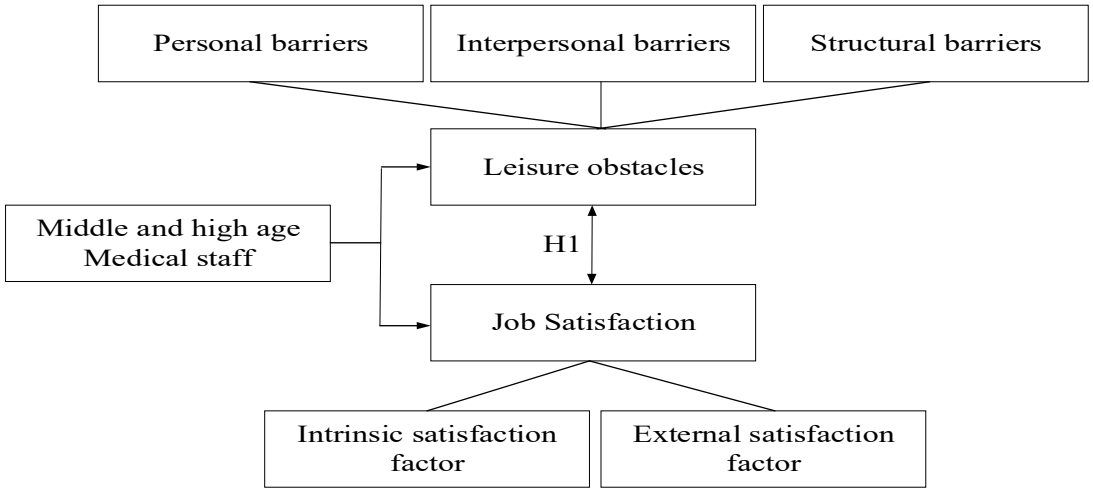

Figure 1. The research structure.

Based on the above framework, the researcher has produced three hypotheses in total.

Hypotheses 1 (H1). *Assume that the middle-aged and elderly healthcare workers have the same view on leisure barriers.*

Hypotheses 2 (H2). *Assume that the middle-aged and elderly healthcare workers have the same view on job satisfaction.*

Hypotheses 3 (H3). *Assume that leisure barriers are significantly related to job satisfaction.*

According to the literature mentioned above, engaging in leisure activities maintains a state of physical and mental health [69], and good physical and mental health affects productivity [38]. If employees are able to improve their productivity, it will influence the performance evaluation of employees by workplace supervisors [35,36]. Personal workplace evaluations will change employees' attitudes and perceptions toward their

jobs [71] and ultimately affect job satisfaction [70]. Therefore, we believe that there may be a mutual effect between leisure constraints and job satisfaction of middle-aged and elderly health care workers. Therefore, it was hypothesized that there would be a significant effect between leisure constraints and job satisfaction.

While scientific research needs to be conducted with adequate theoretical support, rarity or novel research areas are relatively weak in the theoretical foundation. Adopting a complex research approach, complementing the breadth of research with quantitative research methods [70,71], and deepening the depth of research with qualitative research [72] can compensate for research methodological or theoretical shortcomings [73]. The study adopted a mixed research method. First, a sample of middle-aged health care workers from the medical workers at the Central Hospital of Taiwan was created using deliberate sampling and an online questionnaire survey platform. Then, 300 questionnaires were distributed using snowball sampling and 260 valid questionnaires were recovered, with an effective questionnaire rate of 87%. If the sample can obtain 5 multiples of the variable [74,75], or if the number of questionnaires exceeds 100 [75–77], it was considered representative. Using SPSS 22.0 and AMOS 23.0 statistical software, we examined the current status of leisure constraints and job satisfaction among middle-aged and elderly health care workers using basic statistics, and then analyzed the relationship between the two using a structural equation model. Then, on-the-job health care workers or scholars in the fields of health care, public health, or human resource management were interviewed to provide insights based on the analysis results, and, finally, the information was compiled, organized, and analyzed in order to construct the report [78]. Finally, the multivariate verification analysis method was used to integrate the information of different research subjects, research theories and methods, and to obtain accurate knowledge and meanings by comparing the research results from multiple perspectives and multiple data [79,80].

3.2. Measurements

The questionnaire adopted a 5-point Likert scale, with a score of 1 being very dissatisfied and 5 being very satisfied. After the content was edited with reference to the literature, three experts were sought to examine the content, and then SPSS 22.0 statistical software was used to determine the topic and then test statistically. A Kaiser–Meyer–Olkin (KMO) value > 0.06 and a p-value of less than 0.01 ($p < 0.01$) in Bartlett's test indicated that the scale was suitable for continuous factor analysis [81]. A coefficient α greater than 0.60 indicated that the questionnaire had good reliability [82].

In the questionnaire, the background of the respondents was composed of gender, 45–64 years old age group, unmarried, married and other (divorced) marital status, junior college, university or postgraduate education.

The questionnaire refers to related literature on leisure barriers [23–25,38,39,58,59] and job satisfaction [47,60–67]. Leisure obstacles consist of 12 questions. The leisure obstacles aspect had a KMO value > 0.923, Bartlett's approximate χ^2 value of 1849.134, degree of freedom (df) of 66, and significance of 0.000 ($p < 0.001$), making it suitable for factor analysis. The explained variances of the scale were 26.21%, 17.75%, and 16.91%, for a total explained variance of 60.87%. Considering the understanding of the actual state of economic development, all questions were retained after factor analysis. The following three areas were designated: personal obstacles (4 questions), interpersonal obstacles (4 questions), and structural obstacles (4 questions), with 0.922, 0.917, and 0.920, respectively.

For the job satisfaction aspect, the explained variances of the scale were 34.17% and 26.88%, with a total explained variance of 61.05%. Considering the understanding of the actual state of economic development, all these were retained after factor analysis. The following three areas were designated: internal satisfaction factor (4 questions) and external satisfaction factor (4 questions), with 0.902 and 0.899, respectively.

As mentioned above, the contents of the revised final questionnaire on leisure constraints and job satisfaction of middle-aged and elderly health care workers are shown in Table 1.

Table 1. Questionnaire tool description for leisure constraints and job satisfaction of middle-aged and elderly health care workers.

Issue	Content
Background	Gender (male/female); age (45–49/50–54/55–59/60–64); Education (junior college/university/institute); marriage (unmarried/married/other)
leisure constraints	1. Introverted personality 2. Family does not support 3. Poor health 4. Too many skills 5. Friends have no time 6. Friends have no money 7. Friends have no transportation 8. Friend has no energy 9. I have no money 10. The place is too narrow 11. I have no information 12. Own no transportation
job satisfaction	1. Environment and facilities 2. Salary 3. Promotion opportunities 4. Get praise 5. Realization ability 6. Get a sense of accomplishment 7. Competent job 8. Profession has special meaning

After collecting the questionnaires and deleting the invalid questionnaires, the study used SPSS 20.0 to establish a document and conduct statistical verification and analysis on the questionnaire. Next, AMOS 23.0 was used to conduct the analysis on the relationship between variables and verification of the plausibility of the research model. As shown in Figure 2.

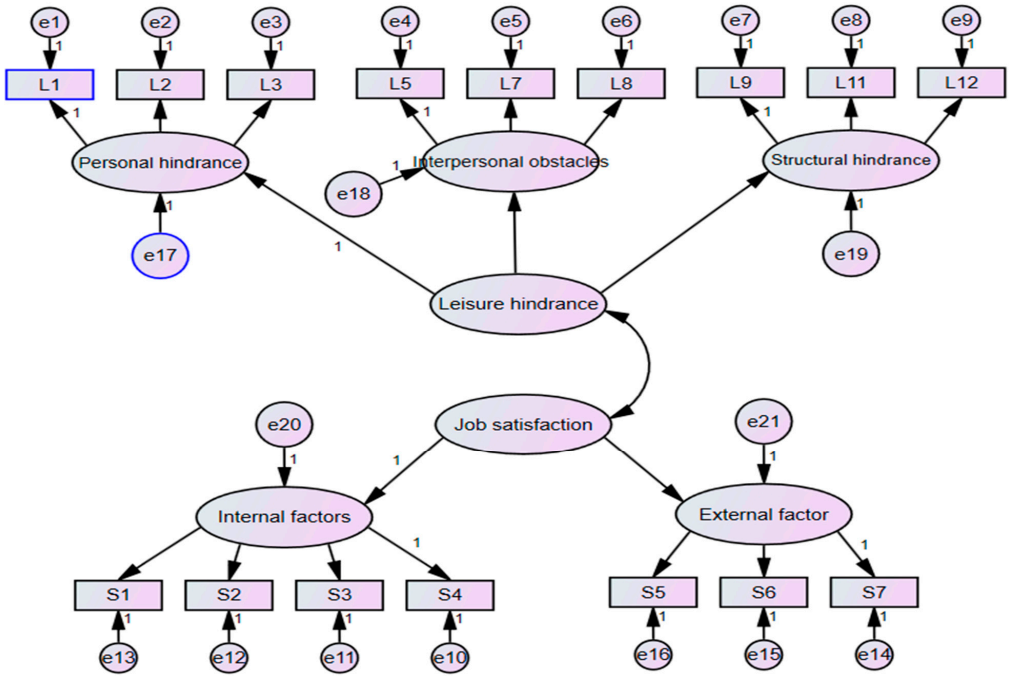

Figure 2. Structure diagram of confirmatory factor analysis of leisure obstacles and job satisfaction.

3.3. Data Analysis

Next, after obtaining 260 responses to the formal questionnaire, the researcher used SPSS 22.0 and AMOS 23.0 statistical software to examine the current status of leisure constraints and job satisfaction using basic statistical tests. The structural equation model was used to analyze the correlation between leisure constraints and job satisfaction, and the overall model suitability was determined by examining the offending estimates first, and was based on the χ^2 test, χ^2/degree of freedom (DF), goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), root mean square error of approximation (RMSEA), comparative fit index (CFI), and Parsimonious comparative fit index, PCFI).

3.3.1. Offending Estimate

Before undertaking the checking on overall goodness of fit, there needs to be a check on offending estimate; therefore, this study is in compliance with no offending estimate [83–89]. Offending estimates are used to check whether the estimated coefficients are within an acceptable range before assessing model fitness [90]. Offending estimates exist when the estimate coefficients show 1. negative error variance, 2. insignificant error variance, 3. standardized regression coefficients that are above or too close to 1 (with a threshold of 0.95), and 4. a too large standard error [91,92].

From Tables 2 and 3, the variance in the research was 0.07 to 0.12 and standardized coefficient was 0.68 to 0.82, not over the standardized value of 0.95 and can thus be used to conduct goodness-of-fit check with the overall model of the study.

Table 2. Leisure hindrance scale offending estimate check table.

	Item Code	Standardized Regression Coefficient	Deviation Variance
L1	Introverted personality	0.70	0.12
L2	Family does not support	0.74	0.08
L3	Poor health	0.77	0.09
L4	Too many skills	0.69	0.09
L5	Friends have no time	0.79	0.07
L6	Friends have no money	0.68	0.09
L7	Friends have no transportation	0.79	0.07
L8	Friend has no energy	0.80	0.07
L9	I have no money	0.69	0.09
L10	The place is too narrow	0.76	0.08
L11	I have no information	0.75	0.08
L12	Own no transportation	0.68	0.09

Table 3. Job Satisfaction scale offending estimate check table.

	Item Code	Standardized Regression Coefficient	Deviation Variance
S1	Environment and facilities	0.75	0.09
S2	Salary	0.73	0.09
S3	Promotion opportunities	0.77	0.09
S4	Get praise	0.77	0.09
S5	Realization ability	0.78	0.08
S6	Get a sense of accomplishment	0.82	0.07
S7	Competent job	0.80	0.08
S8	Profession has special meaning	0.74	0.09

3.3.2. Measurement Mode Analysis

The questionnaire of the study was followed by confirmatory factor analysis to verify the reliability and validity, and the project was revised according to the revised indicator modification index (MI) [93]. This study deletes items such as L4 and L10 in the leisure

hindrance model and S8 in the job satisfaction model. The rest are within compliance with the standards, so the project remains.

3.3.3. Verification of Convergent Validity

Bagozzi and Yi [36] believe that convergent validity can be derived from the composite reliability (C.R.) and average variance extracted (AVE) of factor perspective. The recommended C.R. value should be greater than 0.7 and AVE greater than 0.5 to show that the questionnaire has convergent validity [90]. The convergent validity of the factors of leisure constraints and job satisfaction was verified, and all factor loadings were in the range of 0.73–0.83, where C.R. values were in the range of 0.77–0.84 and AVE in the range of 0.53–0.64, which is within the normal range [87]. Therefore, this study possessed convergent validity [93], as shown in Table 4.

Table 4. Leisure obstacles and job satisfaction model—confirmatory analysis.

Perspective	Index	Standardized Factor Loading	Non-Standardized Factor Loading	S.E.	C.R. (*t*-Value)	*p*	SMC (R^2)	C.R.	AVE
Personal obstacles	L1	0.73	1.00				0.54	0.80	0.58
	L2	0.78	0.87	0.08	11.50	***	0.60		
	L3	0.78	0.97	0.08	11.43	***	0.62		
Interpersonal obstacles	L5	0.79	1.00				0.62	0.84	0.64
	L7	0.79	0.98	0.07	13.22	***	0.63		
	L8	0.82	1.07	0.07	14.23	***	0.67		
Structural obstacles	L9	0.70	1.00				0.49	0.77	0.53
	L11	0.78	1.10	0.10	10.81	***	0.61		
	L12	0.71	0.99	0.10	10.33	***	0.51		
Intrinsic satisfaction factor	S1	0.76	1.00				0.57	0.84	0.57
	S2	0.73	0.92	0.08	11.73	***	0.53		
	S3	0.77	1.05	0.09	12.13	***	0.59		
	S4	0.77	1.02	0.08	12.10	***	0.59		
External satisfaction factor	S5	0.80	1.00				0.64	0.84	0.64
	S6	0.83	1.04	0.07	14.30	***	0.69		
	S7	0.77	1.02	0.08	12.96	***	0.59		

*** $p < 0.001$.

3.3.4. Discriminant Validity Verification

Long [94] pointed out that discriminant validity is to verify the existence of correlation and significant difference between two different perspectives. The bootstrap 95% confidence interval suggested by Torkzadeh et al. [95,96] was used to check the related coefficient between perspectives. If 1 does not appear, it means it completely correlated and has discriminant validity. From Tables 5 and 6, the bootstrap 95% confidence intervals are all less than 1, indicating that the research complies with discriminant validity [97–99].

The present study used bootstrap method to establish the confidence intervals of Pearson's correlation coefficients between perspectives. If the confidence interval does not contain 1, then the null hypothesis is rejected, i.e., it is perfectly correlated, which means that there is discriminant validity between perspectives [93]. In this verification, the bootstrap assessment was repeated 1,000 times and at the 95% confidence level, it was found that no confidence interval including 1 occurred between perspectives. Therefore, the judgment of the first-order model in the research has discriminative validity.

Table 5. Leisure hindrance—bootstrap 95% confidence interval table of related coefficients.

Parameter			Estimate	Bias-Corrected		Percentile Method	
				Lower Boundary	Upper Boundary	Lower Boundary	Upper Boundary
Personal obstacles	↔	Interpersonal obstacles	0.84	0.75	0.91	0.75	0.91
Personal obstacles	↔	Structural obstacles	0.80	0.69	0.88	0.69	0.89
Interpersonal obstacles	↔	Structural obstacles	0.92	0.85	0.98	0.85	0.99

Table 6. Job satisfaction—bootstrap 95% confidence interval table of related coefficients.

Parameter			Estimate	Bias-Corrected		Percentile Method	
				Lower Boundary	Upper Boundary	Lower Boundary	Upper Boundary
Intrinsic satisfaction factor	↔	External satisfaction factor	0.93	0.85	0.99	0.85	0.99

3.3.5. Analytical Method

The study adopted a mixed-method approach by collecting questionnaires and then using SPSS 22.0 and AMOS 23.0 statistical software to conduct basic statistical tests, *t*-tests, ANOVA tests, Pearson product moment correlation analysis, and related tests. Next, five active health care workers with at least 10 years of experience or academics with medical, public health, or human resource management expertise were interviewed and invited to provide insights into the data results. Finally, after compiling, comparing, and analyzing the data from multiple sources, a multivariate validation analysis was used to examine this issue. Are shown in Table 7.

Table 7. Background of the interviewees and content of the interview.

Identity	Professor(A)	Teacher (B)	Doctors (C)	Nurse (D)	Pharmacy (E)
Seniority	12	20	18	13	20
Interview content	1. What are the main obstacles to leisure for healthcare workers? Please briefly explain the reasons. 2. What are the work indicators that medical workers care about most when they are engaged in work? Please briefly explain the reasons. 3. Based on the research results of leisure obstacles, that is, job satisfaction, what do you think are the influencing factors?				

3.4. Ethical Considerations

This research was conducted using the intentional sampling method to identify the subjects, combined with the snowball sampling method. However, the sample collection process needs to be properly and carefully planned, and the difficulties and obstacles in the sample collection process need to be explained [100]. The research is based on the code of ethics [101,102], and sample information is collected. Therefore, all respondents agreed to provide relevant data and understood the main purpose of the study. All questionnaires and interviews were recorded and collected from anonymous and informed respondents.

4. Results

4.1. Leisure Barriers and Job Satisfaction—Structural Model Analysis

The analysis revealed that leisure constraints had a significantly low correlation ($p < 0.01$) with job satisfaction (0.33), and there were also significant effects of various components. However, among leisure obstacles, interpersonal obstacles (0.942) are the highest, and among job satisfaction, external satisfaction (0.945) is the highest. In terms of research inferences, interpersonal obstacles (0.942) were the highest factor influencing the leisure constraints of middle-aged and elderly health care workers, and the external satisfaction factor (0.945) was the key factor influencing job satisfaction. Among the leisure constraints, interpersonal obstacles had the greatest effect on job satisfaction (0.33), and external factors of job satisfaction were crucial to leisure constraints. It was then found that, among the external satisfaction factors of job satisfaction, obtaining a sense of accomplishment (0.377) had the greatest effect on leisure constraints, whereas friends without physical strength (0.352) was the main factor affecting job satisfaction among the interpersonal obstacles of leisure constraints, as shown in Table 8.

Table 8. Correlation analysis of leisure obstacles and job satisfaction.

	Intrinsic Satisfaction Factor		**External Satisfaction Factor**	**Overall Dimensions of Job Satisfaction**		**Leisure Hinders the Overall Dimension**
Personal obstacles	0.226 **		0.311 **	0.285 **		0.899 **
Interpersonal obstacles	0.295 **		0.327 **	0.330 **		0.942 **
Structural obstacles	0.261 **		0.292 **	0.294 **		0.913 **
Intrinsic satisfaction factor	1		0.778 **	0.941 **		0.284 **
External satisfaction factor	0.778 **		1	0.945 **		0.338 **
Overall dimensions of job satisfaction	0.941 **		0.945 **	1		0.330 **
	Leisure obstacles—interpersonal obstacles			Job satisfaction—external factors		
	Friends have no time	Friends have no transportation	Friend has no energy	Ability to achieve	Get a sense of accomplishment	Competent job
Overall dimensions of job satisfaction	0.276 **	0.251 **	0.352 **		-	
Leisure hinders the overall dimension		-		0.305 **	0.337 **	0.284 **

** $p < 0.01$.

4.2. Discuss

4.2.1. Discussion of Sample Background

Although the demand and participation of male health care workers have increased with the global promotion of equal work rights for both genders, women still constitute the majority of health care workers in primary care because of the highly technical nature and the delicate work content of professional nursing, general care and medical cleaning. However, although primary health care jobs are stable and the salary grows with seniority, the long working hours and labor-intensive nature of health care, coupled with a workplace environment affected by existing work and epidemic prevention pressures and few opportunities for high-level jobs, make it difficult for new parents or families with childcare needs to take care of their children and afford additional childcare and education costs, and to attract high-level talent. As a result, the nursing workforce is still dominated by women, and highly educated individuals possessing workplace competitiveness, as well as those under the age of 49 who face family pressure and are unable to cope with work pressure, are less inclined to choose a healthcare career.

By hiring sufficient manpower, setting regular duty hours, reducing occupational stress, and offering higher benefits and wages, the willingness of senior medical workers under the age of 49 to seek employment could be improved.

4.2.2. Discussing the Current Situation of Leisure Obstacles and Job Satisfaction among Middle-Aged and Senior Medical Staff

Middle- and high-aged health care workers have already reached the age of marriage and have to spend time with their families and take care of their health while working. Those who are single or in other marital statuses are under stress due to the long hours of clinical work, time difference and poor sleep quality caused by shift work, the broad scope of their jobs, and the high level of medical responsibilities. Therefore, most middle-aged and elderly health care workers were discouraged from engaging in leisure activities, due to personal factors such as a lack of family support and poor health (4.5), a lack of exercise partners (4.57), and insufficient additional exercise budget (4.62).

The advancement structure of the medical employment system is clear, the more years of experience, the greater the chance of advancement. In addition, health care workers are respected by the public for their role in saving lives and taking care of people's health. However, due to the rising COVID-19 epidemic, the prevalence of the variant virus, and the differences in the awareness and cooperation of individual diagnosed patients, the epidemic has not yet been controlled and there are localized cases of institutional infections, which undermine the confidence of most health care workers [24–26]. Therefore, most middle-aged and elderly health care workers believed that good promotion opportunities (4.99) and receiving praise (4.97) make it easy to achieve higher job satisfaction, while dissatisfaction with the current working environment and facilities (4.73), due to the persistence and spread of the epidemic and negligent decision making, prevented them from achieving personal fulfillment in their health care work (4.83).

The advancement system of Taiwan's medical employment system is well established, and the longer the years of experience, the greater the opportunities, but there is still a shortage of employees in the field. Although the educational requirements for entry into the primary care workforce are low and there are many job opportunities, the life quality and the physical and mental health of middle-aged and elderly healthcare workers are affected by factors such as limited high-level jobs, the highly technical, complex, and laborious nature of the workplace, the shift work mechanism, the fixed and confined workspace, the frequent contact with patients, as well as the current outbreak of epidemics and cluster infection cases in hospital institutions [18], which further impact their willingness to work [19]. Those with college degrees valued environment and facilities planning more, while those who were unmarried or married valued promotion opportunities. Those who were married were more likely to receive appreciation. Those with college and university degrees were more likely to obtain a sense of accomplishment.

By improving the working environment, replenishing departments that lack manpower, stabilizing the duty mechanism for medical staff, improving benefits and wages, planning in-hospital fitness facilities for staff, providing psychological counseling services, developing proper epidemic prevention and medical management strategies, and motivating primary medical staff, the perceptions of middle-aged and elderly medical workers regarding leisure constraints and job satisfaction could be improved, and the feelings of unmarried and highly educated medical professionals about their current workplace and their willingness to plan personal leisure activities could be reversed.

4.2.3. Discussion on the Relationship between Leisure Obstacles and Job Satisfaction

Leisure activities help to improve physical and mental health, and enhance personal performance and productivity [38,67]. However, exercise requires companionship, and effective companionship can promote leisure motivation [98]. In particular, health care workers have monotonous and stressful jobs, and middle-aged and elderly people have to take care of the quality of family life and children's health, so they have little energy to engage in leisure activities. In addition, it is not easy to find partners for leisure activities because of the similar nature of work in the circle of friends. As a result, it is impossible to properly relieve physical and mental stress, improve work efficiency, or promote work performance and satisfaction. Thus, although there was a low correlation between leisure

constraints and job satisfaction (0.33), interpersonal obstacles became the main factor influencing job satisfaction, and friends' lack of physical strength (0.352) was the main factor preventing middle-aged and elderly healthcare workers from engaging in leisure activities.

Leisure activities can improve physical and mental health, enhance personal performance [38], increase productivity [67], and maintain the individual's willingness to engage in work or leisure [37–40]. However, for middle-aged and elderly health care workers, it is more important to be paid for their work and to maintain a stable family and personal lifestyle and daily needs. Particularly in a severe epidemic environment, health care workers can gain job security and encouragement from the public if they can perform well in their jobs, which in turn increases their sense of self-worth; both help stabilize performance and relieve stress for health care workers, freeing up time for planning leisure sports. Thus, job satisfaction has a low level of influence on the willingness of middle-aged and elderly health care workers to engage in leisure, but external job satisfaction level factors have a higher influence on leisure constraints, and the factor of having a sense of accomplishment at work (0.33) is the most critical.

The government, organization directors, or the public could motivate health care workers promptly, improve the welfare of health care workers, design or cooperate with fitness centers nearby, and plan to provide public transportation for staff to engage in leisure activities and children's pick-ups and drop-offs, so that individuals can plan health maintenance or leisure activities of appropriate intensity for a short period of time to maintain their physical and mental health. In this way, we can enhance the willingness of middle-aged and elderly medical workers for leisure activities, maintain their physical and mental health, improve their job satisfaction, and uphold the quality of medical care.

4.2.4. For Research Objects and Clinical Verification

Health care technology is closely related to human life. Although the standard of employment for primary care jobs only requires a junior college degree, the job is not easily replaced due to its technical and professional content. Compared to other jobs, the pay is good enough to cover basic family expenses, although there are some laborious tasks such as lifting and moving patients and beds. Medical interaction requires the patience, care, and gentleness that most women possess. This makes health care a sacred, stable, and rewarding career.

Due to the design and limitations of the study, however, the data in this study were mainly obtained by analyzing the subjects' perceptions of the issues from the questionnaire. In the future, if volunteers can be obtained to conduct actual leisure exercise experiments and then continue to analyze their job satisfaction perceptions, the results can further verify our findings.

5. Conclusions

Middle-aged and elderly health care workers are faced with existing medical work pressure, COVID-19 epidemic surveillance responsibilities, and pressure from the public, resulting in a less friendly medical work environment in the field. In addition, the unstable duty hours, inadequate benefits and wages, limited time for leisure and exercise, and few choices of venues are the key factors that prevent most middle-aged and elderly health care workers from engaging in leisure activities, thus lowering their job satisfaction. If the working environment can be improved, the manpower can be replenished, the shift mechanism can be stabilized, benefits can be improved, fitness facilities can be planned, psychological counseling services can be provided, and management strategies can be developed to motivate employees, the perception of middle-aged and elderly medical workers about leisure constraints and job satisfaction can be improved, and the unmarried and highly educated medical professionals' perceptions of their current workplaces and their willingness to plan their leisure activities can be reversed.

The analysis shows that women continued to be the dominant practitioners among middle-aged and elderly health care workers, although the proportion of men was begin-

ning to increase. Although there was a significant correlation between leisure constraints and job satisfaction, only external job satisfaction was significantly associated with leisure constraints and no other significant effects were found, which is inconsistent with the previous literature [23–25,35,36]. We believe that the demand for male workers will continue to rise, due to the need to move medical equipment, patients, etc. Focusing on the feelings and attitudes of male workers in the field and improving their willingness to work will be a key to improving the quality of services in healthcare facilities. Furthermore, although leisure constraints are significantly associated with job satisfaction, not all work-level stressors are key contributors to leisure constraints. Therefore, it is suggested that future studies could target male health care workers to understand their feelings and attitudes in the workplace, and analyze the critical influences on external job satisfaction, which would help to fill the research gap.

Based on the above content, the following research suggestions are put forward:

1. The employment willingness of senior medical staff should be valued, and benefits should be improved;
2. Comprehensive on-site medical and epidemic prevention management decisions should be formulated in order to safeguard the existing medical environment in advance;
3. A fitness center should be provided in the facility or through cooperation with a nearby one;
4. Public transportation should be provided for employees to engage in leisure activities and transportation of children to and from their families;
5. Middle-aged and elderly health care workers should schedule 30–60 min of moderate-intensity exercise after work, at least three times a week, to maintain physical and mental health;
6. The medical staff should be supplemented, and the shift schedule mechanism should be stabilized;
7. Find leisure activity partners from work, or plan short-time, moderate-intensity leisure exercises, and engage in leisure regularly to maintain physical and mental health;
8. Exploring the feelings of male health care workers and analyzing the factors that influence external job satisfaction in depth will help fill the research gap;
9. Due to the sampling method and limitations of the study, errors may occur. It is recommended that follow-up researchers use additional sampling methods to obtain a larger amount of data for analysis, and include other age groups in the study, which may complement our findings.

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Assessment of Workplace Safety Climate among Healthcare Workers during the COVID-19 Pandemic in Low and Middle Income Countries: A Case Study of Nigeria

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Abstract: The COVID-19 pandemic has presented several organizations with the opportunity to review their operational strategies, as well as the existing safety climate within their establishments. The healthcare sector is not an exception, especially those in Low and Middle Income Countries (LMICs), where most safety systems are not robust when compared with developed countries. The study aim is to assess the occupational safety climate among healthcare workers (HCWs) in LMICs using Nigeria as a case study. A cross-sectional study was adopted to measure safety climate perception among professionals working in healthcare establishment during the COVID-19 pandemic using a validated Nordic Safety Climate Questionnaire (NOSACQ-50). At the end of the survey period, 83% (433) of the responses were adjudged to have met the threshold criteria and were used to inform the study outcome. Worker safety commitment within the healthcare facilities ($M = 3.01$, $SD = 0.42$) was statistically significantly higher than management safety priority, commitment, and competence ($M = 2.91$, $SD = 0.46$), $t(130.52)$, $p < 0.001$. A significant effect of the management role was found in regards to management safety priority, commitment, and competence ($F(1, 406) = 3.99$, $p = 0.046$, $\eta^2 = 0.010$). On the contrary, the managerial position does not have a significant effect on worker safety commitment ($F(1, 417) = 0.59$, $p = 0.440$, $\eta^2 = 0.001$). The outcome from the study showed that, where there is active promotion of a positive safety climate in healthcare sectors in LMICs, employees are more likely to engage in positive safety behaviour. To help address the identified gaps, there is the need for more effort to be made towards promoting an effective and positive safety climate across the establishment, including management and healthcare worker commitments.

Keywords: safety climate; safety leadership; healthcare; LMICs; Nigeria

1. Introduction

The COVID-19 pandemic has had a significant impact on existing health and safety systems in different sectors of the economy, to which the healthcare establishment has had its own share of this impact. Professionals within the healthcare sector had to find means of responding to the increasing rate of infection, as well as endure back to back overtime

shifts as they dealt with the overwhelming rate of hospitalization due to the pandemic and manage other diseases and chronic conditions, all of which increase physical and mental exhaustion. In Africa and other LMICs, the states of healthcare delivery systems are mostly below the required safety standards owing to their abject state of neglect, deficiency of both human and technical resources, and the almost nonexistence of healthcare management information systems, which predate the emergence of the SARS-CoV-2 pandemic [1–3].

In order to warrant workplace safety performance, healthcare sectors will be required to come up with safety rules and procedures and ensure that they are applied across the organization [4]. The principle is to guarantee both employees and patients their safety, as well as the avoidance of costs associated with accident or injury. While this has been the tradition moving forward, healthcare facilities, especially in LMICs, now need to invest in the implementation of formal safety programs and risk management systems [5].

Developing a culture of safety in healthcare organizations is an important pillar, as it strives to eliminate the factors that contribute toward the management of mental and physical exhaustion, medical errors, patient harm, unsafe conditions, and the enhancement of overall patient safety [6–9]. In addition, an organization's safety culture is an important factor that influences systems safety. Wagner, Schöne, and Rieger [10] advanced seven antecedent variables that help form a good safety climate: structural attributes of the work environment, symbolic social interaction, group and organization leadership, psychological work ownership, organizational commitment, job stress, burnout, and personality. Nieva and Sorra [11] defined safety culture as "shared attitudes, beliefs, values and assumptions that underlie how people perceive and act upon safety issues within their organizations", whereas the term safety climate refers to the shared expression or measurable components of safety culture, such as management behaviors, safety systems, and employee safety perceptions [12]. Even though the precise denotations of safety culture and safety climate are dissimilar, these two expressions have been used interchangeably. Moving forward, the present study focus is around safety climate within healthcare settings in Nigeria.

Traditionally, safety climate has been researched in high-risk industries that include oil and gas, the construction sector, transportation, manufacturing factories, nuclear facilities, etc. [13–17]. However, the complex and unique characteristics of the healthcare organization further call for safety climate research to help improve both patients' and employees' safety. Recently, there has been growing acceptance within the healthcare establishment around the assessment of leading indicators, which are considered important in the promotion of patient safety. These factors include emphasis on production, efficiency, and cost controls, organizational and individual inability to acknowledge fallibility, and professional norms for perfectionism among healthcare providers [11,18,19]. Workplace safety climate assessment provides organization understanding of safety-related perceptions and attitudes of its workforce, and can be applied as a diagnostic tool to help identify areas within the organization that need improvement, providing needed impetus for further assessment while making use of staff input to address identified gaps [11]. As such, the benchmarking of the safety climate within healthcare facilities is now a focus, especially in developed countries that include the United Kingdom, USA, etc. [20,21].

The high increase in the number of healthcare facilities in Nigeria over the last decade has presented the challenge of the maintenance of best practices to guarantee the safety of patients and employees [3,22]. In addition, Nigeria has one of the largest pools of healthcare personnel in Africa [23]. The healthcare sector in the country makes up about one-third of the total workforce, but mostly is concentrated in urban tertiary healthcare services in the southern part of the country. Due to the present state of the healthcare services in most LMICs, healthcare workers (HCWs) perform their duties in an increasingly hazardous work environment and occupational setting [24–26]. Personnel in this workforce are responsible for providing quality healthcare services, even though their work places are increasingly unsafe [27], and they encounter frequent forms of hazards at work that include injuries, direct infections, stress, assault from patients and their relatives, allergies, back pain, and other musculoskeletal injuries [5,28]. The multiplier effects of occupational

injuries and diseases among HCWs include economic loss, physical loss, and psychological disorders, such as stress and depression. These have an overall negative impact on the workers, their families, and the nation at large. Identifying factors relating to occupational hazards among HCWs is essential in formulating occupational health safety policy and a system that will improve productivity and the overall wellbeing of HCWs [29].

Promotion of a positive culture of safety is associated with clinical outcomes [30]; as such, the assessment of the safety climate within healthcare facilities can provide a picture of management commitment, performance, and quality of care that further promotes a positive safety culture within the organization. While there has been a resurgence in research on workplace safety within healthcare, there are limited research works that have focused explicitly on the workplace safety climate and workplace characteristics in Nigeria. The aim of the present study is to assess the occupational safety climate among healthcare workers (HCWs) in LMICs using Nigeria as a case study. The objectives of the study are to compare the impacts that individuals with managerial roles have on the seven indicators of work safety climate in the promotion of an effective safety culture in healthcare sectors; to establish the most significant determinants of the work safety climate; and to make appropriate recommendations for improving the workplace safety climate in the healthcare sector in Nigeria.

2. Materials and Methods

The present study measured safety climate perception among healthcare workers during the COVID-19 pandemic. The Nordic Safety Climate Questionnaire (NOSACQ-50) was used among randomly selected healthcare workers. The questionnaire consists of 50 statements, which set out to evaluate seven safety climate dimensions.

2.1. Sample Size

Due to the lack of official data in the public domain, an estimated 14,000 HCWs are working in the study area. To determine the sample size for the study, Fisher's formula [31] for estimating single proportions and an estimation for minimum sample size was applied, and the estimated sample size was 423.

Fisher's formula:

$$n = \frac{Z^2 P(1-P)}{d^2}$$

where:
n = sample size;
Z = standard deviation for a 95% confidence level (Z = 1.96);
P = prevalence of the attribute (50.0%);
d = acceptable difference (if 5%, d = 0.05);
q = 1 − p.

2.2. Study Population

At the end of the survey, 433 participants comprised of doctors, nurses, midwives, pharmacists, laboratory scientists, physiotherapist, dietitians, radiographers, community health officers, community health extension workers, environmental health professionals, etc., from five states in the northern part of Nigeria consisting of Adamawa, Gombe, Plateau, Taraba, and the federal capital territory Abuja were considered in the study. The survey was conducted using the Joint Information Systems Committee (JISC) online survey platform, and a link was sent to target healthcare management for distribution among the staff. Similarly, the survey link was sent to social media host administrators for each local professional identified, and, where deemed appropriate by the administrator, it was shared among its group members. All participants agreed to participate in the study by signing an electronic consent form before they were able to progress to the question section. The Gombe State Ministry of Health (MOH/ADM/621/1/294) granted ethics approval for the study.

2.3. Survey Design

The survey was conducted from October 2020 to March 2021 with different professionals working in healthcare establishments across the northeast and north central region of Nigeria. The NOSACQ-50 questionnaire was adopted to capture the employee's perception of safety climate features that relate to supervisor and management support regarding workplace safety. A translated and validated English version of the questionnaire comprised of 50 items across seven safety climate dimensions to measure the participant's shared safety climate perceptions was adopted. Sections of the questionnaire included: (i) management safety priority, commitment, and competence; (ii) management safety empowerment; (iii) management safety justice (six items); (iv) workers' safety commitment; (v) workers' safety priority and risk non-acceptance; (vi) peer safety communication, learning, and trust in safety ability; and (vii) trust in the efficacy of safety systems. Accordingly, the first three items measured the perception of safety management within the healthcare organization, while the remaining four items were related to employees' safety commitments. Each item was rated using a four-point Likert scale of agreement (from 1 = strongly disagree to 4 = strongly agree) that corresponded to a 1–4 rating scale in case of positively formulated statements or 4–1 for the reversed statements, respectively, and attaining a high scale score was indicative of a positive response. In addition, questions on demographic characteristics were considered in the questionnaire that included age, sex, and whether the respondent held a management position [32].

2.4. Sampling Technique

A pilot survey was conducted among 20 HCWs to assess the instrument acceptability, validity, and reliability. The response and general comments received were found to have met the need of the study, and, as such, there was no further adjustment made to the initial questionnaire in the main study.

A cross-sectional study design was adopted for the study, and a convenient snowball sampling technique was used to reach out to the target participants. Participants were drawn using deliberate contact and sensitization of the different health professional associations and workplace units. All HCWs voluntarily completed the survey either using an online link shared on the HCW's association internal mails or closed social media platforms or by physical administration of hard copies of the questionnaires.

2.5. Reliability Test

To measure the reliability for sets of latent variables in each dimension, Cronbach's alpha test was done [33], and the result revealed that all sets of items were closely related, with an acceptable to good alpha score range of 0.703–0.810 among the seven dimensions measured. The management safety priority, commitment, and competence consisted of nine items (α = 0.787), the management safety empowerment subscale consisted of seven items (α = 0.793), safety communication, learning, and trust among co-workers' safety competence consisted of eight items (α = 0.810), and the overall NOSACQ-50 was found to have an excellent α score of 0.932 (Table 1).

2.6. Statistical Analysis

The statistical data analysis was conducted using SPSS statistics version 25 (IBM, Armonk, NY, USA) after data cleaning.

Descriptive statistics using frequencies and percentages were employed to provide information on the socioeconomic characteristics of the study population. Inferential statistics carried out included a one-tailed Student's t-test to establish statistical differences between the seven NOSACQ-50 components adopted for the study, while associations between dimensions of the safety climate were tested using the Pearson correlation. The mean scores of the safety climate were calculated for all dimensions, where a mean score of more than 3.30 indicated a good level allowing for maintaining and continuing safety developments. Lastly, a one-way ANOVA was conducted to compare the impact that

employees had on the promotion of an effective safety climate. Statistical significance was set at <0.05.

Table 1. Distribution of the mean and Cronbach's alpha reliability test across the seven dimension using the NOSACQ-50.

Dimension	Items	Mean	SD	Cronbach's α
1. Management safety priority, commitment, and competence	9	2.9139	0.45780	0.787
2. Management safety empowerment	7	2.7427	0.38206	0.793
3. Management safety justice	6	2.6918	0.47658	0.754
4. Workers' safety commitment	6	3.0138	0.47543	0.793
5. Workers' safety priority and risk non-acceptance	7	2.6201	0.44197	0.703
6. Safety communication, learning, and trust in co-workers' safety competence	8	3.0033	0.41566	0.810
7. Trust in the efficacy of safety systems	7	3.1734	0.43961	0.756
Overall/Total	50	2.8886	0.33431	0.932

3. Results

At the end of the survey period, 433 (80%) responses were adjudged to have met the study threshold criteria and were used to inform the study outcome. Participants' demographic characteristics are presented in Table 2. From the results, more than half of the participants (53.7%) were male, while 40.7% identified their profession as either nurses or midwives; 45.3% of the sampled group held various managerial positions, such as director, matron, unit head, supervisor, etc. Based on the feedback generated as part of the open-ended comment at the end of the questionnaire survey, 85% of the participants said that they found the questions to be relevant and easy to understand, and had no issue with their layout.

Table 2. Description of participants' socio-demographic characteristics (n = 433).

Variable	Frequency	Percentage
Gender		
Male	230	53.7
Female	198	46.3
Total	428	100
Age group		
18–25	18	4.2
26–30	70	16.4
31–35	84	19.6
36–40	72	16.8
41–45	61	14.3
46–50	55	12.9
51–55	53	12.4
56–60	14	3.3
60-above	1	0.2
Total	428	100
Profession		
Medical doctor	63	15.4
Pharmacists	34	8.3
Nurse/Midwife	167	40.7
Lab Scientist/Technician	42	10.2
CHO/EHO/EHT/PHO	65	15.9
Physiotherapist	3	0.7
Others	36	8.8
Total	410	100
Do you have a managerial position?		
No	234	54.7
Yes	194	45.3
Total	428	100

Table 3 shows one sample t-test result conducted to determine if a statistically significant difference existed between the seven NOSACQ-50 dimensions applied in the study. From the analysis, participants' responses on workers' safety commitment within the healthcare facilities (M = 3.01, SD = 0.42) was statistically significantly higher than management safety priority, commitment, and competence (M = 2.91, SD = 0.46), $t(130.52) = p < 0.001$). In addition, dimension six (M = 3, SD = 0.42) was found to be statistically higher than management safety justice (M = 32.744, SD = 2.69), $t(147.02) = p < 0.001$).

Table 3. One-sample test for the seven domains measured.

Dimensions	t	*df*	*p*-Value	Mean Difference	SD	95% Confidence Interval	
						Lower	Upper
1. Management safety priority, commitment, and competence	129.353	412	0.001 *	2.91391	0.45780	2.8696	2.9582
2. Management safety empowerment	147.469	421	0.001 *	2.74272	0.38206	2.7062	2.7793
3. Management safety justice	115.341	416	0.001 *	2.69185	0.47658	2.6460	2.7377
4. Workers' safety commitment	130.527	423	0.001 *	3.01376	0.47543	2.9684	3.0591
5. Workers' safety priority and risk non-acceptance	120.184	410	0.001 *	2.62009	0.44197	2.5772	2.6629
6. Safety communication, learning, and trust in co-workers' safety competence	147.016	413	0.001 *	3.00332	0.41566	2.9632	3.0435
7. Trust in the efficacy of safety systems	147.232	415	0.001 *	3.17342	0.43961	3.1311	3.2158

* Significant, $p < 0.001$.

To examine the extent to which scores in one dimension were related to other items in the Nordic safety climate questionnaire used, inter-correlation analyses were performed, and the results are presented in Table 4. From the results, all dimensions were statistically significant, and were found to be greater than or equal to r (357) = 0.33, $p < 0.001$. The management safety justice dimension was found to have a high, statistically significant correlation to management safety empowerment (r (357) = 0.68, $p < 0.001$) among the participants. Employees' trust around the efficacy of existing safety systems measured was weakly correlated to management safety justice (r (357) = 0.33, $p < 0.001$).

Table 4. Summary of the inter-correlation matrix testing the correlation between the seven safety climate dimensions.

Dimensions	M	SD	1	2	3	4	5	6	7
1. Management safety priority, commitment, and competence	2.9200	0.46399	1.000						
2. Management safety empowerment	2.7459	0.39557	0.635	1.000					
3. Management safety justice	2.6923	0.47655	0.632	0.682	1.000				
4. Workers' safety commitment	3.0201	0.49795	0.477	0.555	0.513	1.000			
5. Workers' safety priority and risk non-acceptance	2.6226	0.45605	0.464	0.367	0.431	0.385	1.000		
6. Safety communication, learning, and trust, in co-workers' safety competence	3.0035	0.40956	0.489	0.528	0.471	0.673	0.400	1.000	
7. Trust in the efficacy of safety systems	3.1813	0.43902	0.370	0.375	0.333	0.479	0.354	0.573	1.000

Note: All correlations are significant at $p < 0.001$.

A one-way ANOVA between subjects to compare the impact that employees with a managerial role had in the promotion of an effective safety climate showed a significant effect of a managerial role on the promotion of a safety climate within the healthcare facilities when compared to management safety priority, commitment, and competence ($F(1, 406) = 3.99$, $p = 0.046$, $\eta^2 = 0.010$). On the contrary, a management role did not have a significant effect on workers' safety commitment ($F(1, 417) = 0.59$, $p = 0.440$, $\eta^2 = 0.001$) (Table 5). In addition, there was no significant effect on the role played by each professional group toward the promotion of a safety climate within their organization. Additionally, a low level of trust in the efficacy of existing safety systems was found among different

participants in different job roles, and presented the need for improvement (F = 21.965, n = 416).

Table 5. Analysis of variance summary for a managerial position measured against the seven dimension considered in the study.

Dimension	*df* (1#)	MS	*F*	η^2
1. Management safety priority, commitment, and competence	406	0.830	3.989 *	0.010
2. Management safety empowerment	415	0.587	4.030 *	0.010
3. Management safety justice	410	2.035	9.190 *	0.22
4. Workers' safety commitment	417	0.136	0.598	0.001
5. Workers' safety priority and risk non-acceptance	404	1.386	7.289 *	0.018
6. Safety communication, learning, and trust in co-workers' safety competence	407	0.360	2.066	0.005
7. Trust in the efficacy of safety systems	409	1.409	7.379 *	0.018

#*df* between groups = 1, * $p < 0.05$.

4. Discussion

The main purpose of the present study was to measure the safety climate among professional employees within healthcare facilities in Nigeria. The survey tool adopted (NOSACQ-50) has proven to be useful in achieving the study goal. Furthermore, the outcome from the study demonstrated the need for strengthening the safety climate within healthcare facilities, especially in LMICs. The importance of safety climate enhancement in the LMICS healthcare establishment was further demonstrated as part of the participants' safety commitment response: (1) "We who work here try hard together to achieve a high level of safety"; (2) "We who work here take joint responsibility to ensure that the workplace is always kept tidy"; (3) "We who work here help each other to work safely and management safety priority, commitment, and competence; (1) "Management places safety before production"; and (2) "We who work here have confidence in the management's ability to deal with safety", where a mean score of 2.70 to 2.99 was achieved, demonstrating a fairly low level of safety practices and commitment from management. In general, the outcome shows a significant correlation between these outcomes and poor safety perceptions, low job satisfaction, and a high level of stress among the participants. Hence, there is a need for further improvement.

The relationship between safety outcomes among healthcare professionals and the organizational climate has been earlier researched [34,35]; each study concluded that the promotion of a high-quality work environment is likely to present positive effects on the workplace safety climate and outcomes. In the present study, the role played by employees identified as having a managerial position was found to have a significant effect on management safety empowerment ($F(1, 415) = 4.03$, $p = 0.045$, $\eta^2 = 0.010$). To this end, investment in safety empowerment will help enhance the work environment and promote the needed safety climate where an individual will feel supported and enhance their professional service delivery [36]. In addition, employees' trust in the efficacy of existing safety systems was found to have a weak correlation with management safety justice (r (357) = 0.33, $p < 0.001$). In line with this finding, for an organization to encourage the adoption of positive safety culture among its employees, there is the need to apply the right occupational safety and health standards, which in turn requires strong political will and good governance across every stakeholder [37].

Earlier studies have demonstrated a safety climate as highly related to safety participation, and, to promote safety climate in any organization, safety communication, safety training, and safety systems should be actively encouraged within the establishment [38–41]. From the present study, there was acknowledgement of the role played by communication, training, and having good safety systems as the means of achieving a safety climate within the healthcare sector; however, safety climate was found to be not actively encouraged across the participating organization, as represented in the participants' responses. Where safety communication and training is neglected, HCWs are likely

to harbor mistrust and dissatisfaction with the management, and will most likely engage in unsafe behavior that might compromise either their patient or their personal safety. General comments among the present study participants reflect on this position: " . . . . . the management assume we are in the know, considering we are all professionals as such safety training don't often come up until accident happen". This statement further demonstrates the need for managers in healthcare organizations to ensure the promotion of policies that reflect their commitment to employee health and safety, especially in LMICs [39]. While the study did not consider the association between safety climate and staff morale, it is, however, worth highlighting the likely association between safety climate in the healthcare establishment and the brain drain of professionals in LMICs like Nigeria. The reasons cited for a high level of exits from these countries' healthcare systems among professionals include poor safety policies, poor and insecure working conditions, etc., that, in combination, makes work harder to deliver and presents a state of hopelessness among the workforce [42,43].

Previous studies have established a link between safety climate items with occupational accidents, injuries, and illnesses [44–46]. Our study does expand on this finding and emphasizes that safety climate items can impact employees' work ability. Results from questions that measured management effort toward accident prevention include: (1) "Management collects accurate information in accident investigations"; (2) "Fear of sanctions from management discourages employees here from reporting near-miss accidents"; (3) "Management listens carefully to all who have been involved in an accident"; (4) "Management looks for causes, not guilty persons, when an accident occurs"; (5) "Management always blames employees for accidents"; and (6) "Management treats employees involved in an accident fairly"; the mean score range was 2.70 to 2.99. This outcome demonstrates the existence of a fairly low-level safety climate within the participating healthcare facilities, thereby demonstrating the need for further safety culture improvement in order to help reduce the risk of accident and minimize physical and mental impact among the healthcare workers.

5. Strengths and Limitations

The present study has both strengths and limitations. A key strength is the ability to adapt the validated NOSACQ-50 questionnaire to measure safety climate among healthcare workers in Nigeria, and, to our knowledge, this is the first study that has considered the application of the survey tool among HCWs in the country. In addition, acceptance by the state ministry of health to approve the study is a demonstration of the hospital management board's willingness to look into measures that will help enhance the safety climate within healthcare establishments in the region. Furthermore, the present study provides a platform for further application of the survey instruments across the geographical regions of the country.

This study has some limitations. With the proliferation of private healthcare clinics/hospital across the country, a major limitation associated with the study is that the study has failed to ask specific question to enquire if participant works in either a government or private healthcare establishment, which could have helped to compare the safety climates across these two settings. This is recommended in future research work. In addition, because the study only considered HCWs in limited states within the northern part of the country, the present results are limited in terms of generalizability. It can, however, be applicable to other healthcare establishments across the country. Another limitation of the study is the low response rate among the professionals across the region, which was partly due to the data collection approach using an online questionnaire, to which staff with no access to the link were less likely to engage with the survey. In addition, the low research culture in the healthcare establishment, especially in this region, is another likely reason why staff did not engage with the survey.

6. Conclusions

The outcome from the study showed a weak level of positive safety climate promotion within the healthcare sector based on the participants' responses. The results also revealed that, while employees are likely to engage in positive safety behavior, there is the need for more visible leadership commitment to ensure that the interest among the employees is maintained. In order to achieve this goal, enhancement of safety communication, safety training, and the adoption of safety systems at work will encourage HCWs to comply with laid out safety rules and procedures as opposed to voluntary participation in safety practices, which might sometimes not be in the interest of their patients or the organization in general. The study concludes that there is still a long way to go in promoting an effective and positive safety climate in healthcare systems in LMICs, and all actors are encouraged to play an active role to make this a reality. Several challenges that include a lack of political will, weak policies, and limited monitoring by the relevant regulatory body have slowed the pace at which both government-owned and private healthcare establishments promote a safety climate in these countries. To help address this setback, more effort is required at promoting an effective and positive safety climate across the healthcare establishments, including management and healthcare workers' commitments.

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Predictors of Burnout in Healthcare Workers during the COVID-19 Pandemic

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Abstract: The purpose of this study was to identify the predictors of burnout in healthcare workers during the COVID-19 pandemic. Data were collected from March to June in 2020, during the COVID-19 pandemic, from employees of two Romanian hospitals. Five hundred and twenty-three healthcare workers completed a series of questionnaires that measured burnout, job demands, job resources, and personal resources. Among the respondents, 14.5% had a clinical level of exhaustion (the central component of burnout). Three job demands (work–family conflict, lack of preparedness/scope of practice, emotional demands), three job resources (training, professional development, and continuing education; supervision, recognition, and feedback; autonomy and control), and one personal resource (self-efficacy) were significant predictors of burnout, explaining together 37% of the variance in healthcare workers' burnout. Based on our results, psychological interventions during the COVID-19 pandemic for healthcare employees should focus primarily on these demands and resources.

Keywords: burnout; COVID-19; health personnel; pandemics

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1. Introduction

The outbreak of Coronavirus Disease 2019 (COVID-19) is considered a global health threat [1], becoming the third major coronavirus outbreak in recent times following severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS) [2]. The challenges associated with the COVID-19 pandemic (e.g., heavy workload, work pressure, high risk of infection, inadequate resources) may affect the mental health of medical staff, such as frontline workers, mainly in terms of their burnout level [3]. Burnout represents a job-related strain as a result of repeated exposure to stressors at work, which is characterized by exhaustion (i.e., the depletion of one's emotional and physical resources), cynicism (i.e., the negative detachment form work), and reduced efficacy (i.e., the perception of one's lack of productivity and achievement) [4]. During the outbreak of COVID-19, the prevalence of burnout among healthcare workers ranged between 13% and 51%, depending on the country, the specific job in the hospital, and the period in which the data were collected [5–8]. However, there are insufficient data regarding the predictors of burnout

during the COVID-19 pandemic. Identifying these predictors is important in order to develop the best individual and organizational interventions that could provide support for medical staff during the COVID-19 pandemic and during possible future pandemics. Since the burnout of healthcare staff is associated with decreased quality of care and decreased safety of patients [9], the efficient management of medical personnel's burnout has practical implications for both the employees in the medical sector and for the patients, with major consequences for how the health system responds to current or future outbreaks.

Previous studies during SARS and MERS outbreaks indicate a series of job characteristics that are related to burnout in healthcare employees. After the 2003 outbreak of SARS, healthcare workers from hospitals that treated SARS patients reported higher levels of burnout than hospital employees who had not treated such patients [10]. Their perceived adequacy of training, protection, and support was negatively associated with burnout [10]. Support from supervisors, colleagues, and the organization was a negative predictor of psychiatric symptoms and of psychological distress during the SARS outbreak [11,12]. The emergency department nurses' burnout was related to the lack of resources for treatment during the MERS outbreak [13].

These findings are in line with the Job Demands–Resources Theory (JD-R) [14], which suggests that job demands lead to a higher level of burnout and job resources decrease burnout. In addition, the theory suggests that personal resources lead to lower levels of burnout. This last assumption of the theory is supported by data from the medical sector. Under normal working conditions, personal resources such as optimism and self-efficacy are related to decreased levels of burnout in nurses [15,16].

Based on the JD-R theory and on previous research during SARS and MERS outbreaks, job demands are expected to be positively associated with burnout, and both job resources and personal resources are expected to be negatively associated with burnout in healthcare workers during the COVID-19 pandemic.

2. Materials and Methods

Employees of two hospitals from Romania were asked to complete a questionnaire including all the studied variables. The questionnaire was distributed in a paper-and-pencil form or in an online form. The questionnaires were distributed through the managers or the decision-makers of the hospitals. They were contacted and informed about the purpose of the study and were asked for permission to collect data. They received the hard copy questionnaires or the link to the online form and were asked to distribute them to the employees of the two hospitals. The hard copy questionnaires were collected by one of the researchers after several visits to the hospitals, following safety and protection measures. The managers or the decision-makers did not have access to the participants' answers. The completion of the questionnaire took approximately 30 min. Data were collected from March to June in 2020, during the COVID-19 pandemic. All procedures performed in the study were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. To protect data confidentiality, participants completed questionnaires anonymously, and data were analyzed globally. The questionnaires in hard copy were stored in a safe place, and only those who performed the statistical analyses had access to the online database. Informed consent was obtained from all individual participants included in the study, according to the legal rules of informed consent [17]. Out of a total of 544 responses, 21 were invalidated due to missing values. Table 1 illustrates the characteristics of the two groups and the results of their comparison. There were no significant differences between study participants and those excluded due to missing data in relation to age, gender, tenure, and occupation.

Table 1. Comparison between included and excluded participants.

Variables	Included Sample (n = 523)	Excluded Sample Due to Missing Values (n = 21)	Test
Age (years) (M/SD)	42.86/9.43	43.53/12.03	$t = -0.30$, $p = 0.77$
Gender	19% men 81% women	19% men 81% women	$\chi^2 = 0.00$, $p = 0.99$
Job tenure	5% under 1 year 8% between 1 and 3 years 15% between 3 and 5 years 7% between 5 and 10 years 65% over 10 years	5% under 1 year 0% between 1 and 3 years 15% between 3 and 5 years 15% between 5 and 10 years 65% over 10 years	$\chi^2 = 3.25$, $p = 0.51$
Occupations	28% physicians 67% nurses 5% other occupation (e.g., stretcher-bearers)	14% physicians 86% nurses 0% other occupation	$\chi^2 = 3.54$, $p = 0.17$

Burnout was measured using the Maslach Burnout Inventory—General Survey [18,19]. The 16 items of the scale measure three components of burnout: exhaustion (5 items, e.g., "I feel burned out from my work."), cynicism (5 items, e.g., "I have become less enthusiastic about my work."), and professional efficacy (6 items, e.g., "I feel confident that I am effective at getting things done."). The items are scored on a 7-point Likert scale, from 0 (never) to 6 (every day).

Job demands were measured with the Job Demands in Nursing Scale [20]. Lack of comfort with working conditions was measured with 4 items (e.g., "I am satisfied with my day-to-day routine".), lack of preparedness/scope of practice was measured with 4 items (e.g., "I do not feel adequately prepared for my area of practice."), and lack of equipment and supplies was measured with 4 items (e.g., "The equipment needed for patient care is poorly maintained".). The instrument uses a scale from 1 (strongly disagree) to 5 (strongly agree) for all these demands. In addition, emotional demands were measured with 4 items developed specifically for health care professions [21]. Employees reported on a scale from 1 (never) to 5 (always) how often they were confronted with death, human suffering, aggressive patients, and troublesome patients. Quantitative demands were measured with 5 items (e.g., "Do you have to work very fast?") [22] on a scale from 1 (hardly ever) to 5 (always). Finally, work–family conflict was measured with Work–Family Conflict Scale [23], composed of 5 items (e.g., "The demands of my work interfere with my home and family life".) on a 7-point (strongly disagree–strongly agree) response scale.

Job resources were measured with the Job Resources in Nursing Scale [20]. Supervision, recognition, and feedback was measured with 4 items (e.g., "I feel validated by my supervisor for a job well done".), training, professional development, and continuing education was measured with 4 items (e.g., "I am able to access an adequate number of in-services or continuing education activities".), staffing and time was measured with 4 items (e.g., "There are enough staff members in my work setting to get the job done".), technology was measured with 4 items (e.g., "I am able to provide better care because of the information systems and technology available to me".), autonomy and control was measured with 4 items (e.g., "My job description is flexible; I am able to modify my daily duties or the type of work that I do".). The instrument uses a scale from 1 (strongly disagree) to 5 (strongly agree) for all these resources. In addition, social support was measured with the Job Demands–Resources Questionnaire [24], using three items (e.g., "If necessary, can you ask your colleagues for help?") on a scale from 1 (never) to 5 (very often).

Personal resources were measured with the Job Demands–Resources Questionnaire [24]. Self-efficacy (e.g., "I can handle whatever comes my way".) and optimism (e.g., "I usually expect the best in uncertain times".) were measured with four items each on a scale from 1 (absolutely wrong) to 4 (absolutely right).

3. Results

Burnout scores ranged from 0 to 5, $M = 1.35$, $SD = 0.93$; exhaustion scores ranged from 0 to 6, $M = 2.05$, $SD = 1.31$; cynicism scores ranged from 0 to 5.60, $M = 1.27$, $SD = 1.10$; professional inefficacy scores ranged from 0 to 5, $M = 0.94$, $SD = 0.92$. Statistical analyses indicated an adequate reliability for the burnout measurement: Cronbach's $\alpha = 0.89$ for the overall score, Cronbach's $\alpha = 0.84$ for exhaustion, Cronbach's $\alpha = 0.74$ for cynicism, and Cronbach's $\alpha = 0.80$ for professional inefficacy. We tested the factor structure of the burnout measure by conducting a series of confirmatory factor analyses using M plus 7.0 [25] in order to investigate the validity of the hypothesized measurement model. The first-order and second-order theoretical models of burnout were compared with the model in which all items loaded on a single factor. The fit indices ($\chi^2 = 295.64$, df = 99, $\chi^2/df = 2.99$, CFI (Comparative Fit Index) = 0.94, TLI (Tucker–Lewis Index) = 0.93, RMSEA (Root Mean Square Error of Approximation) = 0.06 (CI = 0.05, 0.07), SRMR (Standardized Root Mean Square Residual) = 0.05) for the first-order model (in which the three components of burnout were loaded by their specific items) showed a good fit with the data. Similar results ($\chi^2 = 295.64$, df = 99, $\chi^2/df = 2.99$, CFI = 0.94, TLI = 0.93, RMSEA = 0.06 (CI = 0.05, 0.07), SRMR = 0.05) were found for the second-order model (in which a general burnout factor was loaded by exhaustion, cynicism, and professional inefficacy, which in turn were loaded by their specific items). An alternative model, in which all items loaded on a single factor, showed poor fit with the data ($\chi^2 = 639.60$, df = 102, $\chi^2/df = 6.27$, CFI = 0.84, TLI = 0.81, RMSEA = 0.10 (CI = 0.09, 0.11), SRMR = 0.07). The burnout measure showed a good fit because CFI (Comparative Fit Index) and TLI (Tucker–Lewis Index) were above 0.90 [26], the RMSEA (Root Mean Square Error of Approximation) was 0.06, and the SRMR (Standardized Root Mean Square Residual) was lower than 0.08 [27]. Therefore, the burnout measure adopted in our study was valid. Since the cutoff points presented in the Dutch version of the Maslach Burnout Inventory (MBI) manual or recommended in other studies were not able to satisfactorily differentiate between clinical and non-clinical burnout, we used a 3.50 cutoff point for exhaustion in order to minimize false negatives [28]. Based on this cutoff point, 76 (14.5%) of the healthcare workers had a clinical level of exhaustion during the COVID-19 pandemic in Romania. There were no differences between men and women in terms of their burnout level ($p > 0.05$). Additionally, there were no differences between professions regarding the level of burnout ($p > 0.05$).

Table 2 shows the means, standard deviations, reliabilities, and the correlations with burnout (the overall score and the three factors) for the variables included in the study (job demands, job resources, and personal resources). As expected, job demands were positively associated with burnout, and both job and personal resources were negatively associated with burnout.

A three-stage hierarchical multiple regression was conducted in order to predict healthcare workers' burnout during the COVID-19 pandemic based on their job demands, job resources, and personal resources. All the job demands were entered at stage one. A significant regression equation was found; $F_{(6, 516)} = 27.128$, $p < 0.001$, with an R^2 of 0.23. Job demands accounted for 23% of the variation in burnout. All the job resources were entered at stage two. A significant regression equation was found; $F_{(12, 510)} = 20.074$, $p < 0.001$, with an R^2 of 0.31. Adding job resources to the regression model explained an additional 8% of the variation in burnout during the COVID-19 pandemic. The final model also included personal resources; $F_{(14, 508)} = 22.487$, $p < 0.001$, explaining an additional 6% of the variation in burnout. The final model explained 37% of the variance in healthcare workers' burnout. When all the independent variables were included in the regression model, only three job demands (work–family conflict, lack of preparedness/scope of practice, emotional demands), three job resources (training, professional development, and continuing education; supervision, recognition, and feedback; autonomy and control), and one personal resource (self-efficacy) were significant predictors of burnout in healthcare workers during the COVID-19 pandemic. The regression statistics are presented in Table 3. The results are in line with our hypotheses.

Table 2. Means, standard deviations, reliabilities, and correlations with burnout (n = 523).

Variables	*M*	*SD*	α	Burnout	Exhaustion	Cynicism	Professional Inefficacy
Job demands							
Emotional demands	3.31	0.70	0.59	0.23 ***	0.24 ***	0.19 ***	0.14 **
Quantitative demands	3.43	0.74	0.65	0.25 ***	0.35 ***	0.14 **	0.12 **
Work–family conflict	3.71	1.63	0.93	0.30 ***	0.39 ***	0.18 ***	0.17 ***
Lack of comfort with working conditions	2.79	0.84	0.76	0.22 ***	0.34 ***	0.13 **	0.08
Lack of preparedness/scope of practice	1.56	0.60	0.68	0.28 ***	0.15 ***	0.26 ***	0.32 ***
Lack of equipment and supplies	2.57	0.92	0.75	0.28 ***	0.28 ***	0.24 ***	0.17 ***
Job resources							
Autonomy and control	3.20	0.77	0.62	−0.34 ***	−0.35 ***	−0.27 ***	−0.26 ***
Supervision, recognition, and feedback	3.27	0.92	0.80	−0.36 ***	−0.33 ***	−0.31 ***	−0.32 ***
Training, professional development, and continuing education	3.41	0.87	0.78	−0.40 ***	−0.35 ***	−0.36 ***	−0.32 ***
Staffing and time	2.89	0.90	0.73	−0.26 ***	−0.37 ***	−0.15 ***	−0.12 **
Technology	3.41	0.67	0.72	−0.27 ***	−0.24 ***	−0.23 ***	−0.25 ***
Social support	3.76	0.93	0.75	−0.15 ***	−0.06	−0.17 ***	−0.20 ***
Personal resources							
Self-efficacy	3.51	0.56	0.88	−0.39 ***	−0.31 ***	−0.31 ***	−0.35 ***
Optimism	3.90	0.88	0.89	−0.30 ***	−0.23 ***	−0.28 ***	−0.22 ***

Footnotes: *M* = mean, *SD* = standard deviation, α = Cronbach's alpha, ** $p < 0.01$, *** $p < 0.001$.

Table 3. Summary of hierarchical regression analysis for variables predicting burnout (n = 523).

Variables	Model 1			Model 2			Model 3		
	B	*SE B*	*β*	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Work–family conflict	0.10	0.03	0.18 ***	0.09	0.03	0.16 ***	0.07	0.03	0.12 **
Lack of equipment and supplies	0.13	0.04	0.13 **	0.05	0.04	0.05	0.01	0.04	0.01
Lack of preparedness/scope of practice	0.40	0.06	0.26 ***	0.32	0.06	0.21 ***	0.16	0.06	0.10 **
Quantitative demands	0.07	0.06	0.05	0.00	0.06	0.00	−0.01	0.06	−0.01
Emotional demands	0.22	0.06	0.17 ***	0.18	0.05	0.14 **	0.21	0.05	0.16 ***
Lack of comfort with working conditions	0.11	0.05	0.10*	0.07	0.05	0.06	0.05	0.04	0.05
Training, professional development, and continuing education				−0.16	0.05	−0.15 **	−0.15	0.05	−0.14 **
Supervision, recognition, and feedback				−0.13	0.05	−0.13 **	−0.15	0.04	−0.15 ***
Autonomy and control				−0.13	0.05	−0.11 *	−0.11	0.05	−0.09 *
Technology				−0.04	0.06	−0.03	−0.04	0.06	−0.03
Staffing and time				0.03	0.05	0.03	0.03	0.05	0.03
Social support				−0.07	0.04	−0.07	−0.07	0.04	−0.07
Self-efficacy							−0.43	0.04	−0.26 ***
Optimism							−0.06	0.07	−0.06
R^2	0.23			0.31			0.37		
F for change in R^2	27.13 ***			10.14 ***			25.43***		

Table footnotes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.00$.

4. Discussion

The results of this study are in line with the JD-R theory [14] and with previous research during SARS and MERS outbreaks. Job demands were positively associated with burnout during the COVID-19 pandemic, as in the case of the MERS outbreak for emergency department nurses [13]. A negative relationship between job resources and burnout was found in both the current study and during the SARS outbreak, when training,

protection, and support from supervisors, colleagues, and the organization were negative predictors of psychological stress and burnout [10–12]. Regarding the negative relationship between personal resources and burnout, our results are in accordance with findings under normal working conditions in healthcare [15,16]. Workplace stressors for medical staff has been studied in Romania before but not in pandemic conditions [29]. As far as we know, only one study investigated the burnout of Romanian medical personnel during the pandemic, but it focused only on prevalence [30]. The present study contributes to the development of knowledge related to burnout in the medical field during pandemics by highlighting a number of predictors.

Based on our results, psychological interventions during the COVID-19 pandemic for healthcare employees should focus primarily on three job demands (work–family conflict, lack of preparedness/scope of practice, emotional demands), three job resources (training, professional development, and continuing education; supervision, recognition, and feedback; autonomy and control), and one personal resource (self-efficacy). The existing data support the efficiency of some interventions in reducing burnout. Three types of interventions that reduce exhaustion have been identified: those based on relaxation techniques, those that provide new role-related knowledge and work skills, and those that provide cognitive-behavioral therapy [31]. Moreover, job crafting interventions have a positive effect on the well-being and performance of employees in the medical sector [32]. Finally, self-efficacy can be increased with psychological capital interventions [33]. These types of interventions can be used in order to reduce the effect of the identified predictors on burnout.

This study has a number of limitations. Firstly, the job characteristics during the COVID-19 pandemic were measured with self-report instruments. The collected data do not provide an objective evaluation of actual demands such as lack of preparedness or resources such as supervision. Secondly, the sample consists of Romanian employees, raising concerns regarding the generalizability of our findings to other countries. Finally, the study was cross-sectional; therefore, we cannot draw causal conclusions. Future longitudinal studies could identify predictors of medical staff burnout in other countries and using multiple measurement methods.

5. Conclusions

This paper contributes to the field by extending the JD-R model's assumptions about predictors of burnout in particular work situations, such as the context of an outbreak for healthcare workers. In line with the model, burnout was associated with high demands and with the lack of job and personal resources, supporting the utility of JD-R in understanding negative psychological states at work during pandemics. Our findings suggest that psychological interventions during the COVID-19 pandemic for healthcare employees should focus primarily on three job demands (work–family conflict, lack of preparedness/scope of practice, emotional demands), three job resources (training, professional development, and continuing education; supervision, recognition, and feedback; autonomy and control) and one personal resource (self-efficacy). In these demanding circumstances, practitioners in the field of occupational health psychology can implement cognitive-behavioral interventions, relaxation techniques, job crafting interventions, psychological capital interventions, and trainings aimed at developing work-related knowledge and skills.

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Article

Work-Related Musculoskeletal Complaints in Surgeons

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Abstract: The aim of the present study was to examine the prevalence of work-related musculoskeletal complaints and potential risk factors among Romanian surgeons. Ninety-five surgeons of different specialties (62.11% males) completed a questionnaire about work-related musculoskeletal complaints (WMSCs). Ninety-one surgeons (95.78%) experienced WMSCs at least in one body part in the last year. Most surgeons reported pain in four body parts (33.68%). The most common WMSCs were reported on the lower back (74.73%), followed by complaints in the neck region (55.79%), shoulder and upper back (46.32%), knee (31.58%), wrist–hand (16.84%), elbow (14.74%), hip (11.58%) and ankle–foot (4.21%). Surgeons rated their pain more severe on upper back, lower back and knees. A higher percentage of male surgeons reported upper back pain ($\chi^2_{(1)} = 5.818$, $p = 0.015$). Significant age differences were found between the reported pain sites ($F_{8,278} = 2.666$, $p = 0.008$); the surgeons reporting wrist–hand pain were younger than those reporting neck, shoulders, elbows, dorsal and lumbar pain. Surgeons with significantly less experience in years reported significantly more WMSCs in wrist–hand, hip and ankle–foot regions compared with those more experienced ($p < 0.05$). Surgeons are at high risk of developing work-related musculoskeletal complaints, which affects both their professional and personal life. Further studies are needed to identify all risk factors and ergonomic strategies to reduce the prevalence and the negative impact of WMSCs.

Keywords: musculoskeletal complaints; pain; surgeons

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1. Introduction

Surgeons, as all other healthcare workers, are at risk of developing work-related musculoskeletal complaints (WMSCs) and disorders. A substantial number of surgeons suffer from work-related musculoskeletal symptoms that are exacerbated as those surgeons continue to operate [1].

Several studies have reported that surgeons are exposed to intense physical strain while performing different surgical procedures. All well-known risk factors for WMSCs are met during surgical procedures—awkward, prolonged static postures, repetitive movements of upper limbs [2]. Kant et al. [3] have analyzed the most common static working position adopted by surgeons and this implies the head bent forward, the spine bent forward and twisted, the shoulder raised and standing on one leg. Ruitenberg et al. [4] found that surgeons stand 130% longer and performed fine repetitive movements 26 times longer than other hospital physicians. The physical demands were perceived by surgeons as uncomfortable and exhausting, the main reason being the prolonged repetitive movements and the working postures. The authors concluded that the physical demands of performing surgery are a threat to surgeons' physical health, work ability and job performance [4]. Another study also described that the discomfort or symptoms reported by surgeons were attributed to performing any mode of surgery—open, laparoscopic or robotic [5].

Yang et al. [6] have analyzed the posture, fatigue and pain across different surgical specialties and procedures. They found that the work posture of surgeons performing open operations was more demanding for neck, trunk and right upper limb compared with other procedures (laparoscopic, endovascular), as measured objectively by a IMU system (inertial measurement units). Of note, 50% of the surgeons participating in that study reported moderate or higher levels of fatigue and clinically significantly neck and lower back pain immediately after the operation. Other studies have also studied the ergonomic risks the surgeons are exposed to during surgeries, using objective ergonomic assessment tools [7–9].

WMSCs have a negative impact on surgeons' professional activities, quality or performance of surgical care. One-third of the surgeons having a physical complaint in the arm or knee felt impaired in their work functioning, and one out of seven surgeons had difficulties coping with their work physical demands due to impairments in their physical well-being [4]. Another study revealed that more than half of the injured surgeons reported at least a minimal impact on their operating performance while recovering from injury [10].

The aim of the present study was to examine the prevalence of work-related musculoskeletal complaints and potential risk factors among Romanian surgeons.

2. Materials and Methods

2.1. Participants

A total of 95 surgeons of different specialties completed an anonymous questionnaire focused on musculoskeletal complaints. Eligibility criteria were: (1) surgical experience of at least 1 year; (2) no clinically diagnosed inflammatory musculoskeletal disorders; (3) no history of surgeries in the last 6 months.

This cross-sectional study was carried out in accordance with the Declaration of Helsinki and has been approved by the local Ethics (approval No. 173/03.10.2019). Participation in the study was voluntary. Participants who agreed to participate in the study and met the inclusion criteria read and signed an informed consent.

2.2. Assessments

The questionnaire was structured in two parts. The first part included questions regarding age, sex, height, weight, working experience, weekly working hours, operating hours per week, number of surgeries/week. The second part included questions about WMSCs, questions that were adapted from the Nordic Musculoskeletal Questionnaire, a validated, repeatable sensitive and useful screening tool [11]. A body diagram was used to help the respondents indicate the affected body parts. If a subject answered with "yes" on the question "Have you had pain in your neck/shoulder/elbow/wrist–hand/upper back/lower back/hip/knee/ankle–foot in the last 12 months?", then the participant had to answer the questions regarding the pain severity on a 10-point visual analogue scale (VAS), duration, treatment, and the impact of pain on daily living and on professional life.

2.3. Statistical Analysis

Data were analyzed with MedCalc Statistical software version 19.2.1 (MedCalc Software Ltd., Ostend, Belgium). Descriptive statistics (means and standard deviation, median and interquartile range (IQR)), number and percentage) were calculated. The relationship between WMSCs and sex, years of experience, daily working hours and number of treated patients was evaluated using Chi-square and Cochrane's Q tests. In order to compare variables based on the affected regions, a one-way ANOVA with Tukey–Kramer post hoc tests and Kruskal–Wallis with Conover post hoc tests were performed. A stepwise logistic regression was performed in order to identify risk factors for pain in each region. Variables with p-values < 0.1 in the univariate logistic analysis were entered in the multivariate logistic analysis. The significance level was set at $p < 0.05$.

3. Results

Ninety-five surgeons (62.11% males; height 173.1 ± 8.3 cm; weight 76.75 ± 17.99 kg) agreed to participate and completed the questionnaires. Their age ranged between 25 and 64 years with a mean age of 37.56 ± 8.74 years. Participants' characteristics are presented in Table 1. The participants had different surgical specialty—general surgery (n = 6, 6.32%), vascular surgery (n = 10, 10.53%), plastic surgery (n = 14, 14.74%), neurosurgery (n = 21, 22.11%), orthopedic surgery (n = 12, 12.63%), urologic surgery (n = 8, 8.42%), cardiac surgery (n = 8, 8.42%), thoracic surgery (n = 8, 8.42%), obstetric/gynecologic surgery (n = 8, 8.42%).

Table 1. Participants' characteristics.

Variable	
Age, years (mean ± SD)	37.56 ± 8.74
Sex	
male, *n* (%)	59 (62.11)
female, *n* (%)	36 (37.89)
Weight, kg (mean ± SD)	76.75 ± 17.99
Height, cm (mean ± SD)	173.1 ± 8.3
BMI, kg/m^2 (mean ± SD)	25.44 ± 5.04
Dominant hand	
Right, *n* (%)	89 (93.68)
Left, *n* (%)	6 (6.32)
Physical activities, *n* (%)	60 (63.16)
Number of days performing physical activities (median (IQR))	2 [0–4]
Sleeping time, hours/day (mean ± SD)	6.72 ± 0.96
Surgical experience, years (mean ± SD)	10.09 ± 8.41
Weekly working hours (mean ± SD)	41.03 ± 14.62
Surgery hours/week (mean ± SD)	13.07 ± 7.27
Number of surgeries/week in the last 6 months (mean ± SD)	7.56 ± 3.73
Wearing lead apron, *n* (%)	67 (70.53)
Number of hours with lead apron/day (median (IQR))	1 [0–2]

BMI—body mass index.

Ninety-one surgeons (95.78%) experienced WMSCs at least in one body part in the last year. Most surgeons reported pain in 4 body parts (n = 32, 33.68%), 19 surgeons (20%) in one region, 14 surgeons (14.74%) in 2 regions, 13 surgeons (13.68%) in 5 regions, 11 (11.58%) in 3 regions and only 2 surgeons (2.1%) in 6 regions. The most common WMSCs were reported on the lower back (n = 71, 74.73%), followed by complaints in the neck region (n = 53, 55.79%), shoulder and upper back (n = 44, 46.32%), knee (n = 30, 31.58%), wrist–hand (n = 16, 16.84%), elbow (n = 14, 14.74%), hip (n = 11, 11.58%) and ankle–foot (n = 4, 4.21%). Pain and subjects' characteristics based on the affected region are presented in Table 2.

Gender differences were found only for upper back pain, with a higher percentage of male surgeons reporting WMSCs in this area ($\chi^2_{(1)} = 5.818$, $p = 0.015$). Significant age differences were found between the reported pain sites ($F_{8,278} = 2.666$, $p = 0.008$); the surgeons reporting wrist–hand pain were younger elbow pain ($p < 0.05$).

Surgical experience was significantly correlated with neck pain ($\chi^2_{(5)} = 43.11$, $p < 0.0001$), shoulder pain ($\chi^2_{(3)} = 16.36$, $p = 0.001$), upper back pain ($\chi^2_{(5)} = 20.36$, $p = 0.001$), lower back pain ($\chi^2_{(5)} = 42.83$, $p < 0.0001$) and knee pain ($\chi^2_{(3)} = 11.33$, $p = 0.01$), with those with less than 10 years of experience reporting more WMSCs. Surgeons with significantly less experience years reported significantly more WMSCs in wrist–hand, hip and ankle–foot regions compared with those more experienced ($p < 0.05$).

Surgeons with shoulder pain reported significantly more operating hours/week than those with pain in the cervical, wrist–hand, upper back and ankle–foot regions ($p < 0.05$).

The analysis of the prevalence of WMSCs by surgical specialties revealed that the elbow, upper back and lower back pain was highest in neurosurgeons, while upper and lower back were also prevalent in plastic surgeons (Table 3).

Data related to pain and its impact on surgeons' activities are presented in Table 4. Pain severity differed significantly across regions ($F_{8,287} = 37.77$, $p < 0.0001$). Surgeons rated their pain more severe on upper back, lower back and knees compared with all other sites ($p < 0.05$).

A significantly number of surgeons reported pain in the neck and lower back for more than 30 days in the last 12 months (cervical pain $\chi^2_{(2)} = 18.42$, $p < 0.001$; lower back $\chi^2_{(2)} = 29.18$, $p < 0.001$). In regards to shoulder, elbow and wrist–hand regions, significantly more surgeons reported pain with a duration of less than 7 days (shoulder $\chi^2_{(2)} = 9.86$, $p = 0.007$; elbow $\chi^2_{(2)} = 17.71$, $p < 0.001$); wrist–hand $\chi^2_{(2)} = 26.37$, $p < 0.001$).

The impact of pain on professional activities, leisure activities or both differed significantly according to the affected region ($\chi^2_{(8)} = 30.65$, $p < 0.001$; $\chi^2_{(8)} = 55.59$, $p < 0.001$; $\chi^2_{(8)} = 125.73$, $p < 0.001$, respectively). The number of surgeons with neck pain whose professional activities were affected by WMSCs was significantly higher compared with those with elbow, wrist–hand and ankle–foot pain ($p < 0.05$). Leisure activities and both professional and leisure activities were affected in a higher proportion by lower back pain compared to the other affected regions ($p < 0.05$). Neck and knee pain affected both professional and leisure activities in a higher percentage than elbow, hip and ankle–foot pain ($p < 0.05$). The majority of surgeons continued working with pain.

Significant differences were observed in the number of surgeons receiving medical treatment for their WMSCs ($\chi^2_{(8)} = 73.78$, $p < 0.001$), a higher prevalence of surgeons with lower back pain following medical treatment in the last 12 months compared with those with pain located in other body parts ($p < 0.05$). Four surgeons with lower back pain (5.63%) needed sick leave due to their musculoskeletal complaints.

The logistic regression analysis revealed that a higher BMI was a risk factor for upper back pain (OR-1.1, 95% CI: 1–1.21, $p = 0.04$) and elbow pain (OR-1.14, 95% CI: 1.02–1.27, $p = 0.01$). Being female increased the risk for neck pain (OR-2.63, 95% CI: 1.07–6.44, $p = 0.03$). A sedentary lifestyle proved to be a risk factor for shoulder pain (OR-8.7, 95% CI: 2.99-25.29, $p = 0.0001$) and for elbow pain (OR-5.53, 95% CI: 1.5–20.37, $p = 0.01$). Other risk factors related to professional activities were the number of surgeries performed in the last 6 months for neck pain (OR-1.13, 95% CI: 1.01–1.27, $p = 0.03$) and shoulder pain (OR-1.29, 95% CI: 1.12–1.49, $p = 0.0003$); number of weekly working hours for lower back pain (OR-1.13, 95% CI: 1.04–1.21, $p = 0.001$) and for hip pain (OR-1.09, 95% CI: 1.03–1.15, $p = 0.002$); wearing a lead apron during surgeries for upper back pain (OR-3.66, 95% CI: 1.32–10.08, $p = 0.01$).

Table 2. Subjects' characteristics related to the affected region.

Parameters	Neck Pain (*n* = 53)	Shoulder Pain (*n* = 44)	Elbow Pain (*n* = 14)	Wrist–Hand Pain (*n* = 16)	Upper Back Pain (*n* = 44)	Lower Back Pain (*n* = 71)	Hip Pain (*n* = 11)	Knee Pain (*n* = 30)	Ankle–Foot Pain (*n* = 4)
Sex									
male, *n* (%)	28 (52.83)	24 (54.55)	6 (42.86)	6 (37.5)	30 (68.18)	41 (57.75)	6 (54.55)	18 (60)	2 (50)
female, *n* (%)	25 (47.17)	20 (45.45)	8 (57.14)	10 (62.5)	14 (31.82)	30 (42.25)	5 (45.45)	12 (40)	2 (50)
Age, years (mean ± SD)	37.81 ± 10.47	38.95 ± 9.81	42.57 ± 8.54	30.75 ± 2.41	38.59 ± 9.79	38.05 ± 9.42	31.82 ± 5.27	43.5 ± 14.39	30.5 ± 0.58
Height, cm (mean ± SD)	172.86 ± 8.35	172.06 ± 7.68	169 ± 4.54	172.32 ± 12.24	174.45 ± 7.11	172.9 ± 8.19	176.09 ± 6.71	173.13 ± 8.68	168 ± 13.85
Weight, kg (mean ± SD)	77.79 ± 17.63	78.95 ± 22.23	83.38 ± 17.72	69.18 ± 22.55	80.68 ± 19.14	72.46 ± 17.97	68.54 ± 15.62	73.36 ± 14.8	65 ± 18.47
BMI, kg/m^2 (mean ± SD)	25.92 ± 5.25	26.45 ± 6.49	29.03 ± 5.27	22.82 ± 5.11	26.36 ± 5.6	25.43 ± 5.19	21.87 ± 3.63	24.42 ± 4.42	22.56 ± 2.81
BMI > 25 kg/m^2, *n* (%)	18 (33.96)	18 (40.91)	10 (71.42)	2 (12.5)	20 (45.45)	25 (35.21)	2 (18.18)	10 (33.33)	0 (0)
Physical activity, *n* (%)	33 (62.26)	17 (38.63)	4 (28.57)	10 (62.5)	26 (59.09)	42 (59.15)	6 (54.54)	15 (50)	4 (100)
Wearing lead apron, *n* (%)	38 (71.7)	28 (63.64)	10 (71.43)	14 (87.5)	36 (81.82)	51 (71.83)	11 (100)	24 (80)	4 (100)
Surgical experience, years (median (IQR))	6 [2–14]	8 [6–14]	9 [6–28]	3 [2.5–6]	8 [3–20]	8 [3–15]	3 [1–8]	8 [3–10]	2 [2–2]
1–5 years, *n* (%)	22 (41.51)	10 (22.73)	2 (14.29)	9 (56.25)	12 (27.27)	29 (40.85)	7 (63.64)	11 (36.67)	4 (100)
6–10 years, *n* (%)	17 (32.08)	22 (50)	6 (42.85)	7 (43.75)	16 (36.36)	19 (26.76)	2 (18.18)	13 (43.33)	0 (0)
11–15 years, *n* (%)	2 (3.77)	4 (9.09)	0 (0)	0 (0)	2 (4.55)	7 (9.86)	0 (0)	0 (0)	0 (0)
16–20 years, *n* (%)	2 (3.77)	0 (0)	2 (14.29)	0 (0)	4 (9.09)	4 (5.63)	2 (18.18)	2 (6.67)	0 (0)
21–25 years, *n* (%)	2 (3.77)	0 (0)	0 (0)	0 (0)	6 (13.64)	4 (5.63)	0 (0)	0 (0)	0 (0)
26–30 years, *n* (%)	8 (15.09)	8 (18.18)	4 (28.57)	0 (0)	4 (9.09)	8 (11.27)	0 (0)	4 (13.33)	0 (0)
Surgery hours/week (median (IQR))	10 (6–16.25)	14.5 (10–20)	10 (6–25)	10 (4.5–20)	10 (8–18)	12 (10–20)	10 (10–18)	10 (4–20)	3 (3–3.5)

Table 3. Prevalence of WMSCs by surgical specialty.

Parameters	Neck Pain (*n* = 53)	Shoulder Pain (*n* = 44)	Elbow Pain (*n* = 14)	Wrist–Hand Pain (*n* = 16)	Upper Back Pain (*n* = 44)	Lower Back Pain (*n* = 71)	Hip Pain (*n* = 11)	Knee Pain (*n* = 30)	Ankle–Foot Pain (*n* = 4)
Surgical specialty									
General, *n* (%)	5 (9.43)	2 (4.54)	2 (14.28)	0 (0)	2 (4.54)	6 (8.45)	2 (18.18)	4 (13.33)	0 (0)
Vascular, *n* (%)	3 (5.66)	4 (9.09)	0 (0)	1 (6.25)	8 (18.18)	8 (11.27)	3 (27.28)	1 (3.34)	0 (0)
Plastic, *n* (%)	10 (18.87)	2 (4.54)	0 (0)	4 (25)	10 (22.73)	10 (14.08)	2 (18.18)	4 (13.33)	2 (50)
Neurosurgery, *n* (%)	11 (20.75)	8 (18.18)	10 (71.44)	3 (18.75)	10 (22.73)	19 (26.76)	0 (0)	5 (16.67)	0 (0)
Orthopaedic, *n* (%)	6 (11.32)	8 (18.18)	0 (0)	4 (25)	6 (13.64)	8 (11.27)	2 (18.18)	4 (13.33)	0 (0)
Urologic, *n* (%)	8 (15.09)	4 (9.09)	0 (0)	2 (12.5)	4 (9.09)	2 (2.82)	0 (0)	4 (13.33)	2 (50)
Cardiac, *n* (%)	4 (7.55)	6 (13.64)	0 (0)	0 (0)	2 (4.54)	6 (8.45)	0 (0)	4 (13.33)	0 (0)
Thoracic, *n* (%)	2 (3.77)	2 (4.54)	0 (0)	0 (0)	2 (4.54)	6 (8.45)	0 (0)	0 (0)	0 (0)
Obstetric/gynecologic, *n* (%)	4 (7.55)	8 (18.18)	2 (14.28)	2 (12.5)	0 (0)	6 (8.45)	2 (18.18)	4 (13.33)	0 (0)
p *	0.09	0.45	**0.01**	0.73	**0.02**	**0.004**	0.98	0.92	NA

* *p*—relates to differences between surgical specialties. Bold: the statistical-signifiant values.

Table 4. Pain characteristics based on regions.

Parameters	Neck Pain (*n* = 53)	Shoulder Pain (*n* = 44)	Elbow Pain (*n* = 14)	Wrist–Hand Pain (*n* = 16)	Upper Back Pain (*n* = 44)	Lower Back Pain (*n* = 71)	Hip Pain (*n* = 11)	Knee Pain (*n* = 30)	Ankle–Foot Pain (*n* = 4)
VAS (median (IQR))	4 (3–5)	4 (3–5)	4 (2–4)	3.5 (2.5–4)	5 (4–7)	5 (4–7)	4 (3–5)	5 (4–6)	3 (2.5–3)
Pain duration									
1–7 days, *n* (%)	10 (18.87)	23 (52.27)	12 (85.71)	15 (93.75)	14 (31.82)	15 (21.13)	4 (36.36)	8 (26.67)	1 (25)
8–30 days, *n* (%)	15 (28.30)	6 (13.64)	2 (14.29)	0 (0)	14 (31.82)	11 (15.49)	1 (9.09)	7 (23.33)	1 (25)
>30 days, *n* (%)	28 (52.83)	15 (34.09)	0 (0)	1 (6.25)	16 (36.36)	45 (63.38)	6 (54.55)	15 (50)	2 (50)
Impact on professional activity, *n* (%)	16 (30.19)	10 (22.73)	4 (28.57)	4 (25)	8 (18.18)	12 (16.90)	6 (54.55)	8 (26.67)	0 (0)
Impact on leisure activities, *n* (%)	0 (0)	3 (6.82)	0 (0)	0 (0)	0 (0)	4 (5.63)	1 (9.09)	1 (3.33)	0 (0)
Impact on both professional and leisure activities, *n* (%)	20 (37.73)	11 (25)	0 (0)	8 (50)	8 (18.18)	41 (57.75)	2 (18.18)	19 (63.33)	4 (100)
Continue working with pain, *n* (%)	41 (77.36)	34 (77.27)	12 (85.71)	16 (100)	38 (86.36)	54 (76.05)	7 (63.64)	22 (73.33)	4 (100)
Received medical treatment, *n* (%)	4 (7.54)	16 (36.36)	4 (28.57)	2 (12.5)	8 (18.18)	28 (39.44)	3 (27.27)	12 (40)	0 (0)
Sick leave, *n* (%)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	4 (5.63)	0 (0)	5 (16.67)	0 (0)

4. Discussion

The aim of the present study was to examine the prevalence of work-related musculoskeletal complaints and potential risk factors among Romanian surgeons. The main finding of this study was that the surgeons are at high risk for development of work-related musculoskeletal complaints; 95.78% of the respondent surgeons have experienced WMSCs in at least one body part in the last 12 months. Most surgeons reported pain in 4 body parts (33.68%).

Our findings are in agreement with previous results, suggesting that surgeons are at high risk for developing WMSCs [12–18]. Alnefaie et al. [12] reported that 80% of respondent suffered from musculoskeletal manifestations related to surgery, with back and neck being the most affected parts (71.1% and 59.8%, respectively). Dianat et al. [14] found a prevalence of 77.2% of surgeons reporting musculoskeletal symptoms, with 76% of these with pain or discomfort in more than one body region. In the study of Szeto et al. [13], over 80% respondent surgeons reported experiencing at least one area of musculoskeletal symptoms in the past 12 months, neck region (82.9%) being the most affected, followed by lower back (68.1%), shoulder (57.8%) and upper back (52.6%).

The most affected region in our study was lower back (74.73%), followed by complaints in the neck region (55.79%), shoulder and upper back (each 46.32%), knee (31.58%), wrist–hand (16.84%), elbow (14.74%), hip (11.58%) and ankle–foot (4.21%). Similar results were also reported by Auerbach et al. [19], who identified a prevalence of lower back pain of 62% and neck pain of 59%. Radiculopathy was present in 30% cases with lower back pain and 28% cases with neck pain. Upper limb complaints were also prevalent in their study sample, 49% reporting shoulder pain and 24% rotator cuff symptoms. Other studies reported the neck as the most affected region [2,13,15,16,18]. In a study of 141 surgeons of different specialties, Giagio et al. [2] reported the most frequently affected body regions as being the neck (79%), lower back (75%), upper back (59%), shoulders (51%), and wrist and hand (26%). In the study of Kokosis et al. [16], 94% of the responders (plastic surgeons) have experienced musculoskeletal pain, with neck being the most affected area.

In our study, surgeons reported more intense pain at the upper back, lower back and knee, with a higher number of surgeons experiencing pain for more than 30 days in the last 12 months. Lower back pain had a significant impact on both leisure and professional activities, with 39.44% of surgeons receiving medical treatment to ameliorate WMSCs in the lower back. In all cases, the surgeons continued working with pain. Our findings are in accordance with those published by Dianat et al. [14], who also reported the mean severity rating of the symptoms experienced by the surgeon being moderate and high. In their study, almost half of the surgeons reported disruption of their normal activities due to musculoskeletal symptoms. Davis et al. [10] reported that 40% of the surgeons included in their study sustained a musculoskeletal injury in the workplace during their career, the common injured regions being the back, hand and neck. In half of the cases, the pain lasted more than 1 month, 66% of injuries being attributed to chronic causes as strain from the operating posture.

The high prevalence of musculoskeletal complaints among surgeons could be attributed to the physical demands of prolonged static working positions and postures, repetitive movements of the upper limbs during surgeries, with very fine eye–hand coordination, long working hours [2,5,13,17]. Yang et al. reported that the working posture of surgeons performing open surgeries was demanding for the neck, trunk and right upper extremity [6]. Not only the bad posture, but also the equipment use during surgery could be considered a cause of musculoskeletal complaints [18]. Our results showed that the majority of surgeons reporting WMSCs wore a lead apron during surgery.

We found gender differences only for upper back pain, with a higher percentage of male surgeons reporting WMSCs in this area. Previous studies showed a higher prevalence of symptoms in female surgeons in the neck, shoulders, elbows, hand/wrists, upper back, hips, knees and ankles [14]. Female surgeons have been reported to experience more pain and discomfort in the wrists [18] and to be at higher risk for multisite musculoskeletal pain

than male surgeons [20]. In our study, being female proved to increase the risk for neck pain, maybe as a result of an ergonomic disadvantage of being shorter. Sutton et al. [21] considered that the higher prevalence of symptoms reported by female surgeons in the shoulder area is due to the fact that female surgeons need to accommodate to the operating table height by raising their arms. Similar results were also reported by Adams et al. [22], who hypothesized that being shorter and having less upper body strength place female surgeons at risk of developing musculoskeletal symptoms or disorders.

Our results revealed that wrist–hand pain was more frequent in younger surgeons. Moreover, surgeons with less years of experience experienced more WMSCs in the wrist–hand, hip and ankle–foot regions compared with those more experienced. Neck, shoulder, upper and lower back and knee pain were more frequent in those with less than 10 years of experience. Similar results were reported by Alnefaie et al. [12], who found a higher percentage of surgeons with 5–10 years of practice with musculoskeletal manifestations, and also by Kokosis et al. [16], who found that musculoskeletal complaints started early in the training of plastic surgeons. Mavrovounis et al. [23] specified that musculoskeletal symptoms appeared early in the residency in their study sample of neurosurgeons. Hemal et al. [24] found that finger numbness is more common in junior laparoscopic surgeons than in senior surgeons. This aspect could be explained by the limited experience, which could lead to inefficient practice. Early training regarding surgery ergonomics could be of much help in preventing musculoskeletal complaints in surgeons. Giagio et al. [2] found that career longevity of more than 20 years is a protective factor for WMSCs. On the other hand, it might be expected that older surgeons, with many years of experience, would be at risk for developing musculoskeletal complaints, as a result of cumulative exposure to physical demands and stress during surgeries.

The analysis of the prevalence of WMSCs by surgical specialties revealed that the elbow, upper back and lower back pain was highest in neurosurgeons, while upper and lower back were more frequent also in plastic surgeons.

A higher BMI and a sedentary lifestyle proved to increase the risk of upper back, shoulder and elbow pain. Dianat et al. [14] reported that the prevalence of neck, shoulder and lower back symptoms decreased with more time spent on sport/physical activities.

Our findings are in agreement with other studies which showed that the professional high physical demand (number of surgeries, number of weekly working hours) increases the risk of work-related musculoskeletal complaints [4,13,14,20].

Due to the high frequency of work-related musculoskeletal complaints and the impact on surgeons' professional and personal life, we recommend preventive programs that will raise awareness of the importance of ergonomics, working postures, surgery schedules and active breaks.

The present study has some limitations. The relatively small sample size, not including all surgical specialties, and the retrospective recall of symptoms are some of the limitations. No objective assessment tool was used to identify the musculoskeletal complaints. We have not considered the working positions, and this is an aspect that should be considered in future studies in order to prevent work-related musculoskeletal complaints due to bad posture and positions during surgeries. Another limitation is that we did not study the loupes usage, which can lead to supplementary load of the neck and, consequently, higher pain in that region.

5. Conclusions

Romanian surgeons are at high risk for work-related musculoskeletal complaints that affect both professional and personal life. Further studies are needed to identify all risk factors and ergonomic and educational strategies to reduce the prevalence and the negative impact of WMSCs.

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Article

Work Stress, Mental Health and Validation of Professional Stress Scale (PSS) in an Italian-Speaking Teachers Sample

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Abstract: This study aimed validate the Italian version of the Professional Stress Scale (PSS). A questionnaire was translated into Italian and administered to two sample groups. The first group (n = 200) was the control group and the second (n = 1137) the experimental group. The participants in the study were students enrolled in a special needs training teacher course or a specialization course that aims to train support teachers. The study conducted two analyses; factor and reliability analyses. The factor analysis utilized the Kaiser-Meyer-Olkin (KMO) test which had a result of 0.925 for the scale; this was above the acceptable value of 0.7. The research studied 33 items and the BTS was significant for the 33 items scale ($\chi 2$ (528) = 4353.508, $p < 0.001$). Moreover, five eigenvalues greater than 1 were identified in the data, whereas the total variance explained was 63.7%. The reliability test utilized the Cronbach's Alpha score (0.936) of the scale and the value is calculated based on the response of 1106 individuals. The value is well above the value of 0.80, which indicates a high internal consistency level of the different items of the scale. This study showed that the Italian version of the PSS is a reliable and valid measure that can be used for research and clinical purposes.

Keywords: work stress; mental health; Italian professional stress scale

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1. Introduction

Stress is often associated with negative experiences or notions of distress and negative effects that are related with the incapacity to deal with them. Every job can produce a certain level of stress which can affect individuals at all levels in the organization, from employees to managers to senior leaders. If stress is occasional it does not appear to be harmful, but problems often arise when it is chronic. Some of the sources of stress at work include interactions among employees, the workload, personal responsibility, and conflicts between home and work. Stress is known to cause adverse effects on health, physically and mentally [1,2]. For instance, it can lead to an escalated anxiety, substance addiction, burnout and depression. Employees who feel stressed at work are highly likely to get involved in unhealthy behaviors like poor diet, smoking, drug abuse, and alcoholism. Reports show that excess work stress leads to approximately 120,000 deaths and a total of approximately $190 billion in health care costs annually [3] around the world. This is about 5–8% of the healthcare spending of national economies, which is a result of high direct expenditures (about $48 billion), lack of insurance cover (about $40 billion), and conflict ($24 billion) [4]. Work stress can worsen an existing mental health problem, thus making it harder to control. Common mental and physical health issues and stress can exist independently, meaning people can be stressed about work and at the same time experience physical changes like high blood pressure with no depression or other mental health conditions. They may also have depression without experiencing stress. The effects

of work stress include reduced job satisfaction, absenteeism, poor delivery of services and higher mortality rates.

Employees today are experiencing greater challenges than ever because of company strategies, policies, restructuring, technological advancements, and deadlines that lead to high levels of professional stress. Professional stress occurs due to a discrepancy between the demands at the workplace and the capacity of an individual to meet these demands [5,6]. Professional stress greatly affects productivity, mental, physical, behavioral, and emotional health among professionals. The Professional Stress Scale (PSS) is a self-reporting technique for establishing sources of stress for professionals. It is utilized to determine the degree of stress experienced by professionals in the healthcare workplace (specifically referencing mental health professionals who work in schools such as school psychologists) and in the school environment [7,8]. This paper aims to discuss work stress, mental health and validate the Professional Stress Scale. For this purpose, the 33-item PSS scale, which includes four subscales, was administered to 200 individuals in a cool group and 1137 individuals in an experimental group. It had a Cronbach's Alpha score of 0.936 and KMO score of 0.925.

Most jobs may promote work related stress, particularly nowadays it involves the healthcare sector [9–11]. There are few studies carried out on mental health professionals, whose work is often considered less interesting, however, lots of research shows that these professionals may display high vulnerability to stress. Reports show that psychiatrists seem to have the highest rates of suicide among healthcare practitioners [12,13]. Other authors report that mental health professionals experience a wide range of problems which lead them to drop out of training [14]. According to [15], there is a perceived distress level of 59% of clinical psychology trainees, which is higher than in other groups. If the stresses of mental health professionals have to be mitigated, it is important to systematically analyze the stressors that cause them. Some studies show that mental health professionals face different stressors from other professionals in other healthcare sectors. Mental health studies show that besides being susceptible to stressors that are inbuilt in the workplace, mental health workers tend to face more challenges. For instance, a descriptive literature review reveals that the two primary sources of stress in healthcare facilities are patient contact, and organizational and administrative factors. According to the research conducted by Travers and Firth-Cozens [16], some of the causes of stress in the workplace include lack of resources and shortage of personnel, along with the major one being violent experiences with patients. While most of the problems in psychiatry field seem to be common to all health workers, the impacts may be aggravated by the intrinsic nature of the job. As such, Ref. [17,18] show that there are unique problems in this group that should be addressed. Thus, there is a great need for more research on the specific stressors faced by mental health workers. Hellman et al. [19] established five key stressors related to the therapeutic role of mental health workers in the public and private sectors. These factors include scheduling, professional uncertainty, personal degradation, work overload, and sustaining a therapeutic relationship. In a study of psychologists, Cushway and Tyler [20] noted that factors like self-doubt and client distress were stress factors. Additionally, other factors like organizational issues and workload were revealed. The coronavirus has changed the way people live and work. The study by Irawanto et al. [21] revealed that working from home, work-life balance, and work-related stress have significant effects, both direct and indirect, on job satisfaction. In fact, COVID-19 has changed working conditions due to social distancing policies. As many workers have begun to use new technologies at work, the study by Oksanen et al. [22] probed the potential effects of social media communication (SMC) stress on work. The results indicate a disparity in the resilience of workers during remote work and highlight the need for organisational support [23]. The study by Hong et al. [24], on the other hand, examined the associations between work overload, parental stress, work-family conflict, and job satisfaction during COVID-19. Seven hundred and eighteen kindergarten teachers participated in the study.

Labour resources can buffer the deleterious effect of adverse work environments. Stress reactivity can be an important work resource on a personal biological level. Deng et al. [25] examined how stress responsiveness interacts with work environments in predicting work burnout. Social stress at work appears to accelerate the loss of resources over consecutive working days. Elfering et al. [26] analyse workplace social stressors and resources possessed. The study by Wang et al. [27] aimed to investigate the prevalence of burnout as well as anxiety, depression and stress in resident physicians and evaluate the effects of an online psychological intervention on the mental health status of physicians with a high degree of burnout. The work-related well-being of an employee is to some extent related to the work environment perceived by colleagues rather than absolute [28,29]. It found that perceiving colleagues as having higher or lower demands than themselves is associated with lower job satisfaction and higher levels of emotional exhaustion. Therefore, the processes of social confrontation regarding job requests can influence the well-being of employees.

There are contexts such as education, services and the helping professions where nothing material is built and such immateriality of the work product can unsettle the individual. The lack of a material aspect makes, for some, the work objectionable because the results are not visible and immediate. In these areas, if the worker has not made strategic alliances, his or her work life can be very problematic. For this reason, in order to better evaluate the dynamics related to work-stress, the need to validate the PSS tool in Italian emerged. It also it seemed useful and interesting to validate the tool with educational professionals: individuals who often have difficulty in immediately recognizing the fruits of their labor.

In order to verify the presence of a work-related stress situation for these professionals, the Professional Stress Scale (PSS) which investigates through appropriate questions certain parameters such as workload, difficulty in working with others, lack of resources, conflicts with colleagues and superiors, self-esteem and home/work conflicts was administered. Although the standardized version has a good diffusion, in the specific Italian context the need arises for the validation of tools that make research in work-related stress a sector of greater depth [30–32]. Today's work with the use of technologies, multitasking, e-mails, the Internet insert today's worker into a "network" in which at times they risk being harnessed.

The present study thus aimed to validate the Italian version of the Mental Health Professionals Stress Scale, developed in 1996 by Cushway and colleagues. The Mental Health Professionals Stress Scale (MHPSS) measures stress for mental health professionals using the self-report method and identifying sources of stress. The expected relationships between the scale and between the criterion measures—the General Health Questionnaire, a symptom check list, job satisfaction, self-reported stress level and quality of social support—were demonstrated. The results also provide evidence for the discriminant validity of the subscales to measure different aspects of the stress experience [20].

The Italian version of MHPSS was used, prior to the present validation, in two studies by Zefferino and colleagues in 2006 [33] and 2009 [34].

The aim of the 2006 study was to identify the presence of sources of stress in an urban police emergency team and the causes of such stress using the PSS test and biomarkers such as salivary cortisol and interleukin 1β. In the 2009 study Zefferino investigated stress using a double approach: (i) a psycho-diagnostic test able to show psychological effects and (ii) a kit test able to measure salivary markers of stress as cortisol and interleukin 1β.

The present study responds to a pressing need to structure a protocol for the diagnosis and treatment of psychophysical stress within the services of the University Hospital of Foggia.

2. Methods

2.1. Study Design

Often, the subject does not know at the end of the day what his work consisted of. There are claims that in areas such as education, services and the aid professions nothing

material is built, and the immateriality of the product of work is something that can upset the individual, as the lack of a material aspect makes work critical. The Mental Health Professionals Stress Scale (MHPSS) is a self-assessment method for identifying sources of stress for mental health professionals. The 42-item scale, which includes seven subscales, was administered to 154 clinical psychologists and 111 mental health nurses. MHPSS was found to have good internal consistency (α = 0.87 for clinical psychologists; α = 0.94 for mental health nurses). Preliminary evidence suggests that the simultaneous validity of MHPSS is good. The modified mental health Professional Stress Scale (PSS) is used to assess self-perceived work-related stress [31]. This research included a validation of the Italian Version of Professional Stress Scale [32,33]. The questionnaire consists of 33 questions and detects the frequency of occurrence of certain stressful events using the following 4-value scale: 0 = never happened, 1 = doesn't happen usually, 2 = happens occasionally, and 3 = happens to me.

Emotions, thoughts, workload, relationships with colleagues and superiors, and the ability to reconcile professional and personal life are investigated. The total score is equal to the sum of the scores obtained for each item. Higher values indicate a greater degree of work-related stress.The items and the answer alternatives are easy to understand. In two previous experiments, the questionnaire was applied to a specific category of workers (an urban police team) who, by answering a specific question, showed maximum understanding of the questions. Furthermore, the questions are of a general nature and, therefore, are free from content specific to any subpopulation. To examine the proposed PSS, Zefferino et al. [34] conducted an explorative factor analysis (EFA) and a confirmatory factor analysis (CFA). The authors reported that there was support for validity of the Professional Stress Scale.

These results showed that the factors present an acceptable validity and reliability. In addition, the instrument was shown to have adequate convergent validity with theoretically related constructs. All constructs exhibited composite trait reliability levels that exceeded 0.7 [34], ranging between 0.87 and 0.95.

2.2. Sample

Subjects participating in our study were teachers enrolled in a TFA support specialization course, a course that aims to train support teachers. The sample was selected in order to investigate the level of perceived stress in teachers and validate the scale on this sample. The authors and research team evaluated the intentional sample through the technique of heterogeneous sampling. This type of sampling is intended to provide a wide range of cases relevant to a particular phenomenon or event. The purpose of this type of sample design is to provide as much information as possible about the event or phenomenon under consideration. In the case of the present research, it was deemed useful to analyze the sample of teachers enrolled in the TFA support specialization course.

The study involved samples from two groups, a control group (n = 200), and an experimental group (n = 1137), but the results are based on the information obtained from the responses of 1106 respondents.

An attempt was made to make the experimental group as large as possible to reduce the influence of non-obvious differences between the subjects, and the aim was also to simultaneously reduce the probability of incurring a first and second type of error.

To build the Italian version of a foreign instrument, it is necessary to start with data collection to verify the validity and reliability of the tool for the Italian context. Once these have been verified, the standardization sample can be collected. The standardization sample should normally be proportional to the population at which the test is aimed and present samples similar in characteristics to those present in the original manual.

The control group was made up of 200 people who represent in percentages the same demographic and socio-cultural characteristics (educational qualification, geographical origin) of the experimental group (25% belonging to each grade of kindergarten, primary, secondary, and secondary school second degree and maintaining the same gender ratio).

The pilot study is developed in the Italian context, where the initial training course for teachers is online and distributed nationally; therefore, teacher interviews from all areas of Italy (67% from southern Italy) were included. By pilot study, we mean it is an exploratory test survey to demonstrate that the Italian version of the PSS test can work so that it can subsequently be used on a large scale. It is therefore presented as a feasibility study intended to test the questionnaire to guide the application of the test on large dimensions.

The Italian version of the questionnaire was administered to teachers on the initial training course to support teachers at the University of Foggia (n = 1106). The data were broken down by demographic profile, response processing and educational level. The data was provided via a Google form in December 2020 during the COVID-19 state of emergency. Using the online form made it possible to receive results in real time and to quickly view a summary.

2.3. Data Collection Instrument

The research utilized questionnaires to collect information and the professional stress scale to determine the factors contributing to stress in the workplace.

2.4. Ethics

The research study complied with the general ethical principles of the Declaration of Helsinki and was approved by the research team's University Institutional Review Board, protocol code 40979-III.11 and approved on 6 August 2021 issued by La Sapienza University of Foggia.

2.5. Statistical Analysis

The research performed a t-test to assess the differences between the means. A chi square test was also conducted to establish the statistical significance of the subscales. To evaluate the external validity, the research made comparisons using the PSS, to determine the level which occurrences are considered stressful. The PSS version that was used was a 33-item tool. The research utilized the Cronbach's Alpha score, which was 0.936, to determine consistency. The study also conducted a factor analysis using the KMO test which was 0.925.

To establish if the collected information was suitable for the analysis, we applied the Kaiser-MeyerOlkin (KMO) measure of sampling adequacy and BTS tests. The KMO value was acceptable (0.943) and the BTS was significant ($\chi 2$ (528) = 18,361.702, $p < 0.001$). As such, the data was relevant for factor analysis; thus, a principal components analysis was performed. The results showed that the majority of the items showed the factor loading values of 0.5 and above, whereas items 6, 29, 31, and 32 have factor loading values of 4 or above, which are acceptable values in research. Since the chi-square value is less than 3 (2.360), it shows that the model was adequate.

3. Results

3.1. Sample Description

Data was taken from Google modules in reference to a sample of 1137 people. The experimental group consisted of school teachers enrolled in the TFA support course as students. The subjects belong to the 5th cycle of the University of Foggia, of which 85.7% are women and 14.3% men. Although there are only slight numerical differences with respect to the degree of origin, the most representative degree was lower secondary school (29% of the participants). The age varied between 20 and 60 years.

A total of 1106 respondents completed the questionnaire. The 33 items were evaluated through the PCA extraction method in which the majority of the items had factor loading values of 0.5 and above, while a few had 4. The KMO test result value was 0.943, an acceptable value of above 0.7. The BTS was significant for the 33 items scale (χ^2 (528) = 18,361.702, $p < 0.001$). Also, 6 eigenvalues greater than 1 were identified in the data, while the total

variance explained was 60.8%. Internal consistency Cronbach's a for the entire sample was found to be 0.936.

3.2. Reliability Analysis

Table 1 shows the Cronbach's Alpha score (0.936) of the scale and the value is calculated based on the response of 1106 individuals. The value is well above the baseline value of 0.80, which indicates a high internal consistency level of the different items of the scale. Moreover, Table 2 shows the item statistics that include the values of the mean and standard deviation of all the items of the scale.

Table 1. Cronbach's Alpha.

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No of Items
0.936	0.936	33

Table 2. Item Statistics.

Item	N	Mean	Std. Deviation	Scale Mean If Item Deleted	Scale Variance if Item Deleted	Corrected Item Total Correlation	Cronbach's Alpha If Item Deleted	Loadings
1	1106	2.30	0.794	45.44	287.383	0.403	0.935	0.578
2	1106	2.19	0.873	45.56	284.850	0.450	0.935	0.615
3	1106	1.90	0.901	45.85	283.228	0.489	0.935	0.538
4	1106	1.89	0.940	45.86	283.835	0.447	0.935	0.680
5	1106	1.75	0.942	45.99	281.950	0.507	0.935	0.551
6	1106	1.38	0.868	46.36	282.821	0.524	0.934	0.433
7	1106	1.54	0.916	46.20	278.040	0.655	0.933	0.595
8	1106	1.29	0.981	46.45	278.168	0.603	0.934	0.626
9	1106	1.42	0.900	46.32	277.754	0.677	0.933	0.699
10	1106	1.37	0.907	46.37	277.327	0.686	0.933	0.741
11	1106	1.42	0.935	46.32	276.562	0.689	0.933	0.716
12	1106	1.36	0.918	46.39	276.822	0.694	0.933	0.737
13	1106	1.35	0.948	46.39	277.218	0.658	0.933	0.664
14	1106	1.62	0.990	46.12	279.618	0.552	0.934	0.601
15	1106	1.79	0.956	45.96	279.093	0.590	0.934	0.734
16	1106	1.32	0.980	46.43	280.245	0.538	0.934	0.680
17	1106	1.43	0.939	46.31	278.564	0.620	0.933	0.660
18	1106	0.97	0.883	46.77	280.074	0.610	0.934	0.604
19	1106	1.01	0.949	46.74	279.644	0.577	0.934	0.596
20	1106	0.46	0.755	47.29	287.191	0.434	0.935	0.583
21	1106	1.19	0.926	46.55	280.800	0.555	0.934	0.531
22	1106	1.42	0.905	46.33	281.707	0.538	0.934	0.519
23	1106	0.99	0.833					0.558
24	1106	1.25	0.927					0.756

3.3. Factor Analysis

The 33 items of the scale were examined through the PCA extraction method. As shown in Table 3, the majority of the items showed factor loading values of 0.5 and above, whereas items 6, 29, 31, and 32 have factor loading values of 4 or above, which are accepted values in research [35,36]. The demographic items were not included in the factor analysis.

Table 3. Eigen Values, KMO & BTS Tests.

Test							
Eigen Value	11.1	2.8	2.4		1.4	1.3	1.2
Percentage of Variance	33.7	8.4	7.2		4.1	3.9	3.5
Total Variance Explained				60.8			
Kaiser-Meyer-Olkin Measure of Sampling Adequacy				0.943			
Approx. Chi-Square (BTS)				18,361.702			
Df				528			
Sig.				0.000			

Extraction Method: Principal Component Analysis

The KMO test result value was 0.943 for the scale, which is also well above the acceptable value of 0.7. The BTS was also significant for the 33 items scale (χ^2 (528) = 18,361.702, $p < 0.001$) (Table 3). Moreover, six eigenvalues greater than 1 were identified in the data, whereas the total variance explained was 60.8%. Besides, a scree plot (Figure 1) also showed the six identified eigenvalues of 11.1, 2.8, 2.4, 1.4, 1.3, and 1.2.

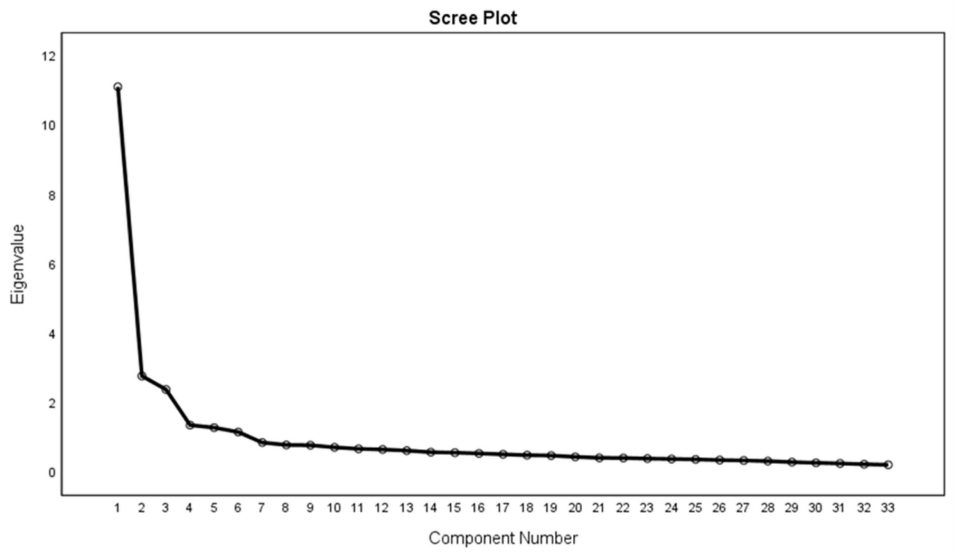

Figure 1. Screen Plot.

4. Discussion

To verify the presence of a situation of work-related stress, the PSS was administered, which investigates through appropriate questions some parameters such as workload, difficulty in working with others, lack of resources, conflicts with colleagues and superiors, self-esteem and home/work conflicts. The effectiveness of these scales for measuring stress has been studied in various mental health settings, ranging from nurses, to university students, to public administration workers [37,38]. Edwards and Burnard [39] revealed an excessive level of workplace stress for mental health nurses. The most frequently reported sources of stress were administrative and organizational concerns, patient issues, heavy workload, interprofessional conflict, financial and resource issues, professional self-doubt, home/work conflict, staffing levels, changes in the health service, maintaining standards, lecturing and teaching, long waiting lists, and poor supervision.

Lee et al. [40] identified, by analyzing a sample characterized by psychologists, nurses, and social workers that for depression and anxiety, that scores appeared slightly different across professional groups. In fact, nurses and social workers showed significantly higher total scores than clinical psychologists, and there were significant differences in subscale scores among professionals. Results and reviews conducted to date have suggested that the scale was a useful measure and predictor of stress [41]. Specifically, in this study, the

PSS was administered to professionals in the educational setting; indeed, it was found that there are contexts such as education, service, and helping professions in which the immateriality of the work product can upset the individual. For this reason, in order to better assess the dynamics related to work stress, the need emerges to validate the PSS tool in Italian.

Challenges, beyond the dimensions already highlighted, could also lead to depression, high blood pressure, and fatal coronary conditions [42]. As such, it is vital to conduct the occupational stress scale because it determines the magnitude of stress experienced by professionals in the healthcare workplace. The results of this study show that the PSS has good characteristics and can be used in future research.

5. Limitations of the Study

The data provided in this study do not represent the whole Italian employed population, as the study focused on mostly teachers rather than on workers in all sectors of the economy. The Italian healthcare setting comprises of many mental health professionals; thus, a more representative sample should be examined for future studies. Although the sample is not broadly representative of different work contexts, we believe it can be used in other work contexts as well since the sample was large (n = 1.106). The non-random sampling technique used to recruit the sample could have contributed to selection bias and lack of representativeness.

Thus, future research should consider sampling workers from all sectors to attain more extensive results. Lastly, the study does not categorize and discuss individual subscales; thus, the results are linked to only two classes of workers (police in the experimental phase and teachers in this validation), and they should also be extended to other categories to generalize the clinical results in the Italian context. Therefore, future observations should categorize the subscales accordingly for easy analysis and interpretation of the results.

6. Conclusions

The results of this research indicate that the Italian version of the Professional Stress Scale has excellent features, and thus, it qualifies to be used for future research. The initial evidence concerning the usage of the PSS is quite intriguing and inspiring, even though there is still a need for more information and analysis. Thus, reliability analysis and more validation of the PSS are worthwhile objectives for future studies. Besides providing evidence of the validity of PSS with other professionals, a study like this could improve the understanding of the causes of stress for professionals in the workplace.

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Effectiveness of Psychological Support to Healthcare Workers by the Occupational Health Service: A Pilot Experience

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Abstract: Work-related stress is a significant risk for healthcare workers (HCWs). This study aims at evaluating the effectiveness of an individual psychological support programme for hospital workers. In all, 35 workers participated (n). A control group of 245 workers ($7n$) was set. Occupational distress was measured by the General Health Questionnaire, (GHQ-12), the quality of life by the Short Form-36 health survey, (SF-36), and sickness absence was recorded. Costs and benefits of the service were evaluated and the return on investment (ROI) was calculated. The level of distress was significantly reduced in the treated group at the end of the follow-up ($p < 0.001$). Quality of life had significantly improved ($p < 0.003$). A 60% reduction of sickness absence days (SADs) following the intervention was recorded. After the treatment, absenteeism in cases was significantly lower than in controls ($p < 0.02$). The individual improvement of mental health and quality of life was significantly correlated with the number of meetings with the psychologist ($p < 0.01$ and $p < 0.03$, respectively). The recovery of direct costs due to reduced sick leave absence was significantly higher than the costs of the programme; ROI was 2.73. The results must be examined with caution, given the very limited number of workers treated; this first study, however, encouraged us to continue the experience.

Keywords: work-related stress; workplace health promotion; well-being; sickness absence; quality of life; distress; return on investment

1. Introduction

In post-industrialized countries, traditional occupational diseases are decreasing, whereas nonspecific and multifactorial stress disorders are growing [1]. In European countries a share of 50–60% of all lost working days should be attributed to work-related stress (WRS) [2]. Nonetheless, only a minority of countries in the world include WRS among the risks to be prevented in the workplace [3]. Only about half of the employers inform their workers about psychosocial risks and their effects on health and safety, and less than a third of companies put in place procedures to deal with WRS [4].

Healthcare workers (HCWs) usually face high levels of WRS [5] as a persistent background associated with accident-related spikes [6], which may hinder the quality of the provided healthcare as well as the patient safety [7–9]. Epidemiological studies have

demonstrated that a high level of WRS is associated with an increased risk of cardiovascular and musculoskeletal diseases, as well as mental disturbances (anxiety, depression, and burnout) [10–18]. Many different well-being-promoting interventions for HCWs have been proposed [4,5,9,19]. Organization-directed psychological support is a sharable approach that has already shown its positive effects [7,20]. Individual interventions based on cognitive–behavioural therapy (CBT) have been shown to be effective at some extent [21]. These programmes aim at improving coping strategies, resilience, and control of emotions through various techniques (i.e., individual support, relaxation techniques, focused breath, meditation methods, and self-awareness training) [22,23].

Effectiveness evaluations of Workplace Health Promotion (WHP) programmes, especially psychological support interventions, are not so frequent. One of the most frequently measured objective indicators of HCWs' health and well-being is sickness absence [5]. Previous evidence showed that, contrary to physical-activity-focused WHP, psychological WHP methods were not considerably related to sickness absenteeism reduction [24]. Subsequently, another study demonstrated that anxiety and depression influence the impact of a perceived health-promotive workplace culture on employee presenteeism and, therefore, productivity [25]. However, an evaluation of the WHP's economic impact is rarely performed [26]. The importance of WHP economic assessment has also been acknowledged in a very recent systematic review, to the extent that knowing the cost–benefit of WHP interventions helps in defining better political and business solutions for healthier and safer workplaces [27]. In sight of this, the present study aims at evaluating the impact of psychological individual support on HCWs health. In particular, we intended to investigate the specific factors influencing the final result of the WHP in terms of psychological distress and quality of life.

2. Materials and Methods

2.1. The Help Point (HP) Programme

A WHP plan was developed in our hospital, including a "Help Point" (HP) programme, specifically designed to give psychological support for all employed healthcare personnel who need it. The HP programme was implemented as a part of improvement actions resulting from the assessment of WRS risk and is currently working.

The programme was addressed to all dependent HCWs of the hospital. Participation in the programme was voluntary. HP aimed at preventing work discomfort and, through active listening, making the worker able to analyse the working context, freely express thoughts to colleagues and superiors, and face stressful situations.

The HP path is currently in operation and is led by a multidisciplinary team, which comprises four occupational physicians, one psychologist, and one physician of the Health Directorate, and consists of the six following phases:

1. The demand analysis phase, in which the request of the worker is collected by their occupational physician and then analysed to ascertain the motivational drive (reasons that induced them to ask for HP) through a first meeting led by the occupational physician who has been following the subject during their working life in the hospital and specifically knows their professional context, together with the psychologist who provides an exploratory interview in order to avoid exploitation of the HP programme to achieve particular benefits; to this respect, exclusion criteria are represented by unfitness of psychosocial risk and non-existence of the psychological disorder.
2. The case assessment phase (pre-evaluation), in which the accepted case is carefully assessed to discover the underlying processes of the reported problems and complaints thanks to a combined examination of the psychologist and occupational physicians (through a psychodiagnostic interview and dedicated inspections of the operative unit, respectively).
3. The psychological support phase, in which a series of therapeutic interviews are set up by the psychologist in the form of individual meetings; the duration may vary

with respect to both individual status of health and working context and is gradually estimated by the psychologist.
4. The feedback phase (post-evaluation), which comprehends a final interview in which the team analyses whether the achieved outcomes are sufficient to give up the psychological support.
5. The pre-post comparison phase, which allows to compare the initial status to the final status and identify the individual trend on the basis of the collected data; this phase is carried out during the last meeting, after the previous phase.
6. The monitoring phase, in which the subject is being monitored independently by the psychologist and the physicians, using a double-check strategy to evaluate the persistence of improvements.

All team members participate in all phases but the third phase, which is carried out by the psychologist alone. The occupational physicians share an in-depth clinical knowledge of workers and their professional risks, while the Health Directorate physician provides a detailed contextualization in the hospital framework. The coordinating occupational physician supervises the whole process. The final health outcome of the HP path is the improvement of mental health and, thus, of quality of life by gaining functional coping strategies.

2.2. Study Design and Setting

In the study period, 35 individuals joined the HP programme. They were mainly women (n = 31; 89%), and the mean age was 49.1 years (SD = 8.19), with an average seniority of 22.8 years (SD = 11.89). The prevalent job category was nurse (n = 24; 69%) followed by health technician (n = 7; 20%); other profiles were physician, biologist, dietician, and social health worker (overall n = 4; 11%). Married persons constituted 48.6% of the group, followed by single (22.8%) separated (20%) and divorced (8.6%). Overall 62.9% had children (mean = 1.3). On the whole, 20% performed night work shift and lived out of Rome. The most commonly underlying causes for joining the HP programme were acute distress syndrome (n = 25; 71.4%) and, to a lesser, extent work discomfort (n = 2; 5.7%).

The analysis was performed from September 2016 to June 2019 in the Bambino Gesù Paediatric Hospital in Rome.

For each of the subjects who asked to participate in the activities of the HP, the following were measured:

1. sociodemographic and work-related variables (age, gender, job category, seniority);
2. clinical management variables related to the performed psychological path (duration of the path, number of meetings);
3. clinical variables (perception of general and mental health level at the beginning and at the end of the treatment), using two questionnaires;
4. sickness absence days (SADs) and sickness absence rate (SAR) in the 6-month and 1-year period before and after the HP programme. The SAR was computed as the ratio between SADs and workable days related to the period (assuming 304 mean workable days in a year and 152 workable days in 6 months);

A control group ($7n$ = 245) was also proportionally set through a random selection of dependent workers of the hospital. The inclusion criteria for controls were represented by the following: (1) being a dependent worker of the hospital; and (2) having the same age, gender, and job category of cases. Each case was uniquely matched to seven controls. For the control group, 89% were women and the mean age was 49.1 years (SD = 8.19). They were mainly nurses ($7n$ = 168; 69%) and health technicians ($7n$ = 49; 20%); physicians, biologists, dieticians, and social health workers were included too ($7n$ = 7 for each category; overall, 11%). Married persons constituted 69.8%, followed by single (20.9%) and divorced (9.3%). Overall, 79.1% had children (mean = 2.1). On the whole, 27.8% performed night work shift, and 11.6% lived out of Rome. The mean seniority was 19.25 years (SD = 10.77). They did not have any psychological follow-up nor were they included in other WHP interventions.

2.3. The Questionnaires

The questionnaires were self-administered during the evaluation meetings at the beginning and at the end of the HP programme (i.e., the second and the fourth phases listed above).

2.3.1. GHQ-12

The Goldberg's General Health Questionnaire (GHQ-12) is a 12-item self-administered screening tool used to detect minor psychiatric disorders for the general population [28]. GHQ-12 assesses the current mental state and asks whether that differs from the usual state. The questionnaire focuses on both lack of ability to carry out normal functions and appearance of new distressing phenomena. Each question is ranged on a four-point Likert scale and refers to the last two-week period. The total score can range from 0 to 36 points. Higher scores indicate greater impairment (Cronbach's alpha for Italian workers: 0.85 [29]); we assumed scores over 21 as needing intervention.

2.3.2. SF-36 Questionnaire

The Short Form-36 Health Survey (SF-36) is a 36-item self-completed investigation of general health [30,31]. Each question is ranged on a five-point Likert scale. SF-36 investigates physical health, general health perception, and psychological–emotional health, and contains eight subscales (domains), each scored from 0 to 100 as a weighted sum of the correspondent questions; two indices are computed deriving from the subscales, synthesizing the overall physical and mental health. The higher the score, the better the perceived level of health (Cronbach's alpha: 0.88 [32]).

2.4. Cost Analysis

SAD-related direct costs were computed using the average per capita cost of a HCW working day (EUR 169.80), which was provided by the Human Resources Directorate of the hospital. The enhancement of savings on total absenteeism in 1 year was used for the definition of the return on investment (ROI) [33], computed as the ratio of the net profit and the investment cost for the HP programme management. In this respect, the weighted sum of the average hourly cost of each working group member was used, multiplied by the number of hours each professional has devoted to the specific activity.

2.5. Statistical Analysis

A descriptive analysis was carried out to define the characteristics of the treated population. Pre-treatment variables were compared to post-treatment variables using Student's paired *t*-test for normally distributed variables or Wilcoxon U test for non-normally distributed variables. Chi-square test was performed between qualitative variables. Two-tailed p-value < 0.05 was considered statistically significant.

In order to understand which, among the numerous factors that can influence the outcome of a psychological support intervention, is more important in determining the improvement, we have built two multiple linear regression models using as a dependent variable the pre–post difference in GHQ-12 and, respectively, SF-36 scores and age, gender, job category, seniority, and number of meetings as predictors.

The improvement in GHQ-12 and SF-36 scores was divided at the median. By logistic regression, the association between demographic/social variables and score improvement higher/lower than the median was studied.

Finally, Student's paired t-test was used to compare SAR between cases and controls. Data were analysed using IBM Statistics Package for Social Sciences (SPSS) (version 25.0).

2.6. Ethical Aspects

Our study follows the principles of the Declaration of Helsinki. According to the guidelines on Italian observational retrospective studies, an independent Ethics Committee (EC) approved the study (protocol number 2000/2019). Moreover, as established by

the Italian legislation about the obligatory occupational surveillance and privacy management, confidentiality was safeguarded, and informed consent was obtained from all the participants.

3. Results

The HP programme lasted approximately 4 months per worker (median = 129 days, IQR = 106–154), distributed on average over eight meetings (median = 8, IQR = 6–13).

Participants in HP programme showed an improvement in the measured parameters. Both GHQ-12 and SF-36 post-test scores significantly improved compared to the pre-test scores (Table 1). All mean scores of the eight subscales of the SF-36 test were higher in post-test compared to the pre-test means. The highest increase was observed in subscale 7 (Emotive Role Limitations: +134.0%), whereas the lowest improvement was in subscale 1 (Physical Activity: +11.7%).

Table 1. GHQ-12 and SF-36 mean scores before and after treatment.

Variable	Pre-HP Score (Mean ± SD)	Post-HP Score (Mean ± SD)	Difference (Mean ± SD)	Paired *t* Test for Groups (*p* Value)
GHQ-12	20.90 ± 7.88	7.23 ± 4.82	−13.67 ± 7.88	0.000
SF-36	375.69 ± 156.50	575.14 ± 140.97	199.45 ± 131.09	0.000
Subscale 1—Physical Activity	77.10 ± 24.61	86.13 ± 16.73	9.43 ± 21.74	0.015
Subscale 2—Physical Role Limitations	47.81 ± 36.46	82.90 ± 22.14	31.94 ± 31.35	0.000
Subscale 3—Physical Pain	52.03 ± 28.56	73.13 ± 23.89	21.09 ± 23.87	0.000
Subscale 4—General Health	55.71 ± 21.71	69.97 ± 19.49	13.51 ± 20.14	0.000
Subscale 5—Vitality	35.16 ± 17.93	60.68 ± 20.12	26.03 ± 19.91	0.000
Subscale 6—Social Activities	39.19 ± 20.55	70.16 ± 22.65	30.23 ± 25.42	0.000
Subscale 7—Emotive Role Limitations	34.86 ± 34.44	81.58 ± 27.57	12.31 ± 27.44	0.000
Subscale 8—Mental Health	39.74 ± 15.70	69.94 ± 16.29	29.20 ± 17.87	0.000

A stepwise multiple linear regression was performed to predict the improvement of mental and general health based on age, gender, job category, seniority, and number of meetings. The pre–post difference of GHQ-12 and of SF-36 scores was used as a dependent variable. The results of the regression indicated that seniority and number of meetings explained 61.5% of the variance of GHQ-12 difference ($p < 0.003$), while the 39.2% of the variance of SF-36 change was significantly predicted by the number of meetings ($p < 0.03$) (Table 2). A significant improvement of mental health was recorded after at least eight meetings ($p = 0.005$).

Table 2. Stepwise linear regression analysis. Relationship between demographic and intervention-related variables and improvement.

Variable	GHQ-12		SF-36	
	Standardized Beta	*p* Value	Standardized Beta	*p* Value
Seniority	0.548	0.001	-	-
Number of meetings	−0.483	0.002	0.392	0.022
Determination coefficient of the model (R^2)	0.379	0.000	0.154	0.022

Variables excluded from the model: gender, age, job category.

After the intervention, SADs decreased by 19 days per worker on average in the 1-year period (−60.89%, $p < 0.04$), with a reduction rate (SAR) of 6.43. Absenteeism reduction in the 6-month period was not significantly different among cases. However, the comparison of SAR of the cases with the correspondent controls showed a statistically significant difference ($p < 0.02$) (Table 3).

Table 3. Changes in sickness absenteeism rate.

		Pre, 6 Months (Mean ± SD)	Post, 6 Months (Mean ± SD)	*p*	Pre, 12 Months (Mean ± SD)	Post, 12 Months (Mean ± SD)	*p*
Cases	SADs	20 ± 49	8 ± 16	0.144	32 ± 50	13 ± 20	0.039
	SAR	6.62	2.68		10.56	4.23	
Controls	SADs	6 ± 13	3 ± 7	0.002	13 ± 23	7 ± 13	0.001
	SAR	1.98 ± 4.40	1.02 ± 2.27		4.17 ± 7.54	2.29 ± 4.13	
Cases vs. controls (reduction)	SAD	−(12 ± 47) vs. −(3 ± 14)		0.019	−(19 ± 49) vs. −(6 ± 24)		0.016
	SAR	−(3.94 ± 15.34) vs. −(0.95 ± 4.64)			−(6.34 ± 16.07) vs. −(1.88 ± 8.06)		

Moreover, from logistic regression analysis, it emerged that the improvement of quality of life (by SF-36 score) is significantly predicted by the comparison of SAD in the 1-year period ($p = 0.05$).

Regarding the cost analysis, the total amount of hours the working group devoted to HP-related activities was 647 h on average in a year (377 h for the psychologist and 54 h for each physician), which multiplied by the hourly cost of each professional, accounted for EUR 21,556.07 (total cost of investment). The total estimated cost saving related to absenteeism reduction in a year was EUR 80,485.20 (gross profit), the net profit was EUR 58,919.13 (calculated as the difference between the gross profit and the total cost of investment). The ROI was EUR 2.73 for each euro invested.

4. Discussion

Workers who voluntarily participated in the HP activities reported a significant reduction in work discomfort and an improvement of mental health status, with an associated reduction of absenteeism. In the treated subjects, SADs decreased by more than 60%, reaching levels lower than the general hospital absenteeism rate. Moreover, the quality of life significantly improved in treated workers. This effect was proportional to the number of meetings, which leads us to believe that the improvement was due to the psychological support interventions. In this respect, eight meetings were enough to realize a noteworthy enhancement of mental health. Additionally, seniority was found to be a predictor of the improvement of mental health. The improvement in productivity generated over EUR 80,000 of savings for the hospital, yielding an ROI of 2.73 for the service. These findings support the effectiveness of the HP activities.

The study confirms the results of the research on this topic. As a part of a comprehensive stress prevention programme existing in the hospital, the psychological support focuses on the individual ability of distress management. The HP programme runs in parallel with an organization-oriented stress intervention based on environmental, ergonomic, structural, and technological improvement measures [34]. Benefits of the HP programme include an outcome relevant for the individual (enhanced psychological and general health) as well as for the organization (reduced sickness absenteeism) [35].

On a clinical level, providing psychological care to employees generates a higher perceived workplace health support, which in turn positively influences productivity [36]. An educational and behavioural mixed approach is confirmed to positively influence cognitive-focused outcomes (such as job-related perceptions) [37]. Moreover, given the structure of the HP path, our study confirms the efficacy of individual engagement of the worker from the beginning of the path, throughout HP development and implementation [38]. In our studied population, age represents the most affecting factor of mental health improvement scores, as older age is associated with a higher risk of stress and emotional exhaustion [39], even if common mental disorders are an age-independent global disease burden [40]. Moreover, the prevalence of women is particularly higher in the studied population than in the whole hospital population (90.3% vs. 71.0%). Women are more susceptible to stress-related disorders than men and have a different neural processing of control [41]. Indeed, women are more prone to seek psychological support from primary care services (such as the occupational service), especially in the case of WRS [42,44]. Con-

sidering that different categories of psychiatric diseases are differently distributed among women and men [42], this composition bias could alter the picture of the mental status of workers in the hospital. Participation of male workers should be encouraged, for instance, by adding a fast-screening questionnaire for the most common male mental disorders during the sanitary surveillance. Finally, current evidence does not definitely assess the duration of CBT to be effective [21]. Our results suggest at least eight meetings on average for a considerably improved mental health condition.

At the organization level, sickness absenteeism is a reliable indicator of WRS and quality of life [5]. Our results proved that the HP programme notably lessened absenteeism, and this effect could last up to a year after the end of the programme. This finding supports sickness absence days to be a reliable objective indicator also in a medium-term period. As established in a previously evaluated WHP addressed to the same population [34,43], improved general and mental health leads to recovered working days, a remarkable economic saving for the hospital.

Furthermore, this study sharpens the specific role of two professional figures. On the one hand, the occupational physician, who embodies the figure of a professional mediator of the needs of workers and the organization and is in the meantime the solely responsible for the health of workers by the Italian law [44]. On the other hand, the psychologist, who is called to take care of the mental aspect of the workforce. Both these professionals need to raise the awareness of workers on the multilayered beneficial effects of the programme and the importance of steadiness in following the path throughout its duration as an individual empowerment strategy able to solve the underlying criticality.

To the best of our knowledge, this is the first effectiveness study of a hospital psychological support service conducted in Italy. The main strength is the accomplished effectiveness of a relatively short psychological support intervention on a medium-term period at the clinical and organization levels. The main limitation of the study is the small sample. The results need further confirmation through a larger number of observations possibly in a longer follow-up.

5. Conclusions

The psychological support programme showed a consistent effectiveness on mental health and quality of life as well as on productivity related to a decreased absenteeism in healthcare settings. It may be considered an effective and cost-saving approach able to mitigate the risk of WRS, a risk that, however, cannot be completely eradicated. The main future challenge in this field lies in confirming the validity of the preliminary results highlighted here on a wide-ranging workforce also in non-healthcare settings.

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Conflicts of Interest: As for F.G., medical director of Italian Ministry of Health, the expressed opinions and the contents of the article are solely the responsibility of the author, and they are not attributable in any way to the institutional and functional positions held by the same at the Italian

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Prevalence and Clustering of Cardiovascular Risk Factors among Medical Staff in Northeast China

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Abstract: Background: The clustering of cardiovascular disease (CVD) risk factors has become a major public health challenge worldwide. Although many studies have investigated CVD risk factor clusters, little is known about their prevalence and clustering among medical staff in Northeast China. This study aimed to estimate the prevalence and clustering of CVD risk factors and to investigate the association between relevant characteristics and the clustering of CVD risk factors among medical staff in Northeast China. Methods: A cross-sectional survey of 3720 medical staff from 93 public hospitals in Jilin Province was used in this study. Categorical variables were presented as percentages and were compared using the χ^2 test. Multiple logistic regression analysis was used to evaluate the association between relevant characteristics and the clustering of CVD risk factors. Results: The prevalence of hypertension, diabetes, dyslipidemia, being overweight, smoking, and drinking were 10.54%, 3.79%, 17.15%, 39.84%, 9.87%, and 21.75%, respectively. Working in a general hospital, male, and age group 18–44 years were more likely to have 1, 2, and $\geq$3 CVD risk factors, compared with their counterparts. In particular, compared with being a doctor, being a nurse or medical technician was less likely to have 1, 2, and $\geq$3 CVD risk factors only in general hospitals. Conclusions: The findings suggest that medical staff of general hospitals, males, and older individuals have a high chance associated with CVD risk factor clustering and that more effective interventions should be undertaken to reduce the prevalence and clustering of CVD risk factors, especially among older male doctors who work in general hospitals.

Keywords: cardiovascular diseases; medical staff; risk factors; clustering; prevalence

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1. Introduction

Cardiovascular disease (CVD) has become the primary cause of death in China and around the world [1,2], accounting for an estimated 17.9 million deaths globally in 2019, and more than three-quarters of these deaths occur in low- and middle-income countries [3]. Moreover, the prevalence of CVD is increasing in China; it killed nearly 4 million people in 2016 [4]. The increasing burden of CVD has become a major public health problem.

At present, most of the research involves the general population [5–7], while research on medical staff is almost entirely absent. Medical staff are essential to protect the health of the general population. Especially during the outbreak of the COVID-19 epidemic, medical staff were fighting on the front line against the epidemic and saving the lives of patients, but they were neglecting their own health. Studies have pointed out that during the COVID-19 epidemic, at least 62 medical workers in China participating in the anti-epidemic effort died on duty, including 23 cases (37.1%) due to an early lack of protection who died from COVID-19, 23 cases (37.1%) due to CVD, 6 cases (9.7%) of possible CVD, and 10 cases (16.1%) due to other reasons [8]. The number of deaths caused by CVD even exceeds the number caused by infection due to insufficient early protection.

Hypertension, diabetes, dyslipidemia, being overweight, smoking, and drinking are the main risk factors for CVD [9–12]. A considerable number of studies have pointed

out that the occurrence and development of CVD can be reduced through appropriate management and control of these six risk factors [13–15]. In addition, clustering multiple risk factors in the same person significantly increases the risk of CVD compared with having only a single risk factor [6,15,16].

Due to the characteristics of medical jobs, such as shift work, inflexible working hours, extended working hours, and heavy workloads, medical staff face extreme stress, which not only impairs their health, but also reduces their productivity and prevents them from performing their work effectively in the workplace [17–20]. The purpose of this study was to investigate the exposure and clustering of CVD risk factors (hypertension, diabetes, dyslipidemia, being overweight, smoking, drinking) among medical staff in Northeast China, and to analyze the individual characteristics (e.g., gender, age, marriage, education, and occupation) affecting their clustering, to provide a scientific basis for the formulation of CVD prevention strategies and measures.

2. Materials and Methods

2.1. Study Population

A cross-sectional survey of medical staff was implemented in Jilin Province from 21 December 2020 to 10 January 2021. In this study, a public general hospital and a public traditional Chinese medical hospital were selected from each county, and 25% of the urban public hospitals were selected from each city in Jilin Province. In general, a total of 93 public hospitals were selected as research objects by a stratified sampling method, including 50 general hospitals and 43 traditional Chinese medical (TCM) hospitals. Through convenience sampling, 20 doctors, 10 nurses, and 10 medical technicians were selected from each hospital. The study participants were selected as medical staff between the ages of 18 and 60. The subjects were substituted if they did not wish to participate in the study. Finally, a total of 3720 medical staff from 93 public hospitals in Jilin Province took part in the study.

2.2. Ethics Statement

The Ethics Committee of the School of Public Health, Jilin University, reviewed and approved the study protocol (NO. 2019-12-03). Each participating medical worker signed an informed consent form prior to data collection.

2.3. Data Collection and Measurement

All data were collected through standard questionnaires to ensure consistency and accuracy. The questionnaire included basic demographic information (e.g., sex, age, marriage, education, and occupation), health-related behaviors (e.g., smoking and drinking), as well as physical measurements (e.g., height, weight, and hypertension) and laboratory tests (e.g., diabetes and dyslipidemia). Physical measurements and laboratory tests were based on the medical staff's physical examination data in the last 2 months. In addition, to ensure the quality and integrity of the questionnaire, the survey supervisor conducted a second review of the submitted questionnaires on the same day to determine the validity of each answer.

2.4. Assessment Criteria

The six major CVD risk factors were clearly defined as follows: hypertension was defined as having been treated with antihypertensive medication within the past 2 weeks, and/or an average systolic blood pressure (SBP) $\geq$ 140 mmHg and/or an average diastolic blood pressure (DBP) $\geq$ 90 mmHg [21]. Diabetes was defined as having been treated with antidiabetes medication (insulin or oral hypoglycemic agents) and/or fasting blood glucose (FPG) $\geq$ 7.0 mmol/L [22]. Dyslipidemia was defined as having been treated with antilipemic medication or having at least one of the following: low-density lipoprotein cholesterol (LDL-C) $\geq$ 4.14 mmol/L, high-density lipoprotein cholesterol (HDL-C) < 1.04 mmol/L, triglycerides (TG) $\geq$ 2.26 mmol/L, and total cholesterol (TC) $\geq$ 6.22 mmol/L [23]. Overweight was

defined as a body mass index (BMI) $\geq$ 24.0 kg/m^2 [24]. Smoking was defined as having smoked at least one cigarette daily continuously over the past 30 days or at least 18 packs in total each year [25]. Drinking was defined as an average alcohol consumption of at least one (women) or two (men) standard drinks per day over the last 30 days, and the total amount of alcohol intake was calculated as the number of standard drinks (10 g of pure ethanol per drink) [26].

2.5. Clustering of CVD Risk Factors

The clustering of CVD risk factors was assessed based on the presence of six major risk factors: hypertension, dyslipidemia, diabetes, being overweight, smoking, and drinking. If one medical staff had 0, 1, 2, $\geq$3 major risk factors (RFs), then RFs = 0, RFs = 1, RFs = 2, RFs $\geq$ 3, respectively.

2.6. Statistical Analyses

Data were analyzed using IBM SPSS 25.0 software (IBM Corporation, New York, NY, USA). Categorical variables were presented as percentages and were compared using the χ^2 test. Adjusted odds ratios (ORs) and 95% confidence intervals (CIs) were calculated by multiple logistic regression, and 95% confidence intervals (CIs) that did not include one revealed that they were statistically significant. Statistical significance was set at p-value < 0.05.

3. Results

As shown in Table 1, among a total of 3720 medical staff, 2000 (53.76%) medical staff worked at general hospitals, and 1720 (46.24%) medical staff worked at TCM hospitals. More than two-thirds (62.69%) of the medical staff were women, and 74.22% of the medical staff were in the 18–44 age group. Nearly four-fifths (79.44%) of the medical staff were married, 62.31% of the medical staff had an undergraduate education level, and half of the medical staff were doctors. In brief, by hospital category, there were significant differences between age and education ($p < 0.05$) but no difference for gender, marriage, and occupation ($p > 0.05$).

Table 2 shows that the prevalence of hypertension, diabetes, dyslipidemia, being overweight, smoking, and drinking was 10.54%, 3.79%, 17.15%, 39.84%, 9.87%, and 21.75%, respectively. The prevalence of hypertension, diabetes, and dyslipidemia was higher in general hospitals than in TCM hospitals ($p \leq 0.05$). In addition, the prevalence of the six risk factors differed significantly by gender, being higher in men than in women ($p < 0.001$), especially for being overweight, smoking, and drinking. Furthermore, except for smoking and drinking, the prevalence of hypertension, diabetes, dyslipidemia, and being overweight differed significantly by age and marriage ($p < 0.001$). Their prevalence was higher in the 45–60 age group than in the 18–44 age group, and their prevalence was the lowest in the unmarried group compared with the other marriage groups. Except for dyslipidemia and drinking, the prevalence of the other factors showed decreasing trends with education level ($p < 0.05$). However, the prevalence of the six risk factors was the highest in the doctor group ($p < 0.001$).

Table 3 shows that the prevalence of RFs = 0, RFs = 1, RFs = 2, and RFs $\geq$ 3 was 45.89%, 29.68%, 13.92%, and 10.51%, respectively. Overall, the number of CVD risk factors differed significantly by hospital category, gender, age, marriage, education, and occupation ($p < 0.001$). Working in a general hospital, male, 45–60 age group, postsecondary education, and being a doctor had a higher prevalence of RFs = 1, RFs = 2, and RFs $\geq$ 3. However, unmarried individuals had the lowest prevalence of RFs = 1, RFs = 2, and RFs $\geq$ 3 compared with married individuals.

Table 1. Descriptive characteristics of medical staff by hospital category.

Category	Subcategory	Total (n = 3720)	General Hospital (n = 2000)	TCM Hospital (n = 1720)	χ^2	p
Gender	Man	1388 (37.31%)	769 (38.45%)	619 (35.99%)	2.40	0.12
	Woman	2332 (62.69%)	1231 (61.55%)	1101 (64.01%)		
Age	18–44	2761 (74.22%)	1453 (72.65%)	1308 (76.05%)	5.58	0.02
	45–60	959 (25.78%)	547 (27.35%)	412 (23.95%)		
Marriage	Unmarried	638 (17.15%)	319 (15.95%)	319 (18.55%)	5.69	0.06
	Married	2955 (79.44%)	1618 (80.9%)	1337 (77.73%)		
	Other	127 (3.41%)	63 (3.15%)	64 (3.72%)		
Education	Post-secondary Education	1083 (29.11%)	449 (22.45%)	634 (36.86%)	94.60	<0.001
	Undergraduate	2318 (62.31%)	1353 (67.65%)	965 (56.1%)		
	Postgraduate	319 (8.58%)	198 (9.9%)	121 (7.03%)		
Occupation	Doctor	1860 (50%)	1000 (50%)	860 (50%)	0.00	1
	Nurse	930 (25%)	500 (25%)	430 (25%)		
	Medical Technician	930 (25%)	500 (25%)	430 (25%)		

Table 2. The prevalence of CVD risk factors by relevant characteristics.

Category	Subcategory	Hypertension	Diabetes	Dyslipidemia	Overweight	Smoking	Drinking
Total	*N* (%)	392 (10.54%)	141 (3.79%)	638 (17.15%)	1482 (39.84%)	367 (9.87%)	809 (21.75%)
Hospital Category	General Hospital	229 (11.45%)	92 (4.60%)	397 (19.85%)	793 (39.65%)	199 (9.95%)	454 (22.70%)
	TCM Hospital	163 (9.48%)	49 (2.85%)	241 (14.01%)	689 (40.06%)	168 (9.77%)	355 (20.64%)
	χ^2	3.82	7.78	22.18	0.06	0.04	2.31
	p	0.05	<0.01	<0.001	0.80	0.85	0.13
Gender	Man	238 (17.15%)	88 (6.34%)	353 (25.43%)	852 (61.38%)	356 (25.65%)	581 (41.86%)
	Woman	154 (6.60%)	53 (2.27%)	285 (12.22%)	630 (27.02%)	11 (0.47%)	228 (9.78%)
	χ^2	102.60	39.47	106.88	428.80	620.24	526.24
	p	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Age	18–44	163 (5.90%)	49 (1.77%)	342 (12.39%)	1006 (36.44%)	262 (9.49%)	596 (21.59%)
	45–60	229 (23.88%)	92 (9.59%)	296 (30.87%)	476 (49.64%)	105 (10.95%)	213 (22.21%)
	χ^2	243.96	119.32	171.05	51.74	1.71	0.16
	p	<0.001	<0.001	<0.001	<0.001	0.19	0.69
Marriage	Unmarried	11 (1.72%)	7 (1.10%)	43 (6.74%)	198 (31.03%)	59 (9.25%)	124 (19.44%)
	Married	360 (12.18%)	127 (4.30%)	569 (19.26%)	1224 (41.42%)	292 (9.88%)	660 (22.34%)
	Other	21 (16.54%)	7 (5.51%)	26 (20.47%)	60 (47.24%)	16 (12.60%)	25 (19.69%)
	χ^2	65.90	15.81	58.87	26.63	1.34	2.92
	p	<0.001	<0.001	<0.001	<0.001	0.51	0.23
Education	Post-secondary Education	156 (14.40%)	62 (5.72%)	198 (18.28%)	487 (44.97%)	131 (12.1%)	233 (21.51%)
	Undergraduate	213 (9.19%)	75 (3.24%)	385 (16.61%)	885 (38.18%)	208 (8.97%)	472 (20.36%)
	Postgraduate	23 (7.21%)	4 (1.25%)	55 (17.24%)	110 (34.48%)	28 (8.78%)	104 (32.6%)
	χ^2	25.40	18.70	1.46	18.37	8.56	24.73
	p	<0.001	<0.001	0.48	<0.001	0.01	<0.001
Occupation	Doctor	258 (13.87%)	99 (5.32%)	435 (23.39%)	848 (45.59%)	253 (13.60%)	504 (27.10%)
	Nurse	50 (5.38%)	15 (1.61%)	96 (10.32%)	243 (26.13%)	13 (1.40%)	103 (11.08%)
	Medical Technician	84 (9.03%)	27 (2.90%)	107 (11.51%)	391 (42.04%)	101 (10.86%)	202 (21.72%)
	χ^2	50.44	26.07	102.29	100.50	105.23	93.52
	p	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Table 3. The prevalence with different numbers of CVD risk factors.

Category	Subcategory	RFs = 0	RFs = 1	RFs = 2	RFs ≥ 3	χ^2	*p*
Total	*N* (%)	1707 (45.89%)	1104 (29.68%)	518 (13.92%)	391 (10.51%)		
Hospital Category	General Hospital	819 (40.95%)	596 (29.80%)	312 (15.60%)	273 (13.65%)	72.27	<0.001
	TCM Hospital	888 (51.63%)	508 (29.53%)	206 (11.98%)	118 (6.86%)		
Gender	Man	265 (19.09%)	484 (34.87%)	326 (23.49%)	313 (22.55%)	817.29	<0.001
	Woman	1442 (61.84%)	620 (26.59%)	192 (8.23%)	78 (3.34%)		
Age	18–44	1419 (51.39%)	813 (29.45%)	330 (11.95%)	199 (7.21%)	212.09	<0.001
	45–60	288 (30.03%)	291 (30.34%)	188 (19.60%)	192 (20.02%)		
Marriage	Unmarried	372 (58.31%)	183 (28.68%)	58 (9.09%)	25 (3.92%)	73.43	<0.001
	Married	1286 (43.52%)	879 (29.75%)	443 (14.99%)	347 (11.74%)		
	Other *	49 (38.58%)	42 (33.07%)	17 (13.39%)	19 (14.96%)		
Education	Post-secondary Education	432 (39.89%)	340 (31.39%)	174 (16.07%)	137 (12.65%)	28.13	<0.001
	Undergraduate	1128 (48.66%)	664 (28.65%)	297 (12.81%)	229 (9.88%)		
	Postgraduate	147 (46.08%)	100 (31.35%)	47 (14.73%)	25 (7.84%)		
Occupation	Doctor	681 (36.61%)	582 (31.29%)	318 (17.1%)	279 (15%)		
	Nurse	592 (63.66%)	232 (24.95%)	80 (8.60%)	26 (2.80%)	231.13	<0.001
	Medical Technician	434 (46.67%)	290 (31.18%)	120 (12.90%)	86 (9.25%)		

* "Other" included divorced and widowed.

The results of the multiple logistic regression analysis are shown in Table 4, in terms of the adjusted OR (95% CIs) of 1, 2, ≥3 CVD risk factors when having 0 CVD risk factors was set as the reference category. Staff working in a general hospital, men, and the 45–60 age group were more likely to have 1, 2, and ≥3 CVD risk factors than staff working in a TCM hospital, women, and the 18–44 age group ($p < 0.05$). In addition, married and other staff were also more likely to have 1, 2, and ≥3 CVD risk factors than unmarried staff ($p < 0.05$). Moreover, as the number of CVD risk factors increased, the adjusted OR (95% CIs) also increased. In contrast, the adjusted ORs (95% CIs) of 1 and 2 CVD risk factors with an undergraduate education were 0.80 (0.66, 0.97) and 0.74 (0.56, 0.98) compared with those with a postsecondary education, respectively ($p < 0.05$). Compared with being a doctor, the adjusted OR (95% CIs) of ≥3 CVD risk factors for nurses was 0.50 (0.30, 0.84), and the adjusted ORs (95% CIs) of 2 and ≥3 CVD risk factors for medical technicians were 0.72 (0.54, 0.97) and 0.70 (0.49, 0.98), respectively ($p < 0.05$).

Table 5 shows the multiple logistic analysis of the CVD risk factor clustering by hospital category. The 0 CVD risk factors were set as the reference category. The results show that men, 45–60 years old, and married were more likely to have 1, 2, and ≥3 CVD risk factors than women, 18–44 years old, and unmarried ($p < 0.05$). In addition, as the number of CVD risk factors increased, the adjusted OR (95% CIs) also increased. It should be noted that for TCM hospitals, the adjusted ORs (95% CIs) of 1, 2, and ≥3 CVD risk factors were not significant for education or occupation ($p > 0.05$). In contrast, for general hospitals, the adjusted ORs (95% CIs) of RFs = 1 and RFs = 2 for those with an undergraduate education were 0.65 (0.48, 0.89) and 0.51 (0.34, 0.77) compared with those with a postsecondary education, respectively ($p < 0.05$). Moreover, compared with being a doctor, being a nurse or medical technician was less likely to have 1, 2, and ≥3 CVD risk factors only in general hospitals ($p < 0.05$).

Table 4. The multiple logistic analysis of the CVD risk factor clustering.

Category	Subcategory	The Number of CVD Risk Factors and Adjusted OR (95%CIs)		
		RFs = 1	RFs = 2	RFs ≥ 3
Hospital Category	TCM Hospital	1	1	1
	General Hospital	1.43 (1.21, 1.69)	1.95 (1.54, 2.48)	3.09 (2.26, 4.22)
Gender	Woman	1	1	1
	Man	4.22 (3.47, 5.14)	9.77 (7.51, 12.71)	21.87 (15.49, 30.88)
Age	18–44	1	1	1
	45–60	1.58 (1.29, 1.95)	2.58 (1.96, 3.39)	3.86 (2.77, 5.38)
Marriage	Unmarried	1	1	1
	Married	1.48 (1.19, 1.84)	2.11 (1.49, 2.98)	4.07 (2.46, 6.73)
	Other *	1.83 (1.13, 2.96)	2.35 (1.13, 4.88)	7.29 (2.87, 18.48)
Education	Post-secondary Education	1	1	1
	Undergraduate	0.80 (0.66, 0.97)	0.74 (0.56, 0.98)	0.79 (0.56, 1.12)
	Postgraduate	0.79 (0.58, 1.10)	0.76 (0.48, 1.20)	0.60 (0.33, 1.1)
Occupation	Doctor	1	1	1
	Nurse	0.82 (0.67, 1.02)	0.84 (0.61, 1.17)	0.50 (0.30, 0.84)
	Medical Technician	0.95 (0.77, 1.16)	0.72 (0.54, 0.97)	0.70 (0.49, 0.98)

* "Other" included divorced and widowed. A multiple logistic regression model was used to estimate OR with 95% CIs, and all other factors were adjusted when OR with 95% CIs of each variable were estimated.

Table 5. The multiple logistic analysis of the CVD risk factor clustering by hospital category.

Category	Subcategory	RFs = 1		RFs = 2		RFs ≥ 3	
		TCM Hospital	General Hospital	TCM Hospital	General Hospital	TCM Hospital	General Hospital
Gender	Woman	1	1	1	1	1	1
	Man	4.54 (3.45, 5.98)	3.93 (2.95, 5.23)	9.95 (6.69, 14.79)	9.53 (6.67, 13.61)	17.75 (10.20, 30.90)	24.09 (15.42, 37.64)
Age	18–44	1	1	1	1	1	1
	45–60	1.52 (1.13, 2.05)	1.65 (1.24, 2.21)	2.80 (1.86, 4.22)	2.45 (1.69, 3.55)	2.96 (1.77, 4.95)	4.62 (2.97, 7.19)
Marriage	Unmarried	1	1	1	1	1	1
	Married	1.37 (1.01, 1.86)	1.59 (1.16, 2.19)	2.17 (1.28, 3.69)	2.19 (1.37, 3.50)	5.30 (2.01, 13.99)	3.74 (2.03, 6.87)
	Other *	1.87 (1.03, 3.59)	1.71 (0.83, 3.53)	2.48 (0.87, 7.04)	2.26 (0.79, 6.44)	9.16 (2.05, 40.99)	7.04 (2.03, 24.41)
Education	Post-secondary Education	1	1	1	1	1	1
	Undergraduate	0.89 (0.69, 1.14)	0.65 (0.48, 0.89)	1.01 (0.7, 1.48)	0.51 (0.34, 0.77)	0.96 (0.58, 1.60)	0.67 (0.41, 1.10)
	Postgraduate	0.67 (0.40, 1.10)	0.79 (0.50, 1.23)	0.84 (0.4, 1.76)	0.61 (0.33, 1.11)	0.73 (0.27, 1.95)	0.51 (0.23, 1.14)
Occupation	Doctor	1	1	1	1	1	1
	Nurse	0.96 (0.70, 1.32)	0.71 (0.53, 0.95)	1.11 (0.67, 1.84)	0.68 (0.44, 0.99)	0.53 (0.21, 1.30)	0.49 (0.26, 0.90)
	Medical Technician	1.28 (0.96, 1.71)	0.68 (0.50, 0.91)	1.08 (0.70, 1.66)	0.50 (0.33, 0.74)	0.85 (0.47, 1.52)	0.60 (0.38, 0.98)

* "Other" included divorced and widowed. A multiple logistic regression model was used to estimate OR with 95% CIs, and all other factors were adjusted when OR with 95% CIs of each variable were estimated.

4. Discussion

With the development of China's economy and changes in people's lifestyles, the prevalence of CVD and its related risk factors in China has been increasing year by year [4,7,27]. However, people's understanding of the disease is still insufficient, resulting in a continuous increase in the prevalence and mortality of CVD in China [28,29]. This

is the first study to assess the prevalence and clustering of major CVD risk factors in a medical worker population in Northeast China.

This cross-sectional study was based on medical staff, and this study found that being overweight and alcohol consumption were the top two risk factors for CVD among medical staff. In addition, the prevalence of being overweight was higher than the average rate in the general adult population [5,6]. This finding may be due to Jilin Province being located in the central part of Northeast China, which has a temperate continental monsoon climate and an annual average temperature of 4.8°C. This climate leads people to eat a lot of meat and not engage in outdoor sports, especially in the cold winter [15]. Furthermore, according to the Global Burden of Disease study, the number of deaths attributable to alcohol consumption in China rose from 368,000 in 1990 to 70,300 in 2017 [30], and other studies have also pointed to the heavy economic burden of alcohol-related deaths in China [31–33]. However, the prevalence of dyslipidemia, hypertension, diabetes, and smoking were significantly lower than those found in other studies [34–38], which may be related to the medical occupation. Compared with the general population, medical staff know more about the prevention and control of related diseases and the harm of smoking on the body.

This study also found that the prevalence of hypertension, diabetes, and dyslipidemia was higher among the staff of general hospitals than TCM hospitals ($p \leq 0.05$). At the same time, compared with TCM hospitals, general hospitals had a higher prevalence of risk factors 1, 2, and $\geq$3, which may be due to general hospital medical staff having more work stress and a higher workload because the number of patients treated in general hospitals is much higher than that in TCM hospitals. In addition, the prevalence of the risk factors differed significantly by gender, being more predominant among men ($p < 0.001$), especially for being overweight, smoking, and drinking. In addition, compared with women, men had a higher prevalence of RFs = 1, RFs = 2, and RFs $\geq$ 3, similar to the findings of other previous studies [27,39,40]. This result may be because men assume more responsibilities in society and tend to have more social parties, drink more alcohol, and smoke more cigarettes than women. In contrast, women tend to be more aware of their weight, especially during young and middle ages, which may translate into a favorable cardiovascular risk profile. Furthermore, except for smoking and drinking, the prevalence of hypertension, diabetes, dyslipidemia, and being overweight showed differences by age and marriage status ($p < 0.001$). The 45–60 age group had a higher prevalence of RFs = 1, RFs = 2, and RFs $\geq$ 3 than the 18–44 age group, which is similar to the findings of previous studies [5]. With increasing age, physical function declines, leading to a higher prevalence of hypertension, diabetes, dyslipidemia, and being overweight than the younger population, while smoking and drinking alcohol are personal habits that are not affected by age. In addition, unmarried individuals had the lowest prevalence of RFs = 1, RFs = 2, and RFs $\geq$ 3 than married individuals, possibly because unmarried people in general are younger and under less pressure. Except for drinking, the prevalence of risk factors was higher among those with postsecondary education ($p < 0.05$). In addition, compared with the other groups, those with postsecondary education had the highest prevalence of RFs = 1, RFs = 2, and RFs $\geq$ 3, which may be related to a higher education level and a better awareness of disease prevention and control [15]. Moreover, the prevalence of the six risk factors was the highest in the doctor group ($p < 0.001$). Compared with other groups, doctors had a higher prevalence of 1, 2, and $\geq$3 risk factors. Other studies have also pointed out that doctors have the most work stress and the highest workloads [41–43].

In addition, this study found that individuals working in a general hospital, men, and the age group 18–44 were more likely to have 1, 2, and $\geq$3 CVD risk factors, compared with their counterparts. Furthermore, the adjusted ORs were lower than those in other studies [5,6], possibly because the study subjects were medical staff. Medical staff generally perform better regarding disease control and prevention than the general population. Finally, the clustering of CVD risk factors in different hospital categories was studied separately, which was similar to the overall study results. However, compared with being

a doctor, nurses or medical technicians were less likely to have 1, 2, and ≥3 CVD risk factors only in general hospitals. Another study has also pointed out that doctors in general hospitals not only treat more patients with more complex conditions but also have greater work pressure and workloads than those in TCM hospitals [44]. Thus, doctors in general hospitals are more likely to have clustered CVD risk factors than nurses and medical technicians.

This study has the following limitations. First, the smoking and drinking status of the medical staff is based on self-reporting, which may have a certain reporting bias. Second, this study was a cross-sectional study, and it was not possible to determine the causal relationship between relevant characteristics and the clustering of CVD risk factors. Third, some other confounding factors that might have impacts on the clustering of CVD risk factors, such as socioeconomic factors, lifestyle (eating, physical activity), and work conditions (shift work, work hours), were not under consideration, which might be the limitation of our study.

5. Conclusions

This cross-sectional study provides information on the regional prevalence and clustering of CVD risk factors among medical staff in Northeast China and fills an information gap. The findings suggest that individuals working in general hospitals, men, and older individuals have a high chance associated with CVD risk factor clustering and that more effective interventions should be implemented to reduce the prevalence and clustering of CVD risk factors, especially among older male doctors working in general hospitals.

Author Contributions: J.Y. and X.Y. had the original idea for the study and, with all co-authors carried out the design. X.Y. provided valuable insight regarding the methodological approach and organization of the manuscript. H.J. was responsible for data cleaning and Z.Z. carried out the analyses. P.C. contributed to data collection. J.Y. drafted the manuscript, which was revised by all authors. All authors have read and agreed to the published version of the manuscript.

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Antibacterial Treatment of Selected High-Touch Objects and Surfaces within Provision of Nursing Care in Terms of Prevention of Healthcare-Associated Infections

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Abstract: Prevention of healthcare-associated infections is an important part of providing nursing care. High-touch objects and surfaces that can be contaminated with various bacteria are matters of concern. The possibility of reducing contamination is the use of antibacterial and hydrophobic nanolayers. The aim of this study was to determine, by means of an experimental method, the microbial efficacy of applied antibacterial and hydrophobic nanolayers on high-touch objects and surfaces used in nursing practice in a regional hospital in the Czech Republic. The results show that the antibacterial efficacy of the applied nanolayer was not demonstrated. Furthermore, the results show that selected objects and surfaces can always be contaminated by bacterial agents in about 1/3 of cases. It is mainly contamination with nonpathogenic bacteria; however, the presence of pathogenic bacteria, such as *Staphylococcus aureus*, has also been detected. The results of this study pinpoint the importance of following the basic rules for the use of decontaminated objects and surfaces used to provide healthcare.

Keywords: antimicrobial nanolayer; bacterial contamination; prevention; healthcare-associated infections; nursing; high-touch objects and surfaces

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1. Introduction

Healthcare-associated infections are still a current problem and, according to the Organization for Economic Co-operation and Development, they are among the most common adverse events in provision of healthcare services [1,2]. Healthcare-associated infections significantly affect patient mortality and morbidity, including increased financial costs of healthcare [3]. According to the European Parliament, an average of 1 in 20 patients acquire healthcare-associated infection every day in the European Union, i.e., 4.1 million patients and 37,000 patients die from healthcare-associated infections. At the same time, it is estimated that 20–30% of infections could be prevented [4]. In many cases, healthcare-associated infections can be effectively prevented using evidence that can reduce the incidence of these infections. One of the basic components of prevention is the observance of basic hygienic-epidemiological principles, including the decontamination of objects and surfaces intended for re-use [5].

Provision of healthcare is closely linked to the use of a variety of objects and surfaces, such as medical equipment and medical devices, including tools, instruments, gadgets and other objects [6]. Objects and surfaces of the hospital environment can be a potential reservoir for the transmission of bacteria and other microorganisms immediately after contaminated hands [7]. Transmission through contaminated hands or contact with contaminated surfaces may contribute up to 20–40% to the development of healthcare-associated infections [8–10]. According to available research, surfaces are a frequent source of transmission of pathogens associated with healthcare through direct contact with the patient or the

environment, or indirect contact through contaminated hands of healthcare professionals, including nurses. Noncritical objects and surfaces are based on the Spaulding classification, which categorizes reusable medical devices for decontamination [11,12]. The matter of concern is mainly noncritical objects and surfaces, which are associated with frequent hand contact [13,14]. In terms of contact frequency, objects and surfaces can be divided into high-touch (e.g., stethoscopes, telephones, medical records) and low-touch or minimal-touch (e.g., ceilings, mirrors, walls) [6,8,12,15,16]. Another important aspect of the transmission of agents is the ability of microorganisms to persist on dry and inanimate surfaces, where the main principle for reducing cross-transmission is the observance and implementation of regular decontamination of objects and surfaces [12,14,17]. High-touch objects and surfaces, which are used to provide healthcare services and specific nursing interventions, require increased attention since they are directly involved in the microorganism transmission chain. For this reason, they require cleaning and subsequent disinfection [18,19]. The Spaulding classification can be used to select the method of decontamination of individual objects and surfaces intended for repeated use [6,20]. In practice, the decontamination of high-touch objects and surfaces might be underestimated, as healthcare professionals may not be aware that these objects and surfaces could be involved in the transmission of pathogens from healthcare-associated infections [19].

Preventive measures also include finding and implementing other options, such as antimicrobial surfaces, which are used to cover or impregnate surfaces in various surfaces of healthcare provision [20]. The main goal of antimicrobial surfaces is to minimize the presence of microbial contamination or reduce the viability of organisms and reduce biofilm formation. Antimicrobial surfaces are gaining more attention for setting other infection prevention strategies [21,22]. The need for antimicrobial surfaces is important because bacterial contamination of the surface contributes to the transmission of healthcare-associated infections in situations where decontamination has not been performed effectively [23,24]. When antimicrobial surfaces are used on high-touch and reusable items, it has the potential to reduce the incidence of healthcare-associated infections [23]. Antimicrobial surfaces can be placed in two categories, antiadhesive surfaces (for example applying a layer of polyethylene glycol or diamond-like carbon) and antimicrobial coatings (organic antimicrobials, such as ionized silver or copper) [22]. Nanomaterials can also be used in surface treatments since there has been increasing evidence that nanomaterials offer new ways to design antimicrobial surfaces [21]. Nanoparticles of silver and other elements, which are gradually released into the environment, are important components for use in healthcare [25,26]. In particular, silver nanoparticles are one of the most important ones due to their bactericidal, fungicidal and virucidal activity [26]. At present, there are various surface treatments of objects and surfaces using a nanolayer containing various organic–inorganic particles ensuring antimicrobial efficiency. The nanolayer can be applied to objects and surfaces in various ways, e.g., by the sol-gel method [27]. Ongoing research on this surface is still important [22]. The aim of this study was to investigate the bacterial contamination of touch objects and surfaces in a nursing practice and to compare contaminations on objects covered by a nanolayer to control objects. Studies on the contaminations of objects and surfaces are important and it is necessary to develop relevant views of bacterial transmission in healthcare facilities and to highlight effective solutions to fight it.

2. Materials and Methods

2.1. Study Design

The research was carried out by the technique of experiment. Its aim was to determine the microbial effectiveness of the applied antibacterial and hydrophobic nanolayer on selected objects and surfaces in nursing practice. The research was carried out at clinical workplaces (standard surgical departments) of a regional hospital in the Czech Republic.

2.2. Selection of Research Samples

The research samples were selected high-touch objects and surfaces that nurses use to provide nursing care. Research samples were selected based on a previous study [28]. These were emesis basins, trays and boxes intended for storing medical supplies, including sterile material in a protective package. Two groups were chosen for the experiment: nano and control. The research samples (emesis basins, trays and boxes) were identical. The nano group included research samples to which an antibacterial and hydrophobic nanolayer was applied. The control group included research samples that were not treated with anything, i.e., without surface treatments. The research samples were selected based on the relevance and feasibility of nanomaterial application. There were six criteria for the selection of samples. Firstly, they had to be objects and surfaces that the nurses used to provide nursing care. Secondly, that objects and surfaces had to be intended for re-use. Thirdly, in order to be able to apply antibacterial and hydrophobic nanolayer. Fourthly, that objects and surfaces had not come into direct contact with the patient. Fifthly, objects and surfaces had to be high-touch. The last criterion was affordability. The control group included a total of 11 emesis basins, 12 trays and 3 boxes for medical supplies. The nano group included a total of 13 emesis basins, 12 trays and 3 boxes for medical supplies. The samples from the nano and control group were ready for use.

2.3. Preparation and Application of the Nanolayer

The nanolayer was applied to the entire surface of the research samples, not only to a part of it. A nanolayer (antibacterial sol), which was composed of a hybrid organic-inorganic sol based on 3-(trimethoxysilyl) propyl methacrylate with silver, copper and zinc cations, under the designation AD30, was applied to the nano research samples. The antibacterial sol corresponded to the specification according to patent CZ303861 [29]. The nanomaterial was prepared and applied by the author of the patent. Further, dilution was performed to a suitable concentration for application using isopropyl alcohol. The actual application of the antibacterial sol to the surface of plastic materials was carried out by high-pressure spraying with compressed air guns. Heat treatment was then performed to complete the polymerization of the base matrix at a temperature of 80 °C for 3 h.

2.4. Sampling Plan and Technique

Research samples were placed at each workplace. Each research sample was marked with an original and random code so that the result was not affected (i.e., blinding the sample origin also to the person responsible for the microbial analysis). Swabs were taken and microbiological verification of the effectiveness of the applied nanolayer was performed in the accredited microbiological laboratory of the regional type hospital every 7 days for 12 weeks. Under standard procedures and according to the conditions of laboratory practice in the Czech Republic [30,31], swabs were taken from individual research samples (ready for use for the provision of nursing care) from the area of 10 × 10 cm using a template. Sterile cotton-tipped applicator sticks moistened with saline were used for the collection. Sampling was performed using aseptic techniques. In one day, swabs were taken from all research samples. Subsequently, the sampling kit was marked and transported in protective boxes to the microbiological laboratory.

2.5. Bacterial Culture

The swab was inoculated under sterile thioglycollate broth tubes (5 mL) under aseptic conditions. The sample was allowed to incubate for 7 days at 36 °C. Subsequently, direct inoculation was always performed on blood agar and Mac Conkey agar. It was then placed in a thermostat for 24 h at 36 °C. Then, a qualitative reading of the grown bacterial colonies was performed and evaluated by a microbiologist. In the case of positive findings, more specific identification was performed, i.e., microscopy (Gram staining), isolation of pure culture or biochemical diagnostics. Pathogenic bacteria were further identified by specifying whether they were multiresistant strains [30,31]. Specifically, *Corynebacterium species*, Coagulase negative *Staphylococcus*, *Streptococcus* species, *Micrococcus* species and Sporulating microorganisms were identified using microscopy. More detailed identification for research purposes was not performed. *Acinetobacter* species and *Pseudomonas aeruginosa* were identified using biochemical diagnostics (biochemical wedge agar), *Enterobacter cloacae* (ESBL negative) and *Serratia rubidaea* (ESBL negative) were identified using enterotest and disk diffusion test (AmpC and ESBL Detection Set D68C) on Mueller–Hinton agar. *Enterococcus* species was identified using biochemical diagnostics (MEAT agar). *Staphylococcus aureus* (MRSA negative and positive) was identified using biochemical diagnostics (STAPHYtest), CHROMagar and Oxacillin Screen Agar 2 and 6. The result was interpreted as without a finding, i.e., without bacterial contamination, or with a finding, i.e., with bacterial contamination. The finding with bacterial contamination was further divided into the presence of nonpathogenic and pathogenic bacteria. The interpretation of the finding was also carried out in accordance with the valid legislation of the Czech Republic. This Act No. 306/2012 Coll. [32] says that objects and surfaces have to be used to treat patients after their decontamination.

2.6. Data Analysis

Research data were analyzed and processed in statistical software (TIBCO Statistica, version 12, Palo Alto, CA, USA). The statistical analysis was carried out in two phases. First, the classification of the first degree was performed on the basis of descriptive statistics (absolute and relative frequency). In the second phase, statistical tests were performed to determine significant relationships between indicators. For statistical testing of hypotheses, the test of agreement of two alternative distributions and the chi-square test with a significance level of $p = 0.05$ were used.

2.7. Ethical Considerations

This study did not include any ethically controversial issues; the research was not conducted on humans. The research was carried out in compliance with the Regulation of the European Parliament and of the Council No. 2016/679 of 27 April 2016. The research was carried out in accordance with the 1975 Helsinki Declaration and its most recent revisions, and in accordance with national ethical standards and regulations. The hospital and the individual workplaces agreed with the implementation of the research.

3. Results

3.1. Culture Results in Emesis Basins

For the purposes of the research, 11 nano emesis basins and 13 control emesis basins were used. A total of 132 swabs from nano emesis basins and 156 swabs from control emesis basins were taken throughout the research. Based on 132 (100.0%) swabs from nano emesis basins, there was a finding without bacterial contamination in 94 (71.2%) swabs and a finding with bacterial contamination in 38 (28.8%) swabs. Based on 156 (100.0%) swabs from control emesis basins, there was a finding without bacterial contamination in 104 (66.7%) swabs and a finding with bacterial contamination in 52 (33.3%) swabs (Table 1). The culture finding was represented by nonpathogenic and pathogenic bacteria.

Table 1. Culture results in emesis basins.

Nano			**Control**		
Category	Number of finding	%	Category	Number of finding	%
Without bacterial contamination	94	71.2	Without bacterial contamination	104	66.7
With bacterial contamination	38	28.8	With bacterial contamination	52	33.3
p-value of Nano versus Control emesis basins 0.407.					
Detailed analysis of culture finding from single swabs					
Micrococcus species	2	1.5	*Micrococcus* species	3	1.9
Sporulating microorganisms	5	3.7	Sporulating microorganisms	11	7.1
Coagulase negative *Staphylococcus*	27	20.4	Coagulase negative *Staphylococcus*	34	21.8
Streptococcus species	1	0.8	Coagulase negative *Staphylococcus*, *Micrococcus* species	1	0.6
Enterococcus species	1	0.8	Coagulase negative *Staphylococcus*, Sporulating microorganisms	1	0.6
Pseudomonas aeruginosa	1	0.8	*Staphylococcus aureus* (MRSA negative)	2	1.3
Acinetobacter species	1	0.8			

3.2. Culture Results in Trays

For the purposes of the research, a total of 12 nano trays and 12 control trays were used, where 144 swabs from nano trays and 144 swabs from control trays were taken throughout the research. Based on 144 (100.0%) swabs from nano trays, there was a finding without bacterial contamination in 88 (61.1%) swabs and a finding with bacterial contamination in 56 (38.9%) swabs. Based on 144 (100.0%) swabs from control trays, there was a finding without bacterial contamination in 90 (62.5%) swabs and a finding with bacterial contamination in 54 (37.5%) swabs (Table 2). The culture finding in nano trays was represented only by nonpathogenic bacteria and in control trays it was represented by both nonpathogenic and pathogenic bacteria.

Table 2. Culture results in trays.

Nano			**Control**		
Category	Number of finding	%	Category	Number of finding	%
Without bacterial contamination	88	61.1	Without bacterial contamination	90	62.5
With bacterial contamination	56	38.9	With bacterial contamination	54	37.5
p-value of Nano versus Control trays 0.808.					
Detailed analysis of culture finding from single swabs					
Micrococcus species	3	2.1	*Corynebacterium* species	1	0.7
Sporulating microorganisms	23	16.0	*Micrococcus* species	3	2.1
Coagulase negative *Staphylococcus*	29	20.1	Sporulating microorganisms	16	11.1
Coagulase negative *Staphylococcus*, Sporulating microorganisms	1	0.7	Coagulase negative *Staphylococcus*	31	21.5
			Acinetobacter species	1	0.7
			Enterobacter cloacae (ESBL negative)	1	0.7
			Serratia rubidaea (ESBL negative)	1	0.7

3.3. Culture Results in Boxes for Storing Medical Supplies

For the purposes of the research, a total of 3 nano boxes for medical supplies and 3 control boxes for medical supplies were used, where 36 swabs from nano boxes and 36 swabs from control boxes were taken throughout the research. Based on 36 (100.0%) swabs from nano boxes, there was a finding without bacterial contamination in 18 (50.0%) swabs and a finding with bacterial contamination in 18 (50.0%) swabs. Based on 36 (100.0%) swabs from control boxes, the findings were the same (Table 3). The culture finding was represented by nonpathogenic and pathogenic bacteria.

Table 3. Culture results in boxes for storing medical supplies.

Nano			**Control**		
Category	Number of finding	%	Category	Number of finding	%
Without bacterial contamination	18	50.0	Without bacterial contamination	18	50.0
With bacterial contamination	18	50.0	With bacterial contamination	18	50.0
p-value of Nano versus Control boxes for storing medical supplies 1.000.					
Detailed analysis of culture finding from single swabs					
Coagulase negative *Staphylococcus*	10	27.8	Coagulase negative *Staphylococcus*	11	30.5
Sporulating microorganisms	7	19.4	Sporulating microorganisms	5	13.9
Staphylococcus aureus (MRSA positive, oxa-R)	1	2.8	Coagulase negative *Staphylococcus*, *Micrococcus* species	1	2.8
			Enterobacter cloacae (ESBL negative)	1	2.8

3.4. Evaluation of the Experiment

The research investigated whether there was a statistically significant difference ($p \leq 0.05$) between bacterial contamination of nano and control objects and surfaces (emesis basins, trays and boxes for medical supplies) within 12 weeks. Based on the analysis, it was found out that no statistically significant difference was demonstrated between bacterial contamination of emesis basins ($p = 0.407$), trays ($p = 0.808$) and boxes for medical supplies ($p = 1.000$) in nano and control groups.

Further, it was investigated whether or not the nano emesis basins, trays and boxes for medical supplies would show bacterial contamination. Based on interval estimates ($\alpha = 0.05$), it can be stated that already during the beginning of the monitoring period the relative degree of contamination in emesis basins was at least 0.152 (i.e., emesis basins will be contaminated in 15.2% of 66 swabs), in trays at least 0.289 (i.e., trays will be contaminated in 28.9% of 72 swabs) and in boxes for medical supplies at least 0.164 (i.e., boxes for medical supplies will be contaminated in 16.4% of 18 swabs). Furthermore, it was found out that in all research nano samples, bacterial contamination will always be detected in at least 26.5%, i.e., more than 1/4 of objects and surfaces will always be contaminated with bacteria.

The experiment also determined whether the degree of bacterial contamination (i.e., findings with bacterial contamination) and the method of treatment of selected objects and surfaces (objects and surfaces with and without the application of antibacterial and hydrophobic nanolayers) are independent. Based on the evaluation of the prevalence between the degree of bacterial contamination and the method of treatment of research nano and control samples, it was found out that a statistically significant dependence could not be demonstrated ($\alpha = 0.05$; $X^2 = 0.210$; $p = 0.900$).

Based on the above analyses, it was realized that no statistically significant difference ($p \leq 0.05$) was found between the degree of bacterial contamination and the method of treatment or effectiveness of the nanolayer depending on the monitoring period. For this reason, a statistically significant incidence was investigated between the emesis basins, trays and boxes for medical supplies, regardless of whether they were treated with antibacterial

and hydrophobic nanolayers. From the analysis of the data, it was found out that a finding with bacterial contamination in the emesin basins was in 31.3% (N = 288), in the trays in 38.1% (N = 288), in the boxes for medical supplies in 50.0% (N = 72) and in all research samples in 36.4% (N = 648). Based on the achieved level of significance, it can be stated that a statistically significant difference ($p \leq 0.05$) was found between the degree of bacterial contamination of the emesis basin and the box for medical supplies (p = 0.003). In other cases, i.e., the dependence between the emesis basin and the tray (p = 0.083) and also the tray and the box for medical supplies (p = 0.067), it was not possible to prove a statistically significant difference.

4. Discussion

The provision of nursing care requires the use of various objects and surfaces intended for single or repeated use for the implementation of nursing interventions. In terms of the possible transmission of healthcare-associated infections, the problematic areas are mainly objects and surfaces that are intended for repeated use and which come into frequent contact with the hands of nurses. These objects can be contaminated with various bacterial agents, as confirmed by this and other studies [8,33]. An important aspect of preventing transmission of healthcare-associated infections through these objects and surfaces is the observance of the basic principles of mechanical cleaning and disinfection [6,8,18]. In the event that disinfection is not performed or is performed imperfectly, the agents of healthcare-associated infections may persist on the surfaces and may be involved in the transmission of infectious pathogens [12–16]. In this context, it is important to seek out and exploit new opportunities to minimize the risk of transmission of healthcare-associated infections through high-touch objects and surfaces used to provide nursing care.

This research, which was carried out in a regional hospital in the Czech Republic, verified the effectiveness of antibacterial and hydrophobic nanolayer, which was applied to selected objects and surfaces. The research revealed that the research samples with the applied antibacterial and hydrophobic nanolayer do not show better antibacterial activity compared to the research samples without surface treatments. However, the study did not investigate the initial bacterial burden on samples. Several studies [7,34,35] have evaluated the direct bacterial concentration on surfaces that have been plated without an enrichment phase. This surface treatment was very effective. These studies observed that most of the touch surfaces were contaminated and that the bacterial burden was highly variable between samples. This may explain the limitations of this study. Based on the research results, it was found that 28.8% of nano emesis basins and 33.3% of control emesis basins were contaminated with bacteria. The situation was similar for trays, when 38.9% nano trays and 37.5% control trays were contaminated with bacteria.

The results show that the applied nanolayer achieves low efficiency. This may have been due to testing in clinical conditions with possible external influences, but in laboratory conditions the effect of antibacterial and hydrophobic nanolayer was significant, especially on Methicillin-resistant *Staphylococcus aureus* [29]. Another possible influence may have been the dependence on the resistance of the surface treatment and damage to the layer during use. A limitation of the study may be that the activity of the nanoparticles was tested in laboratory conditions, not in medical facilities. As well as this, temperature and humidity can be limiting factors. It is also appropriate to consider a change in the composition and method of synthesis of the applied nanolayer. Efficacy could also be affected by the use of disinfectants. This shows that it is necessary to further develop and optimize the nanomaterial applied to individual objects and surfaces in terms of the results of this study. In future studies, it will be important to focus on identifying the negative circumstances that affect the effectiveness of this antibacterial nanolayer. It is also necessary to increase its antimicrobial efficacy. The method of application of the nanolayer can also be an influencing factor. Another study also states that the actual production processes, such as the thickness of the coating and the surface geometry, are also important for the essence of surface treatments. It also states that it is necessary to design and manufacture new

polymeric and nanocomposite materials for effective use in healthcare [36]. The study [37] states that, when used, ZnO-C nanocomposite coatings are very effective for the elimination of *Pseudomonas aeruginosa*.

On the contrary, other studies [22,23,34,35,38] show that antibacterial surfaces, including modifications, are an effective way to prevent healthcare-associated infections. New self-disinfecting surfaces with heavy metal surfaces (copper, silver, etc.) have antimicrobial properties and can retain antimicrobial activity for several weeks to months [38]. For example, a study using copper surfaces revealed that the microbial load on copper objects was 73% lower than without any surface treatments [7]. Another study showed that the frequency of the contamination as well as the specific bacterial population bioburden is reduced on copper alloy surfaces [35]. Additionally, in the Salgado study [39] it was found that reduction of bacterial contamination was observed on objects with copper surfaces against objects without copper surfaces in 44%. For example, another study showed a small reduction of bacterial contamination on surfaces with copper [40].

This study showed that bacterial contamination of noncritical objects and surfaces is relatively high. In the case of emesis basins, all emesis basins were contaminated in 31.3% of 288 swabs. Trays for the preparation of injection and infusion material were contaminated in 38.1% of 288 swabs and boxes used for storing medical supplies were contaminated in 50.0% of 72 swabs. Another important finding is the fact that all research samples were contaminated in 36.4% of 642 swabs. The results also showed that the emesis basins were contaminated with pathogenic microorganisms, such as *Pseudomonas aeruginosa* (0.8%), *Acinetobacter species* (0.8%) or *Staphylococcus aureus* (1.3%). Pathogenic microorganisms were also detected on control trays. In this case, the presence of *Acinetobacter species* (0.7%), *Enterobacter cloacae* (0.7%) or *Serratia rubidaea* (0.7%) was detected. The presence of pathogenic bacteria was similar in boxes for storing medical supplies, such as Methicillin-resistant *Staphylococcus aureus* (2.8%) and *Enterobacter cloacae* (2.8%). The most common nonpathogenic bacteria were Coagulase negative *Staphylococcus* and Sporulating microorganisms. At the same time, it was found that the objects and surfaces were mainly contaminated with skin flora bacteria. Similar results have been found in other studies [1,8,11–14,41,42]. However, another study [43] points to the dangers of Coagulase negative *Staphylococcus*, which are associated with a high degree of antibiotic resistance and are among the main causes of bacteremia. If an infection occurs, treatment options are limited. The Ndegwa study [24] also showed that less than 50% of hospital items and surfaces and other portable medical devices were decontaminated appropriately using chemical disinfectants. This may be due to the fact that healthcare professionals may not adhere to the recommended exposure time or the prescribed concentration of the used disinfectant, including the decontamination procedure [38,44]. In this context, some studies mention that surface contamination of objects and surfaces is mainly due to human failure in the form of the absence of thorough cleaning and disinfection of surfaces rather than the use of an unsuitable product or process [33]. Thus, contaminated objects and surfaces have an effect on the possible cross-transmission of healthcare-associated infections [33]. When implementing nursing interventions, it is important to follow the principles of hospital hygiene, including decontamination and aseptic techniques during the performed procedures [44]. At present, there is still a consensus on the need to improve the mechanical cleaning and disinfection of surfaces, which are among the day-to-day essential elements of the effectiveness of the infection prevention program [38]. This study also found that some nurses do not adequately decontaminate objects and surfaces.

An important aspect of the prevention of healthcare-associated infections is the search for and optimization of options with surface treatment. Furthermore, it is important to optimize and adhere to the set hygienic-epidemiological principles, especially with a focus on the implementation of effective decontamination of objects and surfaces after their use [33,44]. At the same time, it is important to regularly check and search for clinically relevant sites of decontamination by various methods, e.g., using visual inspection, fluorescence, adenosine triphosphate bioluminescence, microbiological swabs and oth-

ers [18,20,33]. There is also a need for continuous education and regular effective training of healthcare professionals in the prevention of infections associated with healthcare, including the implementation of simulation teaching methods. Studies have shown that educational interventions have a positive effect on performing decontamination of objects and surfaces [18,45,46]. Another clinically relevant issue is the knowledge of personnel, including nurses, who perform decontamination. The research has also shown that increasing knowledge of nurses is very important in some areas [47,48]. There are several aspects that affect the achievement of a high degree of efficiency in the decontamination of objects and surfaces, and traditional procedures and disinfection need to be increased and followed. At the same time, the cost-effectiveness of new technologies needs to be addressed [38]. At present, it is necessary to build on these results and compare the effectiveness of various prevention options with implementation in practice, while improving the quality and safety of healthcare services provided through education and the search for new options.

5. Conclusions

Prevention of healthcare-associated infections is an essential part of providing healthcare and nursing care. An important part of provision of healthcare is the use of decontaminated objects and surfaces to minimize the possible transmission of pathogens associated with healthcare to patients or medical staff. In some cases, decontamination of objects and surfaces is insufficient. For this reason, it is important to look for new possibilities for antimicrobial surfaces. Antibacterial and hydrophobic nanolayers may be one of the options. The effectiveness of the used antibacterial nanolayer is not confirmed in this research. Nano research samples show the presence of bacteria. However, there are study limits that could affect antibacterial efficacy. Based on the results of this research, it is important to optimize the applied nanolayer for its effectiveness. Some research states that some antibacterial copper surfaces may be effective in preventing healthcare-associated infections. Based on the results of the study, it is important to deal with the aspect of prevention of healthcare-associated infections and minimization of contamination of objects and surfaces using the current state of knowledge and implementation of new possibilities. It is important to note that approximately 1/3 of the items and surfaces used for nursing interventions may be contaminated with bacteria, including pathogenic bacteria. Based on the results of the study, it is necessary to strengthen the existing programs for the prevention of healthcare-associated infections and to use the available evidence to minimize the transmission of pathogens.

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Implications of Lifestyle and Occupational Factors on the Risk of Breast Cancer in Shiftwork Nurses

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Abstract: Shift work that involves circadian disruption has been highlighted as a likely carcinogenic factor for breast cancer in humans. Also, unhealthy lifestyle habits observed in night work nurses could be causally related to an increase in the incidence of estrogen-positive breast tumours in this population. Assessing baseline risk of breast cancer in nurses is essential. The objective of this study was to analyze the risk of breast cancer that nurses had in relation to their lifestyle and labour factors related to shift work. A cross-sectional descriptive study through a questionnaire about sociodemographic variables, self-perception of health, and working life was designed. The sample consisted of 966 nurses. The relationship between variables was tested. A binary logistic regression and a classification and regression tree were performed. The most significant labour variables in relation to the risk of breast cancer were the number of years worked (more than 16 years; $p < 0.01$; OR = 8.733, 95% CI = 2.811, 27.134) and the total years performing more than 3 nights per month (10 or more years; $p < 0.05$; OR = 2.294, 95% CI = 1.008, 5.220). Also, the nights worked throughout life (over 500; OR = 4.190, 95% CI = 2.118, 8.287) were significant in the analysis. Nurses who had or ever had breast cancer valued their self-perceived health more negatively ($p < 0.001$) and referred a lower quality of sleep ($p < 0.001$) than the non-cases nurses. The occupational factors derived from night work could have several impacts on nurses' health and their family-work balance. Promoting healthy lifestyles, informing about shift work risks, and adjusting shift work schedules are critical methods to decrease the possible effects of circadian disruption in nurses.

Keywords: breast cancer; night work; shift work; health personnel; occupational disease; working conditions; prevention; carcinogens

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1. Introduction

Shift work, including night shift work, has been associated with circadian disruption in several epidemiological studies conducted on nurses [1–5] and in several targeted investigations [6–9] in which expression, methylation and polymorphisms of circadian genes that could be associated with breast cancer risk among shift nurses have been studied.

In fact, long-term rotating shifts (i.e., 12 h rotating shifts) and night work have been linked to the presence of tumours with oestrogen-positive (ER+) and progesterone (PR+)

receptors [4,10–15], and to the luminal subtypes of tumour classification (mainly luminal A) in several studies using nursing populations [16,17]. In addition, high levels of oestradiol have been recorded in nurses performing night shifts compared to those performing day shifts [10,11,13], and several studies have found significant differences between nurses working on permanent night shifts and those who performed rotating shifts, concluding that long-term, high-intensity shifts for several consecutive years can significantly influence the risk of breast cancer. Under this evidence, shift work and night work were classified as likely carcinogenic factors (Group 2A) by the International Agency for Research on Cancer (IARC), especially incidents in those professions that, such as nursing, must adjust their work throughout 24 h a day [18–23], although in-depth studies confirming these findings are still required.

One of the most noted causes has been related to the loss of synchronisation between the circadian rhythm and the sleeping patterns of nurses during continuous and long-duration rotating shift work [18,19,24–26]. Also, eating at night or referring hunger during hours that are normally dedicated to nocturnal rest may lead to disturbances in the suprachiasmatic nucleus control of hunger and satiety cycles, intrinsically related to metabolic regulation mechanisms and energy activity in peripheral tissues [24]. In addition, certain levels of exposure to blue or artificial light at night are known to affect the circadian system, altering production times and melatonin levels, among other hormones [27,28].

Circadian and sleep disturbances (i.e., social jet lag [29] or shift work disorder [30]) can lead nurses to experience extreme tiredness [31,32], to have a less active life during free time [33], and to carry out poor dietary control [23], factors that together increase cardiovascular and diabetes risk [13,34–37], and pose an increased risk of breast cancer [18]. Thus, the duration of the work shift becomes a significant predictor of the quality of nurse care and job safety [38,39], since a longer duration of shifts has been linked to an increase in errors during attendance [40,41]. Therefore, occupational health specialists have the role of providing advice to managers and workers on the best strategies to reduce the negative effects of shift-induced circadian desynchronisation, by evaluating clinical symptoms and behaviours related to sleep-wake patterns, obesity, type 2 diabetes, or dyslipidaemia caused by the shift work disorder [24].

In view of the above, it is necessary to examine the risk profile of breast cancer that nurses working on rotating and night shifts have, as well as their perception of their own health and the factors that can harm or protect it. With this information, conclusions could be drawn that could facilitate health services' managers' decision-making when planning more appropriate work shifts to reduce risk factors of occupational breast cancer. In this way, the objective of this study was to analyse the risk of breast cancer and the self-perception of health by nurses in relation to lifestyle and occupational variables associated with shift work (including night shift).

2. Materials and Methods

2.1. Design and Sample

Cross-sectional, questionnaire-based descriptive study on the population of Registered Nurses in Spain, both men and women (currently 316,094 subjects) [42]. The sample selection was made by non-probabilistic snowball sampling, estimating the optimal size at 980 nurses with a 95% confidence level, 3.5% accuracy, and 20% adjustment for losses.

The inclusion criteria were (a) Being a nurse and being registered in the General Council of Nurses of Spain; (b) Working in private and/or public centres; (c) Wish to participate, having read and signed the informed consent. On the other hand, the exclusion criteria were (a) Not being Registered Nurses; (b) Being under 18; (c) Working outside Spain.

2.2. Shift Work and Night Work Definition

Cambridge Business English Dictionary defines shift work as: "a system in which different groups of workers work somewhere at different times of the day and night".

Besides, the IARC defined night work as: "one that requires at least three hours of work between midnight and 5 a.m." [20,21,43]. The main characteristics of shift work are shown in Table S1 [11,20,21,23,44].

2.3. Instrument

To gather the appropriate information, an online questionnaire was used. The main risk variables related to breast cancer and night work which were used in this investigation were extracted and adapted ad hoc based on other questionnaires found in the scientific evidence [3,11,14,45,46]. The final questionnaire was formed by the 8 sections detailed below. The validation of the final instrument was carried out through two rounds of analysis by a panel of experts using a Delphi technique to determine whether the detected variables and the design of the questionnaire were relevant and appropriate in the context of the study. This group was made up of three nurses, two physicians, two psychologists, two members of a healthcare system management board and one methodologist. Subsequently, a piloting was carried out favourably in 10 people from different nursing areas to assess the suitability of the questions, possible grammatical errors or mistakes that were not previously detected.

2.4. Variables

The variables considered in this study were:

- Sociodemographic data (age, sex and marital relationship).
- Self-perception of health. An ad hoc evaluation tool consisting of 5 direct questions was designed to assess nurses' perception of their own health. The valuation scale was a Likert type with ten response possibilities ranging from 1 "very low" to 10 "very high". The questions used were: "How do you value your overall health?", "How do you value the quality of your rest?", "How do you value the effect shift work has on your health?", "How do you value your level of work stress?" and "How do you value your satisfaction with your current job?".
- General data on disease and cancer (current disease, oncological disease, number of mammograms, use of oral contraceptives and presence of first-degree familial cancer).
- Lifestyle habits (Body Mass Index-BMI-was calculated with the weight and height indicated by the participants. Working exertion, measured by light, moderate, hard or very hard. Free-time physical activity, measured by the time spent in hours).
- Family burdens (care for children under 14, and care for dependents or elderly family members at home).
- Sleeping aids ("Do you take any medication to sleep?", "which?").
- Exposure to tobacco (consumption habits (did you ever smoked?), exposure to tobacco in the workplace and at home).
- Labour information (type of current working schedule, working experience (throughout life), number of years working regularly 3 nights per month or more, number of worked nights accumulated throughout life, and sick leaves throughout life and in the last year).

2.5. Data Collection Procedure

The study development took place from December 2019 to November 2020. Google Forms© (Google, Mountain View, CA, USA) was used to create the online questionnaire. Participants could not access the questionnaire until they had previously done the following: (a) Having read and understood an introductory letter to the study and its objectives; (b) Having confirmed voluntary and anonymous participation in the study; (c) Declaring working as a nurse in Spain and being currently registered. The data obtained from the questionnaires were entered in Excel (Microsoft©, Redmond, WA, USA), R Commander 4.0.0 [47], and SPSS version 26.0 (IBM©, Armonk, NY, USA) for the statistical analysis.

The online questionnaire link was provided via email to the nurses who were registered in the General Nursing Council of Spain and previously had accepted to receive

emails, news and information bulletins from this institution. The General Council of Official Nursing Colleges of Spain is the only regulatory body and competent authority of the nursing profession in Spain, therefore the registration in this government-authorized licensing body is obligatory to obtain a nursing license and be legally authorized to work, thus being considered a Registered Nurse (RN). Given this fact, a high number of nurses were consulted via email thanks to this collaboration, although we were not able to control this intervention due to the Data Protection policy of this institution. The social networks of official entities and professional groups of renowned prestige in the area of nursing in Spain (i.e., University of Huelva or Spanish Nurses Syndicate) also collaborated with the dissemination of the questionnaire.

2.6. Statistical Analysis

Absolute frequencies, percentages, and measures of position and dispersion, depending on the type of variable, described the variables of interest. Student's T-test for independent samples and the Chi-squared test were used to contrast differences and relationship (OR) between the variables and breast cancer risk. The Mann–Whitney U nonparametric test for independent samples was used to analyse heterogeneity in the self-perception of health category.

Binary logistic regression allowed building a model to study the presence of breast cancer and identify those risk variables that played a relevant role. The Hosmer-Lemeshow test was used, and Odds Ratios (OR) were estimated with their confidence intervals.

Finally, the CART (Classification and Regression Trees) data mining method [48,49] was used to design a binary algorithm to predict which variables of the self-perception of health category played a significant role in breast cancer. The CART methodology refers to a model where the target variable and the algorithm itself are used to predict values based on several categorical or continuous input variables. It is shown as a Decision Tree Classifier (Figure 1), where each round is known as Node. Each node will have a question or if-clause according to which the subjects of study will be routed to a specific internal or terminal/leaf-node that will tell the final prediction. Each node shows the predicted class, the predicted probability of cases within the node, and the percentage of cases of the node over the total sample. In summary, there are three types of nodes:

- Root Node: represents a single input variable and a split point on that variable. It does not have any parent node and gives two children nodes based on the question.
- Internal Node: it will have a parent node and gives two children nodes.
- Terminal or Leaf Node: contains an output variable which is used to make a prediction. This node will have a parent node but will not have any children nodes.

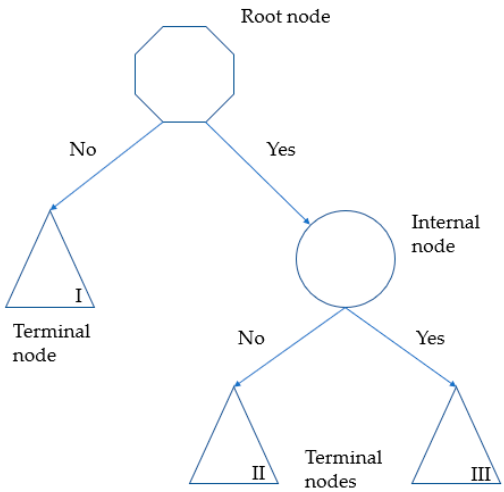

Figure 1. Decision Tree Classifier (for learning purpose).

2.7. Ethical Considerations

For this study, the Declaration of Helsinki (Fortaleza, 2013) was taken into consideration and explicit written permission was obtained from participants through their informed consent. Data obtained in this study were to be duly guarded by the research team, ensuring the confidential use and processing in accordance with the Organic Law on Protection of Personal Data and the Guarantee of Digital Rights. Approval was obtained from the Research Ethics Committee of the province of Huelva, belonging to the Regional Government of Andalusia, with code TD-CMTE-2020. Likewise, approval was obtained from the Research Ethics Committee of the General Council of Official Nursing Colleges of Spain with code PI 2109/02/CE.

3. Results

3.1. Two-Dimensional Analysis for Healthy Participants and Those Who Have or Ever Had Breast Cancer

The questionnaire was answered by a total of 966 nursing professionals, of whom 502 (51.97%) were healthy, 99 (10.25%) had or ever had some form of cancer, and 365 (37.78%) had another type of disease. Of those who had or ever had cancer, for 56.57%, it was breast cancer (56 subjects). Common diseases found in both men and women were hypertension, diabetes, obesity, asthma, or seasonal allergy. In women, isolated cases of thyroid cancer, cervical cancer, melanoma, leukaemia, and lymphoma were also found.

For the bivariate analysis, healthy individuals (502) and breast cancer patients (56) were compared with the variables of interest. The median age of the sample was 41 years ($p = 0.367$) and 89.6% of the sample were women ($p = 0.705$). Subsequent bivariate analysis categorized by sex revealed only age ($\chi^2 = 9.669$; p 0.002; OR = 2.466; 95%CI= 1.376, 4.419) as significant in relation to breast cancer (see Table S2). According to the current workplace, a 19.2% of the sample worked on permanent shifts, mostly morning shifts, and a 74.5% worked on rotating shifts. Only a 3.8% worked on 24h-shifts. Approximately a 72.4% of the sample was working on night shifts at the time of the survey (Table 1).

Table 1. Description of the sample's work organization.

	Cases	Percentage
Permanent Shift	107	19.2%
Only morning	73	68.2%
Only afternoon/evening	5	4.7%
Only night	29	27.1%
Rotative 3 Shifts/24 h Cycles (M/AE/N)	212	37.9%
Rotative 2 Shifts/24 h Cycles	204	36.6%
Only morning + eventual extra-duty (+17 h)	33	16.2%
12-h shifts	71	34.8%
Rotative M and N	31	15.2%
Rotative M and AE	62	30.4%
Rotative AE and N	7	3.4%
24-h Shifts	21	3.8%
Irregular	14	2.5%
Total general	558	100%

M: morning (7-h shift); AE: afternoon/evening (7-h shift); N: night (10-h shift).

No statistically significant differences were found for parity, either in the general ($p = 0.684$) and sex-categorized analysis ($p = 0.648$). On the other hand, significant associations with breast cancer were found in participants with a partner ($p = 0.041$) and those who cared for dependents at home outside the working hours ($p < 0.001$). Indeed, being single (OR = 0.541; 95% CI = 0.298, 0.982) and without family caring responsibilities (OR = 0.288; 95% CI = 0.146, 0.569) were related with breast cancer risk reduction (Table 2).

Table 2. Sociodemographic and lifestyle characteristics of the sample.

	N (%)	Healthy Cases (%) (N = 502)	Breast Cancer Cases (%) (N = 56)	χ^2	*p*	Odds Ratio (CI = 95%)
Sex						
Male	58 (10.4)	53 (10.6)	5 (8.9)	0.144	0.705	1.203
Female	500 (89.6)	449 (89.4)	51 (91.1)			(0.460, 3.145)
Age						
41 or younger	281 (50.4)	256 (51.0)	25 (44.6)	0.813	0.367	1.290
Older than 41	277 (49.6)	246 (49.0)	31 (55.4)			(0.741, 2.247)
Marital relationship						
With partner	317 (56.8)	278 (55.4)	39 (69.6)	4.178	0.041	0.541
Single	241 (43.2)	224 (44.6)	17 (30.4)			(0.298, 0.982)
Children under 14 years						
Yes	225 (40.3)	201 (40.0)	24 (43.0)	0.166	0.684	0.890
No	333 (59.7)	301 (60.0)	32 (57.1)			(0.509, 1.558)
Care for dependents at home						
Yes	58 (10.4)	44 (8.8)	14 (25.0)	14.257	<0.001	0.288
No	500 (89.6)	458 (91.2)	42 (75.0)			(0.146, 0.569)
Mammography (N = 497)						
Yes	211 (42.5)	156 (35.3)	55 (100)	*	<0.001	1.353
Never	286 (57.5)	286 (64.7)	0 (0)			(1.248, 1.466)
Family history of cancer (N = 551)						
Yes	72 (13.1)	58 (11.7)	14 (25.0)	7.814	0.005	0.398
No	479 (86.9)	437 (88.3)	42 (75.0)			(0.205, 0.773)
BMI						
Underweight	10 (1.8)	8 (1.6)	2 (3.6)	8.074	0.045	
Normal	376 (67.4)	347 (69.1)	29 (51.8)			-
Overweight	128 (22.9)	111 (22.1)	17 (30.4)			
Obese	44 (7.9)	36 (7.2)	8 (14.3)			
Physical activity at work						
Light	124 (22.2)	114 (22.7)	10 (17.9)	30.175	<0.001	
Moderate	313 (56.1)	283 (56.4)	30 (53.6)			-
Hard	113 (20.3)	103 (20.5)	10 (17.9)			
Very hard	8 (1.4)	2 (0.4)	6 (10.7)			
Physical activity during leisure time						
Two hours or less	286 (51.25)	259 (51.6)	27 (48.2)	0.230	0.631	1.144
More than 2 h	272 (28.75)	243 (48.4)	29 (51.8)			(0.659, 1.887)
Tobacco consumption						
Yes	301 (53.9)	271 (54.0)	30 (53.6)	0.003	0.953	1.016
No	257 (46.1)	231 (46.0)	26 (46.4)			(0.584, 1.770)
Compliance with the smoking ban at work						
Totally	124 (22.2)	104 (20.7)	20 (35.7)	11.377	0.010	
Almost always	239 (42.8)	213 (42.4)	26 (46.4)			-
Hardly ever	141 (25.3)	132 (26.3)	9 (16.1)			
Never	54 (9.7)	53 (10.6)	1 (1.8)			
Exposure to tobacco smoke at home						
More than 5 h a day	22 (3.9)	15 (3.0)	7 (12.5)	15.967	0.001	
Between 1 and 5 h a day	36 (6.5)	36 (7.2)	0 (0)			-
Less than 1 h a day	42 (7.5)	39 (7.8)	3 (5.4)			
Never or hardly ever	458 (82.1)	412 (82.1)	46 (82.1)			

Table 2. *Cont.*

	N (%)	Healthy Cases (%) (N = 502)	Breast Cancer Cases (%) (N = 56)	χ^2	*p*	Odds Ratio (CI = 95%)
Use of medication to sleep						
Yes	116 (20.8)	83 (16.5)	33 (58.9)	54.988	<0.001	0.138
No	442 (79.2)	419 (83.5)	23 (41.1)			(0.077, 0.247)
Hormone-based oral contraceptives (women only) (N = 504)						
Yes	334 (66.3)	295 (65.7)	39 (70.9)	0.594	0.441	0.786
Never	170 (33.7)	154 (34.3)	16 (29.1)			(0.425, 1.451)

*: Fisher. BMI: Body Mass Index. Under 18.5: Underweight; (18.5, 25) Normal; (25, 29.9) Overweight; equal or higher to 30: Obese.

Having ever had a mammogram and the number of performed mammograms also resulted significative for breast cancer risk (mean = 2.27; SD = 4.43; $p < 0.001$; OR = 1.353, 95% CI = 1.248, 1.466). Similarly, the presence of familial cancer was significant ($p = 0.005$), resulting in risk reduction when there was no family cancer history (OR = 0.398; 95% CI = 0.205, 0.773) (Table 2).

In terms of lifestyle habits, BMI showed significant differences ($p = 0.045$). The higher number of breast cancer cases had normal BMI. Similarly, statistically significant differences ($p < 0.001$) were detected depending on the intensity of physical activity at work. Most breast cancer cases classified their exertion at work as moderate. However, no significant differences were found for the physical activity during free time ($p = 0.631$). Statistically significant differences were found regarding the frequency of exposure to tobacco smoke at home ($p = 0.001$) and the compliance with the smoking ban in the workplace ($p = 0.010$), but not with having ever smoked ($p = 0.953$).

Lastly, the 79.2% of the nurses claimed not to take any sleep medication, although this variable was relevant in breast cancer cases ($p < 0.001$). In fact, not taking sleep medications resulted in risk reduction (OR = 0.138; 95% CI = 0.077, 0.247) (Table 2). The most common medication was oral melatonin (60 subjects, of which 11 had breast cancer). Among other remedies, infusions (valerian, melissa), hypnotics (doxylamine, zolpidem), anxiolytics (alprazolam, bromazepam), antidepressants (trazodone), and other benzodiazepines (lorazepam, lormetazepam, diazepam) were used. Oral contraceptives were only used by women in this study, not being significant for breast cancer ($p = 0.441$).

With respect to labour data (Table 3), being not currently working at night ($p < 0.001$; OR = 2.708, 95% CI = 1.548, 4.735) and being not currently shift working ($p < 0.001$; OR = 3.148, 95% CI = 1.765, 5.615) showed a statistical association with the risk of breast cancer. Considering the working history of the participating subjects, having exceeded 16 years of work was presented as one of the most significant variables in this study ($p < 0.001$; OR = 12.346, 95% CI = 4.854, 31.250). Nurses who had or ever had breast cancer had worked a mean of 26.1 years (SD = 8.1), while healthy nurses had worked a mean of 15.0 years (SD = 9.2). On the other hand, the percentage of cases with breast cancer was also higher in professionals with 500 or more nights worked (OR = 4.190, 95% CI = 2.118, 8.287) and when more than 3 nights per month had been worked for more than 10 years (OR = 4.132; 95% CI = 2.227, 7.634), finding a statistically significant difference in both situations ($p < 0.001$). The mean number of nights worked was 627.9 (SD = 639.4) in the case of healthy subjects and 1017.4 nights in those who had or ever had breast cancer (SD = 837.9). 2.3% of respondents never worked night shifts. Finally, the cumulative number of sick leaves, both in the last year (mean 0.35; SD = 0.542) and throughout the professional life (mean 2.20; SD = 2.118), have shown a statistically significant association with breast cancer ($p < 0.001$ in all cases) (Table 3).

Table 3. Labour variables and risk of breast cancer.

	N (%)	Healthy Cases (%) (N = 502)	Breast Cancer Cases (%) (N = 56)	χ^2	p	Odds Ratio (CI = 95%)
Shift work at this moment						
Yes	444 (79.6)	411 (81.9)	33 (58.9)	16.315	<0.001	3.148
No	114 (20.4)	91 (18.1)	23 (41.1)			(1.765, 5.615)
Night work at this moment						
Yes	378 (67.7)	352 (70.1)	26 (46.4)	12.940	<0.001	2.708
No	180 (32.3)	150 (29.9)	30 (53.6)			(1.548, 4.735)
Working experience						
16 years or less	280 (50.2)	275 (54.8)	5 (8.9)	42.369	<0.001	12.346
More than 16 years	278 (49.8)	227 (45.2)	51 (91.1)			(4.854, 31.250)
Total years performing more than 3 nights a month						
10 years or less	317 (56.8)	302 (60.2)	15 (26.8)	22.870	<0.001	4.132
More than 10 years	241 (43.2)	200 (39.8)	41 (73.2)			(2.227, 7.634)
Total worked nights						
Less than 500 nights	265 (47.5)	254 (50.6)	11 (19.6)	19.358	<0.001	4.190
500 nights or more	293 (52.5)	248 (49.4)	45 (80.4)			(2.118, 8.287)
Total sick leaves over lifespan (N = 550)						
2 or less	342 (62.2)	329 (66.3)	13 (24.1)	36.977	<0.001	6.211
More than 2	208 (37.8)	167 (33.7)	41 (75.9)			(3.236, 11.905)
Sick leaves in the last year (N = 554)						
Without sick leave	385 (69.5)	368 (73.6)	17 (31.4)	40.782	<0.001	6.061
With sick leave	169 (30.5)	132 (26.4)	37 (68.5)			(3.300, 11.111)

3.2. Self-Perception of Health Descriptive Analysis

Regarding the self-perception of health, the overall health was rated 7.94 (SD = 1.26) among the sample nurses, being lower in breast cancer cases (6.45) and higher in the healthy cases (8.11). The lowest value of this category was found in the quality of sleep and rest, with a mean of 6.28 (SD = 1.96) and decreasing to 5.29 in breast cancer cases. The highest value was identified when considering whether shifts affect the health of people, with a mean of 9.08 (SD = 1.37). In relation to stress at work, the mean value was 7.57 (SD = 1.86). The stress perception was higher among breast cancer cases (8.23) as compared to healthy cases (7.49). Finally, the satisfaction with the working conditions was valued with a mean of 7.28 (SD = 1.87). Among all the health self-perception variables, statistical differences were found in terms of overall health ($p < 0.001$), sleep and rest quality ($p < 0.001$), and stress at work ($p = 0.002$) (Table 4).

Table 4. Sample profile according to the health self-perception variables.

From 1 to 10 . . .	M (SD) (*N* = 558)	Breast Cancer Cases (*N* = 56)	Non Cases (*N* = 502)	Mann Whitney-U	p
How do you value your overall health?	7.94 (1.26)	6.45 (1.61)	8.11 (1.09)	5920.500	<0.001
How do you value your sleepingquality?	6.28 (1.96)	5.29 (2.06)	6.39 (1.91)	9741.500	<0.001
How do you value the effect shift work has on your health?	9.08 (1.37)	9.16 (1.60)	9.07 (1.35)	15,223.500	0.262
How do you value your level of work stress?	7.57 (1.86)	8.23 (1.67)	7.49 (1.87)	17,571.000	0.002
How do you value your satisfaction with your current job?	7.28 (1.87)	7.02 (2.09)	7.31 (1.85)	12,903.500	0.305

3.3. Breast Cancer Prediction

The following two regression methods were performed in this study to identify those variables that play a relevant role in breast cancer risk.

3.3.1. Considering Labour Variables and Sleep Medication

Binary logistic regression analysis predicts breast cancer among nurses through the following variables: total years performing more than 3 nights per month, sleep medication, sick leaves, years worked, and actual exposition to night work. This model was validated with the Hosmer-Lemeshov test ($p = 0.811$), correctly classifying 91.3% of cases. In addition, all variables included in this model had significant values lower than 0.05 and OR values greater than the unit (Table 5).

Table 5. Logistic regression analysis for breast cancer.

	Coefficient	OR	CI = 95% for OR	
			Inferior	Superior
Number of working years [1]	2.167 **	8.733	2.811	27.134
Medication to sleep	1.765 **	5.841	2.848	11.978
Night work at this moment	1.701 **	5.479	2.520	11.915
Sick leave last year	1.684 **	5.387	2.527	11.484
Total years performing more than 3 nights per month [2]	0.830 *	2.294	1.008	5.220
Constant	−1.814 **	0.163		
Sensitivity/Specificity			52.8%/95.9%	
Correctly classified percentage			91.3%	
R2 Cox and Snell/R2 Nagelkerke			0.228/0.461	
Hosmer-Lemeshov Test			0.811	
Omnibus test			< 0.001	

OR: Odds ratio. * $p < 0.05$; ** $p < 0.01$. [1]: (more than 16 years); [2]: (10 or more years).

3.3.2. Self-Perception of Health Variable

With regard to the self-perception of health among nurses, the CART showed the 558 cases at a root node, of which 10.03% (0.10; 56 subjects) have breast cancer.

A second node differed according to the valuation of the overall health (higher or equal to 5.5; yes or no), resulting in a breast cancer percentage of 68% (0.68) in the 25 subjects (4% of the total cases) who valued their overall health below 5.5, and 7.3% of breast cancer cases in the subsequent 533 subjects (96% of the sample) whose scores were equal to or higher than 5.5.

For the 4% of cases with worse health perception (overall health below 5.5), an internal node differed according to the satisfaction with the current working conditions. The percentage of breast cancer cases reached 82.4% (0.82) when the level of job satisfaction was higher or equal than 5.5, and otherwise the percentage of cases was 38% (0.38).

Returning to those cases with overall health higher or equal to 5.5 (96%; 533 subjects), the following internal node differed again according to the valuation of the overall health (higher or equal to 7; yes or no). 502 nurses (90%) whose self-perception of health was $\geq$7 showed a 5.8% (0.06) of breast cancer cases. Otherwise, the 6% (33) of nurses whose self-perception of health was between 5.5 and 7 points comprised 29.4% (0.29) of cancer cases.

Finally, an internal node for sleep quality (<6; yes or no) is shown for the cases with overall health between 5.5 and 7. 62% (0.62) of breast cancer cases occurred in 1% (6) of nurses who perceived their sleep quality under 6. On the other hand, 19% of breast cancer cases occurred in the 5% (28) of nurses who perceived their sleep quality over 6 (Figure 2).

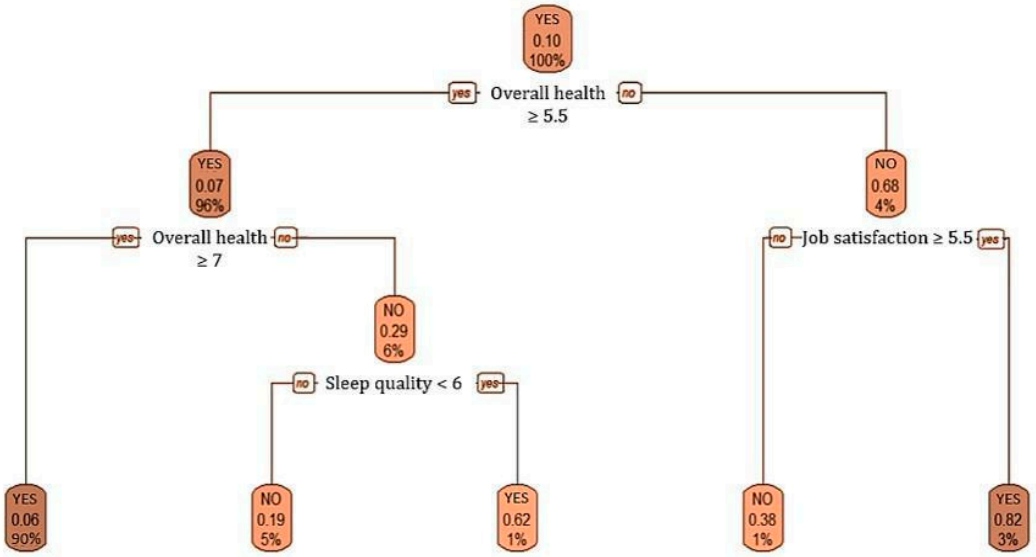

Figure 2. Classification and regression tree of breast cancer cases and self-perception of health.

4. Discussion

The main objective of this study was to analyse the relationship between shift work, especially night shift work, and the risk of developing breast cancer in nursing professionals in Spain, in order to obtain a descriptive image of the labour and lifestyle factors that can influence the risk of breast cancer in this group.

The logistic regression model was successfully validated and showed significant values. Among the measurements of night work that appear to be associated with the risk of breast cancer, having worked a mean of three night shifts per month for 10 years or more (OR = 2.294; 95% CI = 1.008, 5.220) has been highlighted, although the number of total years worked was also significant (OR = 8.733; 95% CI = 2.811, 27.134), taking as a reference the performance of professional activity for more than 16 years and that 95% of the sample reported having worked in rotating shifts at some point of his or her career, although at the time of the survey it was 80.8%. Also noteworthy in this study is the increased risk of breast cancer when 500 nights or more have been worked throughout life ($p < 0.001$; OR = 4.190; 95% CI = 2.118, 8.287). In accordance with other studies [36,50], the data provided suggests that the risk profile of shift-related breast cancer highly varies depending on the number of nights worked, so exposure to permanent and rotating night shifts is considered of key relevance from an early age and throughout the working life. In this way, several studies confirmed the risk of breast cancer among nurses working on rotating night shifts at least 3 nights a month for 20 years or more, particularly those who started in their young adulthood (before the age of 30) [3,12,16]. In premenopausal women, those characteristics of night work that were indicative of high intensity of exposure (3 or more nights per week), long duration of night work over life (at least 10 years in a row), and long night shifts (10 or more hours) were associated with an increased risk of breast cancer at 5 years of their working life [3,15,51,52].

On the other hand, the analysis of nurses' self-perception of health variables and the CART classification and regression tree have made it possible to highlight the importance of attending to the assessment of general health, sleep quality, stress level, and level of job satisfaction referred to by nurses themselves. The present study has confirmed that nurses who had or ever had breast cancer exhibited a higher level of work-related stress and worse self-perceived health than healthy nurses. Equally, it is important to consider the impact of stress at home, as it can lead to work-family related conflicts and health problems [5,34,53,54]. In fact, the perception of stress in the family environment could be considered relevant given the positive association between the care of dependents at home ($p < 0.001$; OR = 0.288; 95% CI = 0.146, 0.569), having a partner ($p = 0.041$;

OR = 0.541; 95% CI = 0.298, 0.982) and the risk of breast cancer found in this study. It is therefore worth noting that the work-family balance can affect the role of nurses [55] and the family stability [56,57], and this may lead to lack of time for leisure and self-care [5,58], tiredness [31], sleep problems [59] and many risk behaviours as alcohol consumption [53] if an important imbalance is given.

The risk profile analysis of nursing professionals in this study identified that professionals who had breast cancer valued worse the quality of their rest (5.29) than healthy professionals (6.39), with significant differences being detected between both groups ($p < 0.001$), although it is true that the quality of rest had a surprisingly low mean value between the two groups (6.28). Despite that, only 20% of respondents resorted to sleep medication, even though this variable showed a statistical significance for breast cancer in the model (OR = 5.841; 95% CI = 2.848, 11.978). Hypnotics intake has been associated with cancer due to the alterations on sleep patterns, such as insomnia, that occur during the disease at any stage and that persist in survivors [26,60]. In addition, slow rotating systems which include longer sequences of consecutive night shifts, can cause disturbances in sleep patterns [3,61], fatigue, and sleepiness even on rest days after shifts [62]. Other studies have shown that irregularity in the organization of the shifts affects the adaptive ability of shift work nurses [18,63,64]. 12-h shifts (day–night) imply less sleep disorders and a more balanced rest period than the 3 × 8 rotation (morning–afternoon–night) [18,65], thus allowing a better recovery. However, workload is more intense in 12-h shifts than in 3 × 8 shifts, due to the longer duration of the shift, resulting in greater physical and mental fatigue [18,64,65].

According to a recent study, when there are no symptoms of depression, anxiety, tiredness or stress, nurses are more resilient and more satisfied with their work [66]. In fact, job satisfaction is an interventional stress-reducing factor that can positively influence the perception of one's own health [67,68], the decrease in the frequency of physical and psychological symptoms [69], and the improvement of the quality and safety of patient care [70–72], as well as the re-induction of errors [40]. Instead, low job satisfaction is a contributing factor to nurses leaving their jobs and profession [73–75]. Data from this study have shown a mean satisfaction of 7.28, that does not differ significantly between the assessed groups. This would make it possible to emphasise that job satisfaction is not one of the most prominent problems regarding the sample of this study since, as can be seen in the CART, low job satisfaction was not a criterion for pointing out a large number of cases of breast cancer.

Finally, according to data on lifestyle habits, physical activity in the working context was statistically significant in relation to breast cancer, reporting the majority of cases when it was classified as "moderate". This may be contrary to other results that report a beneficial association of physically active jobs to reduce breast cancer risk [76]. Meanwhile, physical activity during free time was not significant in our study ($p = 0.631$). With reference to BMI, the 14.3% of the sample who had breast cancer were obese and the 30.4% had overweight. Obesity has been associated with consecutive night shifts (more than 8 shifts per month) and cumulative years of night work (more than 20 years) [36,77,78], as well as increased tobacco consumption [51]. In this line, recent research was consistent with the increased risk of breast cancer that occurs in active, heavy, and long duration smokers and passive smokers [51,79–81], particularly premenopausal women who smoked or were exposed to second-hand smoke between menarche and first full-term pregnancy, in the occupational and residential context [80]. This relationship could correspond to the results of the present study, which significantly linked breast cancer to tobacco exposure both in the workplace ($p = 0.010$) and at home ($p = 0.001$).

It is worth noting that the responses to the questionnaire on current work have identified that not undertaking shifts nor night work were risk factors for breast cancer, given that most of breast cancer cases did not work on shifts by the time of the survey. These results were in line with a literature review on returning to work following a breast cancer process in Spain [82], in which it was concluded that improvements in working

conditions allow workers to adapt their job to their new physical capacity. As described in another study [5], those individuals with breast cancer could have received a change or compensation on behalf of their workplace organisation when they were diagnosed or when re-joined after the sick leave, exempting them from rotating shifts and night work in order to create a less aggressive work environment for the worker.

4.1. Implications for the Practice and Applicability

With a view to future research, investigating nurses' breast cancer risk factors will still play an important role due to its importance in screening and prevention. Detailed information about nurses' working hours and night work-related circadian disruption may also be relevant to increase visibility regarding this occupational health issue. In this sense, it would be interesting to measure total nocturnal output of melatonin in shift workers to make a correlation with total and nocturnal melatonin levels. Cortisol levels also require attention due to its balance with melatonin levels and regulation during day light. It must be noted that future research should also study specific parameters of circadian disruption, such as the expression of peripheral clock genes and clock-controlled genes. Periodic assessment of parameters such as waist circumference, waist-to-hip ratio, BMI, glycemia, glycosylated haemoglobin, triglycerides, and total HDL and LDL cholesterol would be useful to evaluate the risk of night shift-related diseases, such as obesity, type 2 diabetes, dyslipidaemia and metabolic syndrome [83].

It is appropriate to adopt prevention and action guidelines that highlight associations between diet, weight, and physical activity to prevent the development of breast cancer and possible metabolic syndrome on shift workers, taking into account cases in premenopausal and postmenopausal women whenever possible [84–87]. It has recently been shown that the adoption of dietary recommendations by Spanish women who have had cancer was moderate. At the same time, adherence to physical activity and body weight management was higher among older women, women who had one or more children, and those who lived in rural areas. Increased compliance with smoking bans and greater limitation of alcohol consumption were also reported [86].

The results obtained in this study may have applicability in different spheres. In the university education system, it would be relevant to talk about the risk of shift-based breast cancer and cardiovascular risk in order to raise awareness among students of the repercussions of intensive night work during the first years of the career and the risks associated with circadian disruption in order to prevent them.

For the management and human resources systems of healthcare companies, this study would allow managers and supervisors to consider an equitable distribution of shifts and breaks, as well as a limitation of weekly night shifts performed by nurses and overtime (extra-duties).

Similarly, for night workers in general, and for nurses in particular, this study should encourage interventions to promote a healthy and balanced life in order to counteract the negative effects of work on rotating and night shifts. In this way, workers should be informed of the potential risks of performing nights intensively or for several years, and it would be appropriate to provide balanced diets, to install suitable spaces and lighting for work [88] and rest, and to allow sufficient time to eat, pause, and organise work efficiently.

As for nurses who have or have had breast cancer, this study makes it possible to wonder whether shift-related breast cancer could be considered an occupational disease. In such case, it would be desirable to demonstrate individual risk by counting nights and analysing biomarkers. If possible, people who have had breast cancer should be encouraged to return to work through a process of time adaptation and activities.

4.2. Limitations

With regard to the limitations of the study, it should be kept in mind that it was a cross-sectional study and these results, although in line with previous evidence, must be considered with prudence to avoid interpretation bias. In addition, breast cancer diagnosis

was not clinically confirmed because data was collected using self-reported information. It is also important to consider the recall bias as another study limitation related to the retrospective study design. In this sense, some variables such as weight, height or total number of worked nights could have been influenced by recall bias. On the other hand, our analysis could be influenced by a small sample size, as it covered only 56 cases of breast cancer, which could potentially represent participation bias although the sample and number of responses has been estimated as sufficient to overcome low representativeness.

Many variables have not been considered in this study, such as menopausal status, age at menarche, age at first full-term parity, breastfeeding history, sleeping patterns or comorbidities. In this way, the authors encourage its detailed study in future investigations.

Another limitation that has been perceived refers to precision of the intensity grades of the physical activity at work and self-perception of health. In this study, the exertion scores have been stated as light, moderate, hard or very hard, similarly to those scores found in the Borg Rating of Perceived Exertion Scale [89]. However, greater detail of the description provided on the scales should have been considered, according to various authors who proposed a detailed explanation [90,91]. Health-related quality of life and self-perception of health are commonly incorporated as predicting survival factors in the design of research studies and clinical trials in oncology. This study has used a self-assessment scale with a range from 1 to 10, which has allowed the CART method to be performed later. However, it should be noted that there are several validated tools for health assessment and quality of life, so their use should be considered in future research [92–95]. In this same line, this study did not use standard tests to assess the quality of sleep and the state of the circadian system (chronotype). Some scales are purposed like the Pittsburgh Sleep Quality Index [96] or the Morningness-Eveningness stability scale improved (MESSi) [97].

5. Conclusions

This study has highlighted a statistically significant increase in the risk of breast cancer in nurses in association with total years of work experience (the risk increases by over 16 years worked) and the total number of years of more than 3 nights per month (the risk increases by over 10 years worked). In addition, other factors such as the total number of nights worked (the risk increases by more than 500 nights), taking medication to sleep, and having had sick leaves have been associated. Similarly, certain variables related to health self-assessment, such as poor overall health quality, stress levels, or low sleep quality, have been significant in pointing out an increased risk of breast cancer.

Given the incidence of breast cancer in nurses and the frequency of night shift working further research is needed to clinically measure the possible effects of shift work on breast cancer risk, circadian misalignments and other metabolic diseases that could affect nursing professionals. However, many interventions could be developed from the actual moment in order to prevent and inform about this carcinogenic factor.

Supplementary Materials: The following are available online at https://www.mdpi.com/article/10.3390/healthcare9060649/s1, Table S1: Shiftwork organization and characteristics; Table S2: Sex Analysis.

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Institutional Review Board Statement: For this study, the Declaration of Helsinki 2004 was taken into consideration and explicit written permission was obtained from participants through their informed consent for the confidential use and processing of their data in accordance with the Organic Law on Protection of Personal Data and the Guarantee of Digital Rights. Data are guaranteed to be duly guarded by the research team. Ethical approval was obtained from the Research Ethics Committee of the Spanish General Nursing Council, as well as from the Research Ethics Committee of the province of Huelva, belonging to the Regional Government of Andalusia (Spain) with code TD-CMTE-2020.

Informed Consent Statement: Informed written consent was obtained from all subjects involved in the study.

Data Availability Statement: All generated data is presented within this paper and its Supplementary Material. The research team and the University of Huelva are responsible of keeping the datasets of the study, which would be available for investigators under reasonable query.

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The Effects of Emergency Room Violence toward Nurse's Intention to Leave—Resilience as a Mediator

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Abstract: (1) Background: Healthcare workplace violence has been a focused issue in the whole world. The rate of the occurrence is pretty high in every country. The emergency room is a high risk and high frequency place for violence to occur. Under the medical service demands from people, it is quite easy to bring about conflicts. This leads to serious physical and mental harm to nurses. When suffering from physical and mental injuries, resilience is a protective factor away from negative influence. It is rare to explore and study how the nurses' resilience ability, workplace violence and turnover intention are related. Thus, the aim of this study is to understand resilience as a mediator effect in emergency nurses toward the workplace violence. (2) Methods: A cross-sectional survey study was used to collect information from emergency room nurses of a medical center in northern Taiwan. There were 132 samples in total. Three research instruments were included as follows: Hospital Workplace Violence Prevention Questionnaire, Connor-Davidson Resilience Scale, and Turnover Intention Scale. Statistical analysis using *t*-test, ANOVA, Correlation, as well as Sobel test were used in this study. (3) Results: The results revealed that the average age was 29.5 $\pm$ 5.6. Almost 58% of nurses experienced workplace violence. Twelve percent of nurse had experienced physical violence and 53.8% had experienced mental violence. There was significant relationship between shift personnel and religious believers. To the people who suffered physical violence, there was a significant relationship between emergency room working years and the total working years. There was significant difference between those who had suffered mental violence and religious believers. Female nurses suffered mental violence to a much higher extent than male nurses. There was a significant relationship between nurses' working years, the total working years, resilience, and turnover intention. Resilience was not the mediator for workplace violence toward turnover intention in this study. (4) Conclusions: The outcome of this study suggested that on an individual level, nurses can enhance self-protection and communication skills to decrease workplace violence. For emergency environment settings, designing a good working environment, visitors' restriction, avoiding working alone, and enhancing supervising alarm system are recommended. As for hospital administrators, fitness for work and to set up a project team is necessary. These can be references in planning prevention on workplace violence and promoting quality of workplace and patient safety in the future.

Keywords: emergency room; workplace violence; resilience; intention to leave

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1. Introduction

Workplace violence has been a much researched and serious issue in the whole world. Healthcare organizations have been high frequency sites and it is especially common in the emergency room [1–4]. Workplace violence toward nurses is twice higher than

toward the doctors and the other medical staff. They suffered beating 2.26 times more than the others [5,6]. The International Labor Organization (ILO), World Health Organization (WHO), International Council of Nurses (ICN) and Public Services International (PSI), defined mutually, in 2002, the definition of workplace violence as, "Incidents where staff are abused, threatened or assaulted in circumstances related to their work, including commuting to and from work, involving an explicit or implicit challenge to their safety, well-being or health," including physical violence and psychological violence [5].

The survey according to the Occupational Health Safety Network (OHSN) in America in 2012–2015 showed that the rate of emergency room violence was 19.3% and the average annual growth rate was 23% [6]. The occurrence rates in the other countries were 56–75.8% [1,7–10]. The study indicated only 30% occurrence rate had been officially reported [8,11] and up to 80% remained unreported [12]. Besides, every country has different definition on workplace violence, which leads to different data. The causes of emergency room violence were analyzed from four dimensions: inner and external factors, environmental factors and organizational factors. For instance, violence was part of work; there was poor communication skills; the waiting time was too long; doctor–patient information was no equal; the supervisors did not value at all; it was too crowded and noisy; it lacked privacy and there was a shortage of manpower, etc. [1,8,9,13,14]. Eventually workplace violence would reduce nurses' passion for the job and it would result in health organizations losing experienced nurses [3].

Resilience is people's ability to recover after experiencing adversity [15–17]. At present, there is no universal definition, but there are some common characteristics, such as adaptation and adjustment, dynamic process and ordinary magic [18]. First, the person must be exposed to the severe adversity; secondly, he/she can still maintain a positive adaptation under adversity [19,20]. "Workplace adversity" relates to heavy workloads, inexperience, professional autonomy influenced by bullying and violence, organizational problems, and occupational safety issues. These problems may be considered as adversity to people [21]. Nurses with high resilience see adversity as a part of their life, but not a threat [22]. Resilience decreases the influence of mental health to the minimum for nurses who work in the critical care units. It helps them stay in the workplace but not to choose to leave [21,23].

Turnover may be understood as employees leaving the organization or profession voluntarily. Turnover intention means mental status before quitting the organization or profession. It indicates that the employees are not satisfied with their jobs, coming about the ideas to quit, looking for the opportunities to work, evaluating and comparing with other opportunities to work. This situation takes shape before the actual turnover action happens. According to a study of Finnish labors on job disamenities, job satisfaction, and intentions to quit, variables such as education, discrimination, no promotion, heavy mentally, neglect, uncertainty, and harm had significant effects on switch intentions [24]. Choi and Lee [25] specified that 95.5% of nurses had experienced different workplace violence in the past one year. Not only were they exposed to the physical threat, but they were also experiencing slight to severe job burnout. There is a direct relationship between nurses' experience of workplace violence and physical mental symptoms. The working pressure certainly impacts working satisfaction, increases turnover rate and the cost of the hospitals. In addition, it decreases their occupational life quality and healthcare quality and furthermore it becomes the factor of their turnover [26,27].

For more than 15 years of work in the emergency room, the researchers found out some of the nurses left the workplace after having experienced violence, and others were talking about leaving the current job. For those who stayed in the emergency room, they faced workplace violence either positively or ignored it. This phenomenon drew our attention to the relationship between workplace violence and intention to leave and why they still stay in the emergency room. The literature review indicated that healthcare professionals' turnover intentions were mostly job burnout, emotional exhaustion, work pressure, and work satisfaction. Although there were researchers who surveyed the relationship between healthcare professionals' resilience and turnover intention, only a few researchers explored

the related studies about healthcare professionals' workplace violence, resilience, and turnover intention. Therefore, the purpose of this study was to explore the effects of resilience as a mediator in emergency room violence toward nurses' intention to leave.

2. Materials and Methods

2.1. Research Design and Samples

A cross-sectional survey study was used to collect information on emergency room nurses of a medical center in northern Taiwan. There were a total of 171 registered nurses in the emergency room and all of them were recruited in this study. Fifteen subjects refused to participate in the survey and 24 questionnaires were not filled out completely, leaving 132 valid questionnaires. The response rate was 84.6%. Inclusion criteria included: nurses at the emergency room worked over three months and were willing to participate.

2.2. Research Instruments

2.2.1. Workplace Violence Instruments

The scale "Workplace Violence Instruments" was conducted by Institute of Labor, Occupational Safety and Health, Ministry of Labor, Taiwan, in 2014. There were five parts in the questionnaire, including basic data, physical violence, psychological violence (verbal abuse, bullied/mobbed and threats), policies and measurements, and the opinions toward workplace violence (open-ended question: three most important strategies to decrease violence in working environment.).

2.2.2. Connor-Davidson Resilience Scale

The original scale was developed by Connor and Davidson [28] and it was divided into five levels and 25 questions, and the sequence of the levels were: (1) personal competence, high standards, and tenacity; (2) trust in one's instincts, tolerance of negative affect, and strengthening effects of stress; (3) positive acceptance of change and secure relationship; (4) control; and (5) spiritual influences to evaluate the participants' ability to successfully respond to the pressure in the past one month. The present study used a 10-item CD-RISC Scale extracted by Campbell-Sills and Stein [29] from the original CD-RISC Scale. It is a Likert 5-point Scale and it respectively divides into Never (0), Occasionally (1), Sometimes (2), Often (3), and Always (4) from the lowest score 0 to the highest score 40. The higher the scores are, the higher the resilience is. The internal consistency of Cronbach's α is 0.95 in the present study.

2.2.3. Intention to Leave Scale

The present study used the Professor Huang Kai-Yi's Chinese scale translated from Mobley's [25] Turnover Intention Scale. It was mainly to measure the intention of employees' leaving jobs. There were four questions including (1) the idea to leave, (2) the motivation to look for another job, (3) the degree of influence of the external job's opportunity, and (4) the willingness to leave the current job. The questionnaire adapted 7-point to be the scoring method, from the lowest score 4 to the highest 28. The higher the scores are, the higher the turnover intention is. The internal consistency of Cronbach's α is 0.72 in the present study.

2.3. Statistical Method

The Statistical Package Software of SPSS (IBM, Armonk, NY, USA) for Window 18.0 version was used for statistical analysis. Research data counted the obvious level and set p value < 0.05 as the standard to judge statistical meaning. Data analysis method included descriptive statistics, Independent Sample t-test, One Way Analysis of Variance, Chi-Square Test, Pearson Product-moment Correlation Coefficient, and Sobel Test Path Analysis.

3. Results

3.1. The Current Situation between the Participants' Demographic Characteristics and Workplace Violence

A total of 132 participants were recruited in this study. The average age was 29.5 ± 5.6; the average overtime per week was 0.2 h; the average working years in the emergency room was 6.8 ± 5.1; the average total working years was 7.5 ± 5.6; shift personnel was 81.8%; nurses with in-service training on violence prevention was 62.9%; religious believers was 34.1%. In the last year, 57.6% of nurses suffered workplace violence. Twelve percent of nurses experienced physical violence and 53.8% of nurses suffered mental violence. The average resilience scored was 26.48 ± 6.59 and the average turnover intention score was 15.43 ± 4.76 (see Table 1).

Table 1. Current Analysis of Participants' Demographic Data, Resilience, and Turnover Intention (n = 132).

Variable		M ± SD	N	%
Sex				
	men		12	9.1
	women		120	90.9
Age		29.5 ± 5.6		
Education				
	college		12	9.1
	university		120	90.9
Marital status				
	single		93	70.5
	married		39	29.5
Working hours per week		40.2 ± 0.08		
Working years/ER		6.8 ± 5.1		
Working years/total		7.5 ± 5.6		
Shift				
	yes		108	81.8
	no		24	18.2
Training				
	Yes		83	62.9
	no		49	37.1
Religion				
	yes		45	34.1
	no		87	65.9
Workplace Violence				
	yes		76	57.6
	no		56	42.4
Physical Violence				
	yes		16	12.1
	no		116	87.9
Mental Violence				
	yes		71	53.8
	no		61	46.2
Resilience		26.48 ± 6.59		
	low		43	32.6
	middle		38	28.8
	high		51	38.6
Intention to leave		15.43 ± 4.76		

Sixteen (12.1%) participants had suffered physical violence within one year. The main reasons were the patients' condition changed too fast; the patients' waiting time was too long; there was bad communication between nursing staff and patients. When the participants encountered the violence, they usually decided to stop the abusers to cease their behaviors and others would ask security guards for help. For mental violence, there were 71 (53.8%) participants who suffered verbal insult. The reasons were due to the

patients' waiting being too long, bad communication, and a crowded environment. Those who suffered bullying were 12 (9.1%). The bullying mainly came from their colleagues or supervisors and the bullying victims usually did not take any action about it. The personnel suffered threat was 20.5%. The probable causes were the patients' waiting being too long, bad communication, crowded environment, terrible traffic flow, and that the patients' condition changed too fast. When the participants faced mental violence, they usually decided to stop the abusers to cease their behaviors and the others would ask security guards for help. The reasons why they did not report mainly were they thought it was useless; it was not important; or they were afraid of negative results; or they did not know to whom they should report.

3.2. The Comparison of Difference among the Participants' Workplace Violence, Resilience and Turnover Intention

There was a significant difference among workplace violence nurses in shifts and religion. Nurses with shift rotation ($X^2 = 4.840$, $p < 0.05$ *) and religion ($X^2 = 5.121$, $p < 0.05$ *) had higher frequency of workplace violence. There was significant difference among those who experienced physical violence with working years in the emergency room and the total working years. Nurses with less working years in the emergency room ($t = -2.05$, $p < 0.05$ *) and less total working years ($t = -1.991$, $p < 0.05$ *) tended to have experienced physical violence. As far as for mental violence, there was significant difference in religion. Nurses who were religious suffered mental violence more ($X^2 = 8.243$, $p < 0.01$ **) (see Table 2).

Table 2. The Comparison of Difference for the Participants Suffered Workplace Violence, Resilience, and Turnover Intention ($n = 132$).

	Workplace Violence			**Physical Violence**			**Mental Violence**		
M ± SD	**Yes ($n = 76$)**	**No ($n = 56$)**	***t***	**Yes ($n = 16$)**	**No ($n = 116$)**	***t***	**Yes ($n = 71$)**	**No ($n = 61$)**	***t***
Age	30.0 ± 5.7	29.0 ± 5.7	1.1	27.1 ± 4.8	29.8 ± 5.7	−1.8	30.3 ± 5.7	28.6 ± 5.6	1.0
Working years/ER	7.1 ± 5.0	6.5 ± 5.2	0.61	4.4 ± 3.5	7.2 ± 5.2	−2.1 *	7.4 ± 5.0	6.2 ± 5.1	0.69
Working years/total	7.8 ± 5.6	7.1 ± 5.6	0.7	4.9 ± 4.6	7.9 ± 5.7	−2.0 *	8.2 ± 5.6	6.8 ± 5.5	0.9
Resilience	25.9 ± 7.1	27.3 ± 5.8	1.1	24.5 ± 7.9	26.8 ± 6.3	1.3	26.1 ± 7.0	27.0 ± 6.1	0.8
Intention to leave	15.8 ± 4.8	14.9 ± 4.7	−1.0	13.9 ± 4.0	15.7 ± 4.8	1.4	15.9 ± 4.9	14.9 ± 4.6	−1.3
	Yes (%)	**No (%)**	X^2	**Yes (%)**	**No (%)**	X^2	**Yes (%)**	**No (%)**	X^2
Sex			0.31						0.1
Men	50.0	50.0		8.3	91.7		50.0	50.0	
Women	58.3	41.7		12.5	87.5		54.2	45.8	
Education			0.31						0.1
College	50.0	50.0					50.0	50.0	
University	58.3	41.7					54.2	45.8	
Marital status			0.9						0.1
Single	60.2	39.8		15.1	84.9		54.8	45.2	
Married	51.3	48.7		5.1	94.9		51.3	48.7	
Shift			4.8 *						3.1
Yes	62.0	38.0		13.0	87.0		57.4	42.6	
No	37.5	62.5		8.3	91.7		37.5	62.5	
Religion			5.1 *			0.1			8.2 **
Yes	71.1	28.9		13.3	86.7		71.1	28.9	
No	50.6	49.4		12.1	88.5		44.8	55.2	
Training			0.006			0.269			0.017
Yes	48	35		11	72		45	38	
No	28	21		5	44		26	23	

* $p < 0.05$, ** $p < 0.01$.

3.3. The Related Comparison among the Participants' Workplace Violence, Resilience, and Turnover Intention

There was a positive correlation between the working years in the emergency room and age (r = 0.934, $p < 0.01$ **). The total working years and age had a positive correlation (r = 0.959, $p < 0.01$ **). Satisfaction of dealing with physical violence had a negative correlation with age (r = −0.308, $p < 0.01$ **), working years in the emergency room (r = −0.305, $p < 0.01$ **) and total working years (r = −0.311, $p < 0.01$ **) (see Table 3).

Table 3. Related Comparison on Participants' Demographic Data, Resilience, and Intention to leave ($n = 76$).

Variable	1	2	3	4	5	6	7
1 Age	1						
2 Working years/ER	0.934 **	1					
3 Working years/total	0.959 **	0.945 **	1				
4 Satisfaction of physical violence	−0.308 **	−0.305 **	−0.311 **	1			
5 Satisfaction of Mental Violence	0.068	0.109	0.061	−0.193	1		
6 Resilience	0.232 *	0.218	0.218	−0.055	−0.106	1	
7 Intention to leave	0.079	0.023	0.097	−0.276 *	−0.169	−0.159	1

* $p < 0.05$, ** $p < 0.01$.

3.4. The Intermediary Effects of Resilience

To test whether resilience was the mediator effect for the workplace violence and turnover intention, the Sobel test path was used according to Baron and Kenny's [30] method. Using resilience as the mediator variable, the results of path analysis for those who had suffered workplace violence and turnover intention were shown as below:

There was not any significant relationship between nurses who suffered workplace violence and turnover intention (c = 0.091, $p > 0.05$).

No significant relationship showed between nurses who suffered workplace violence and resilience (a = −0.100, $p > 0.05$).

There was not a significant relationship between workplace violence victims' resilience and turnover intention (b = −0.097, $p > 0.05$).

Resilience was not the mediator between nurses who suffered workplace violence and turnover intention ($p > 0.05$) (see Table 4).

Table 4. Regression Analysis Chart with resilience as the mediation variable test ($n = 132$).

	IV	M	DV
	Workplace Violence	Resilience	Intention to leave
Step1			c = 0.091, $p = 0.297$
Step2			a = −0.100, $p = 0.254$
Step3			b = −0.097, $p = 0.272$
Step4			$p = 0.427$

4. Discussion

4.1. Workplace Violence

In the present study, 57.6% of participants had suffered workplace violence within one year, which was similar to previous research [1,7–10]. From patients' point of view, the main reasons were long waiting time, bad communication, crowded environment, and their personal feelings. To nurses, the reasons were that the conditions of the patients changed too fast, the staff's skill problems, and nurses' attitude toward patients. Di Martino [5] pointed out the related reasons in the medical workplace violence could divide into work design and workload, such as ambiguity, overload work, lack of control, death dealing; the

interpersonal relationship at work, such as conflict with the other staff; relationship with the patients and their family members, such as, insufficient preparation, insufficient mood dealing, and the demands of the patients and their family members; work organization and work management, for example, lack of the staffs' support, employees' turnover, the management echelon, and the supervisors' difficulties, lack of resource and personnel shortage; the nursing techniques, such as treatment and nursing problems; personal, such as professional knowledge and skills [10,31–33]. It is recommended that nurse managers re-evaluate work assignment, re-enforce in-house education, and provide enough resources for emergency room nurses.

During the study, senior nurses always arranged with junior nurses, which increased workload for senior nurses. Meanwhile junior nurses suffered workplace violence during night shift and working alone. These reasons led to the results of this study that workplace violence was significantly correlated to shift rotation. There was a significant relationship between the workplace violence occurrence and shifts because the workload, time management, and the degree of busy would relatively enhance [22,32]. Tahghigit et al. [34] indicated that those who fitted the shifts well would be more highly pressure resistant. In this study, the religion was correlated with workplace violence. Nurses with religion tended to suffer workplace violence. It was probably based on Taiwanese's culture that most Taiwanese would search for the help of gods [35,36] in the first place when facing troubles. It is recommended that junior nurses should avoid working at night shift and alone as possible. Nursing managers should pay more attention to nurses who are religious so as to early detect whether they are the victims of workplace violence.

Resilience in this study was not a mediator for intention to leave, which was different from other studies that showed that resilience was the mediator [34,37]. This might be due to that the institutions continue to hold in-service training regarding identification of workplace violence and nurses can identify from the first place and see it as part of the work.

4.2. Physical Violence

There were 12.1% of nurses suffered physical violence in the past one year as compared to 19–28.6% [38,39] in Taiwan and 10–42.7% in other countries [11,31,40,41], which is low. One of the reasons was when suffering violence they usually tolerated and chose not to report [3,40]. Verbal insult usually was the sign of physical violence on abusers [42]. It is recommended the security guards stationed around the clock. When it came to verbal insult, the nurse can inform the security guard immediately and it may stop the physical conflicts before the abusers took his act of violence. In addition, there was usually low notification rate in physical violence [11] with high turnover rate for nurses [42], which might give support the reason why there was lower physical violence or the victims might have left in the study. Hence, there was correlation between physical violence and intention to leave, and yet no correlation between mental violence and intention to leave.

There was significant correlation between working years in the emergency room and physical violence, which was similar to the past studies [10,32,43,44]. Studies revealed that workplace violence is related to age, inexperience, past experience of violence, and lack of communication skills [31,32]. The senior nurses were good at simplifying the events and then dealing with them [45]. They were good at distinguishing situations and having better negotiation skills [31]. Experience can be taught through learning to distinguish the signs before violence, communication skills, and negotiation skills.

4.3. Mental Violence

This study revealed that 53.8% of nurses suffered mental violence. Among these, 53.8% was verbal insult, 9.1% was bullying, and 20.5% was threats, which were similar to the previous research [25,31,32,38–40,46,47]. Verbal violence was five times as much as physical violence [7]. Workplace violence was mainly mental violence [10,25,38] or non-physical violence [31]. Verbal violence was the highest [10,25,38]. Abusers with verbal

insults mainly came from the patients' family members or the patients themselves. Bullying came mostly from colleagues and supervisors, results which are similar to previous studies [25,36,41,48,49]. The main causes of violence were the delay of examination and treatment, or dissatisfaction with quality of care [31,32,45,50]. Violence between the colleagues might be due to the responsibility to protect patients [10]. Nurses were concerned about it being useless to report or were afraid of the negative consequence, which was similar to the past research [49]. Yet, the silent culture inside the organizations would impact the results of the report [43]. Moreover, some nurses complained of not knowing whom they should report to. Therefore, knowledge and systems of prevention of violence should be disseminated to all employees in the institution.

5. Conclusions

There were 57.6% participants who suffered workplace violence in the past one year, while 12.1% suffered physical violence and 53.8% suffered mental violence. Abusers mainly came from patients (32.6%) and patients' relatives and friends (35.6%). Violence occurred mainly because patients' conditions changed too fast, long waiting times, bad communication, crowded environment, and bad traffic flow. When facing violence, the victims would stop the abusers at the first moment and secondly, they would ask the security guards for help. There was a relationship between workplace violence and shifts, religious belief, working years in the emergency room, and total working years. Resilience was not the intermediary variable for workplace violence and turnover intention.

The present study offered suggestions that could be divided into three parts, including individuals, environment, and organization. For nurses, it is important to enhance self-protect, the ability to communicate and coordinate with the patients and their family members as well as to use positive communication skills. For the environment factor, emergency administrators should reinforce the safety control at the main entrance, mark precisely the area and the route, and avoid the environment to work alone, and increase surveillance cameras and alarm systems. As for the organization factor, hospital administrators should adjust the work, allot the work properly, set up task forces toward case management modes, offer conformably the case's mental health rebuilding system, present medical and legal assistance and improve police–civilian cooperation. The study concerned sensitive issues, so we adapted an anonymous questionnaire. Still, we could not exclude the participants not giving exact answers because they tried to fend off the sensitive issues. Therefore, an Internet questionnaire and APP application software are strongly advised in the future. In addition, the reason for low physical violence rate may be due to victims leaving jobs. It is recommended that the violence issue be included in nurses' exit interviews, for a better understanding in future studies.

There are still a high percentage of unreported workplace violence around the world [6,10,13]. Compared to other countries' workplace violence rate, 56–75.8%, this research showed a lower rate of 57.6%. This study provides workplace violence prevention strategies as references for other healthcare organizations internationally.

6. Limitation

Resilience in this study was not a mediator for the intention to leave, which were non-expected results. As for demographic data such as age, total working years, and emergency room working years, there was no correlation with intention to leave as well. This might be due to the institution continues to hold in-service training regarding identification of workplace violence, and nurses can identify it in the first place and see it as part of the work.

This study focused on the relationship between workplace violence and the intention to leave a job. Demographic data such as sex, age, education, marital status, working years, shift, training, and religion were included and yet some other non-occupational factors such as behaviors and emotional balance were not included. These variables will be considered in the future study.

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Factors Affecting Physical and Mental Fatigue among Female Hospital Nurses: The Korea Nurses' Health Study

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Abstract: Nurses often experience work-related physical and mental fatigue. This study sought to identify the levels of physical and mental fatigue present among Korean female nurses and discern factors influencing their onset. This cross-sectional study analyzed data from the Korea Nurses' Health Study (KNHS). A total of 14,839 hospital nurses were assessed by hierarchical regression analysis. The mean scores of physical and mental fatigue were 12.57 and 5.79 points, respectively. After adjusting for confounding variables, the work department had a significant influence on both physical and mental fatigue, that is, nurses working in special care units experienced greater degrees of both physical and mental fatigue than those working in general units. Nurse fatigue is an important consideration to monitor to ensure nurses' continued wellbeing as well as good patient safety levels. Therefore, it is necessary to establish a strategy to mitigate nursing fatigue while considering the characteristics of specific departments. In nursing practice, the introduction of a counseling program and guarantee of rest time that can alleviate the mental and physical fatigue of nurses working in special care units should be considered.

Keywords: physical fatigue; mental fatigue; female; nurses

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1. Introduction

Nurses are required to perform appropriate nursing care and treatment at the front-lines of patient care and, as a result, often experience work-related physical and mental fatigue. According to a prior study, 50.2% of hospital nurses reported work-related chronic and acute fatigue and 84.9% of female nurses have experienced physical and mental fatigue [1,2]. These high proportions of physical and mental fatigue among nurses must be given attention as an important issue. Physical fatigue is caused by physical labor, such as long hours of standing, lifting, or changing the positions of patients, and appears to be a symptom of full-body discomfort and difficulty in tasks requiring strength [3]. In particular, healthcare professionals such as nurses encounter the risks of high exposure to posture-related harm, which can lead to musculoskeletal disorders and become a major factor of physical fatigue [4]. Mental fatigue is caused by work-related emotional stress such as patients' demands and expectations, which results in lethargy, decreased levels of concentration, or lack of motivation for work [3]. Both physical and mental fatigue negatively affect an individual's biological, psychological, and cognitive processes [5,6]. High levels of physical and mental fatigue affect nurses' personal health and health-promoting behavior [7]. Fatigue can also decrease nurses' work performance and may impair their

ability to perpetuate safe behaviors in the workplace [8,9]. Therefore, it can be argued that persistent fatigue is not just a nurse's personal problem but also an issue that directly affects patient safety and the quality of care.

According to previous studies, married nurses, those who work in shifts, and those who receive less income display a higher incidence of fatigue [5,10,11]. Nurses with a lower quality of sleep also reported more fatigue, whereas those without depressive symptoms and who had better-perceived health felt less fatigue [2,12]. Level of fatigue varies by work department as well. Emergency room (ER) nurses are more likely to experience high levels of fatigue relative to nurses working in other nursing departments [1,13]. This discrepancy is attributed to the characteristics of these respective special care departments, including the need to manage complicated and life-threatening medical problems, the existence of physically and mentally demanding job requirements, the persistence of increased pressure to perform well, and the use of complex technologies [1,5]. In addition, to the best of our knowledge, none of the previous studies on fatigue by workplace evaluated differences between physical and mental fatigue among nurses according to their work department. As such, there are limitations in identifying differences and in suggesting the relevance between physical and mental fatigue among departments. This study aimed to (1) identify the levels of physical and mental fatigue among Korean nurses and (2) investigate the factors affecting physical and mental fatigue.

2. Materials and Methods

2.1. Study Design, Population, and Setting

This study was cross-sectional in design. We analyzed data from the Korea Nurses' Health Study (KNHS), which is described in detail elsewhere [14]. The KNHS is a large-scale, prospective cohort study of female nurses that investigates the effects of occupational and lifestyle risk factors on Korean women's health. This study only included female nurses as participants due to the increasing demand to understand women's health issues, considering the dramatic changes in the fertility rate and social changes arising from the rapid economic growth in Korea. The study population of the KNHS included female hospital nurses of child-bearing aged between 20 and 45 years old. Data were collected online, through the KNHS website, from July 2013 to November 2014. Voluntary participation was encouraged by advertising the study on the KNHS website and social networking sites; furthermore, the research team visited the job training sessions held at the hospitals to encourage personnel to participate in the study.

A total of 20,613 nurses participated in module 1, the initial baseline survey, and 14,839 nurses who worked in general care departments and special care departments were included in the analysis for this study. Based on the specialty of the job and the traits of the working environment, the emergency room (ER), intensive care unit (ICU), operating room (OR), and post-anesthesia care unit (PACU) were classified as special care departments, while general wards (i.e., internal medicine, general surgery, and obstetrics and gynecology) and outpatient units were classified as general care departments.

2.2. Measurements

The questionnaires of KNHS were similar to those of the Nurses' Health Study 3 (NHS 3) performed in the United States (US) [14]. A multidisciplinary advisory committee translated the NHS 3 questionnaires, then modified or eliminated some questions to ensure relevance to Korean health research needs and accurately reflect cultural issues.

Fatigue, the primary variable of interest, was measured using the Chalder Fatigue Scale (CFS). This questionnaire consists of 11 items, where items 1 through 7 measure physical fatigue, while items 8 through 11 measure mental fatigue. Answers are assessed using a four-point Likert scale with zero points indicating less than usual, one point indicating no more than usual, two points indicating more than usual, and three points indicating much more than usual. Total physical fatigue scores can therefore range from zero to 21 points, while total mental fatigue scores range from zero to 12 points, with higher

scores indicating more severe levels of fatigue in both cases. The Cronbach's alpha values of the original study were 0.85 (physical fatigue) and 0.82 (mental fatigue; 14) [15]. The Cronbach's alpha value of this study was 0.91.

Stress was measured using the four-item Perceived Stress Scale-4 (PSS-4). Responses were rated on a five-point Likert scale ranging from zero points indicating not at all to four points indicating very often. Possible scores ranged from zero to 16 points and higher total scores suggested the existence of higher levels of perceived stress in respondents. The Cronbach's alpha of the original study was 0.72 [16], while the Cronbach's alpha of the current study was 0.52.

Depressive symptoms were measured via the Patient Health Questionnaire-9 (PHQ-9), a self-reported instrument used to identify the severity of depressive symptoms [17]. The PHQ-9 consists of nine items with a total score that ranges from zero to 27 points. Scores of zero to four points, five to nine points, 10 to 14 points, 15 to 19 points, and 20 points or higher indicate minimal, mild, moderate, moderately severe, and severe depressive symptoms, respectively [17]. The Cronbach's alpha of the current study was 0.90, which is similar to that of the original paper (0.87).

We used the Jenkins Sleep Questionnaire to measure sleep disturbance [18]. This questionnaire consists of four items assessed using a six-Likert scale ranging from one point indicating not at all to six points indicating every night. Total scores here can range from four to 24 points and higher scores suggest the respondent is experiencing more severe sleep problems. The Cronbach's alpha of the original study was 0.79, while that of this study is 0.86 [18].

Participants were also asked to rate their health as good, fair, or poor. Separately, to investigate factors affecting nurses' fatigue, we adjusted for the following general covariates based on a literature review: general characteristics (i.e., age, level of education, marital status, annual income, shiftwork), body mass index (BMI), and sleep and psychological health (sleep problems, perceived health, level of depression, stress). All of these factors were included as potential confounding variables.

2.3. Data Analysis

The data were analyzed using the SPSS Statistics version 26.0 software program (IBM Corp., Armonk, NY, USA). Descriptive statistics were adopted to examine the frequencies and percentages, while Pearson's correlation coefficient was used to examine the associations among variables. Factors affecting the levels of physical and mental fatigue among female hospital nurses were analyzed via hierarchical regression analysis. The threshold for statistical significance was $p < 0.05$.

2.4. Ethical Considerations

This study received ethical approval from the Korea Centers for Disease Control and Prevention (2013-03CON-03-P). Anonymity was assured, and informed consent was obtained from the participants online.

3. Results

Table 1 presents the participants' general characteristics and the differences observed for each variable according to both physical and mental fatigue. Out of the 14,839 nurses, 62.9% were aged 29 years or younger, almost half had completed a four-year university or higher education program (50.9%), and most (70.2%) were single. Approximately half of the participants (42.1%) earned an annual income of lower than $30,000 (USD), while 38.9% earned an annual income of between $30,000 and $39,999 USD. Most of the nurses worked shiftwork (78.3%) and 65.7% had normal BMI values. The majority of the nurses rated their health as either good (41.1%) or fair (48.7%); most of the nurses had no sleep problems (64.9%) and, with regard to depressive symptoms, most said they were experiencing minimal (32.9%) or mild (37.4%) levels of depressive symptoms, while only 3.7% reported severe depressive symptoms. The mean score of stress was 6.61 of 16 points. Considering

the work department, 62.0% worked in general units. The mean score of overall fatigue was 18.36 of 33 points, suggesting a moderate level of fatigue was prevalent throughout the study population. More specifically, the mean score of physical fatigue was 12.57 of 21.0 points, whereas that of mental fatigue was 5.79 of 12.0 points.

Table 1. General characteristics of participants (*N* = 14,839).

Variables			Mental Fatigue		Physical Fatigue	
	N	**%**	**M ± SD**	***t* or F (*p*)**	**M ± SD**	***t* or F (*p*)**
Total	14,839	100	5.79 ± 2.60		12.57 ± 4.04	
Age						
≤29	9334	62.9	5.86 ± 2.66	4.479 (0.000)	12.99 ± 3.98	16.477 (0.000)
≥30	5505	37.1	5.66 ± 2.50		11.86 ± 4.03	
Level of Education						
3-year college	7095	49.3	5.80 ± 2.62	0.417 (0.677)	12.70 ± 4.04	3.604 (0.000)
4-year university or higher	7744	50.7	5.78 ± 2.59		12.46 ± 4.03	
Marital status						
Married	4420	29.8	5.60 ± 2.50	−5.806 (0.000)	11.80 ± 4.01	−15.287 (0.000)
Single or other status	10,419	70.2	5.86 ± 2.64		12.90 ± 4.00	
Annual income (USD)						
≤$2999	6250	42.1	5.77 ± 2.70	4.485 (0.011)	12.69 ± 4.11	40.900 (0.000)
$3000–3999	5764	38.9	5.85 ± 2.53		12.75 ± 3.93	
≥$4000	2824	19.0	5.68 ± 2.53		11.96 ± 4.04	
Shift work						
No	3224	21.7	5.30 ± 2.57	−11.933 (0.000)	11.42 ± 4.18	−17.814 (0.000)
Yes	11,614	78.3	5.92 ± 2.60		12.89 ± 3.94	
BMI						
Normal	9707	65.7	5.77 ± 2.61	0.846 (0.429)	12.48 ± 4.05	78.190 (0.000)
Underweight	2441	16.5	5.84 ± 2.65		13.44 ± 4.00	
Overweight	2631	17.8	5.80 ± 2.54		12.09 ± 3.92	
Perceived health						
Good	6093	41.1	4.84 ± 2.50	1009.34 (0.000)	10.49 ± 3.86	2266.00 (0.000)
Fair	6681	45.0	6.12 ± 2.34		13.38 ± 3.26	
poor	2065	13.9	7.48 ± 2.60		16.11 ± 3.34	
Sleep problem						
No	9626	64.9	5.14 ± 2.44	−43.162 (0.000)	11.28 ± 3.79	−60.598 (0.000)
Yes	5213	35.1	6.97 ± 2.48		14.95 ± 3.35	
Level of Depression						
Minimal	4872	32.9	4.14 ± 2.25		9.72±3.73	
Mild	5540	37.4	5.86 ± 2.15	1517.243	12.81 ± 3.08	1848.911
Moderate	2598	17.5	6.92 ± 2.13	(0.000)	14.59 ± 2.98	(0.000)
Moderate severe	1266	8.5	7.94 ± 2.16		16.12 ± 3.06	
Severe	547	3.7	9.31 ± 2.39		17.68 ± 3.20	
Stress level						
1st quartile	4582	30.9	4.62 ± 2.35		10.95 ± 3.79	
2nd quartile	4385	29.6	5.78 ± 2.24	728.520 (0.000)	12.65 ± 3.41	620.881 (0.000)
3rd quartile	3416	23.0	6.21 ± 2.68		12.88 ± 4.38	
4th quartile	2456	16.5	7.37 ± 2.54		15.02 ± 3.65	
Department						
General	9198	62.0	5.73 ± 2.62	−3.227 (0.001)	12.47 ± 4.09	−3.759 (0.000)
Special	5641	38.0	5.87 ± 2.58		12.73 ± 3.95	

Note: BMI = body mass index; M = mean; SD = standard deviation.

The following parameters were statistically different according to mental fatigue (Table 1): age, marital status, annual income, shiftwork, perceived health, sleep problems, level of depression, and stress level. Meanwhile, the following parameters were statistically different according to physical fatigue: age, marital status, level of education, marital status, annual income, shiftwork, BMI, perceived health, sleep problems, level of depression, and stress level.

Table 2 displays the hierarchical multiple regression results, which were employed to discern which factors affect physical fatigue. As shown in model 3, the work department also significantly influenced physical fatigue (β = 0.027; $p < 0.001$). The adjusted R-square in the final model was 46.7% (F = 996.512; $p < 0.001$), revealing an increase of 42.7% in explanatory power compared with that of model 1. Age, marital status (being married), annual income (≤$2999 USD), shiftwork, BMI, perceived health (both fair and poor), sleep problems, level of depression, and stress level were factors showing a significant association with physical fatigue.

Table 2. Hierarchical multiple regression analysis predicting physical fatigue (*N* = 14,839).

Variables	Model 1		Model 2		Model 3	
	β	*t*	β	*t*	β	*t*
Age	−0.146 ***	−12.049	−0.065 ***	−7.085	−0.065 ***	−7.020
Level of Education (4-year university or higher = 0)						
3-year college	−0.008	−0.937	−0.006	−0.874	−0.005	−0.824
Marital status (Single or others = 0)						
Married	−0.014	−1.287	0.066 ***	8.190	0.066 ***	8.247
Annual income (USD) (≥$4000 = 0)						
$3000–3999	0.003	0.242	−0.003	−0.359	−0.003	−0.321
≤$2999	−0.037 **	−2.739	−0.033 **	−3.199	−0.030 **	−2.953
Shift work (No = 0)						
Yes	0.102 ***	11.843	0.025 ***	3.845	0.024 ***	3.764
BMI			−0.095 ***	−15.295	−0.095 ***	−15.334
Perceived health (Good = 0)						
Fair			0.226 ***	33.546	0.225 ***	33.496
Poor			0.267 ***	37.664	0.267 ***	37.686
Sleep problem			0.157 ***	20.524	0.156 ***	20.463
Level of Depression			0.380 ***	45.484	0.380 ***	45.538
Stress level			0.040 ***	5.665	0.040 ***	5.765
Department (General = 0)						
Special					0.027 ***	4.430
R^2	0.041		0.467		0.468	
Adjusted R^2	0.040		0.466		0.467	
F	104.760 ***		1076.560 ***		996.512 ***	
ΔR^2			0.426		0.001	

Note: BMI = body mass index; *** $p < 0.001$, ** $p < 0.01$.

Table 3 describes the results of hierarchical multiple regression, which were used to determine factors affecting mental fatigue (dependent variable). Socio-demographic factors and conduct of shiftwork were included in model 1. Health-related factors were then added in model 2. Finally, model 3 identified that differences between departments were statistically significant concerning mental fatigue. When the work department (independent variable) was added in the final model, the adjusted R-square was 36.5% (F = 651.819; $p < 0.001$), constituting an increase of 35.4% in explanatory power relative to model 1. The independent variable, work department, had significant influence on mental fatigue (β = 0.027; $p < 0.001$). Age, marital status (being married), shiftwork, BMI, perceived health (both fair and poor), sleep problems, level of depressive symptoms, and stress level were factors that had a significant relationship with mental fatigue.

Table 3. Hierarchical multiple regression analysis predicting mental fatigue (N = 14,839).

Variables	Model 1		Model 2		Model 3	
	β	*t*	β	*t*	β	*t*
Age	−0.020	−1.603	0.060 ***	6.012	0.061 ***	6.078
Level of Education (4-year university or higher = 0)						
3-year college	−0.008	−0.935	−0.007	−0.975	−0.006	−0.929
Marital status (Single or others = 0)						
Married	−0.014	−1.280	0.052 ***	5.931	0.052 ***	5.982
Annual income (USD) (≥$4000 = 0)						
$3000–3999	0.009	0.725	−0.002	−0.216	−0.002	−0.181
≤$2999	−0.010	−0.713	−0.021	−1.845	−0.018	−1.621
Shift work (No = 0)						
Yes	0.089 ***	10.162	0.023 **	3.235	0.022 **	3.160
BMI			−0.021 **	−3.102	−0.022 **	−3.131
Perceived health (Good = 0)						
Fair			0.099 ***	13.519	0.099 ***	13.463
Poor			0.118 ***	15.293	0.118 ***	15.299
Sleep problem			0.089 ***	10.722	0.089 ***	10.661
Level of Depression			0.423 ***	46.339	0.423 ***	46.386
Stress level			0.133 ***	17.414	0.134 ***	17.508
Department (General = 0)						
Special					0.027 ***	4.043
R^2	0.011		0.364		0.365	
Adjusted R^2	0.010		0.364		0.364	
F	26.282 ***		704.042 ***		651.819 ***	
ΔR^2			0.354		0.001	

Note: BMI = body mass index; *** $p < 0.001$, ** $p < 0.01$.

4. Discussion

This study aimed to confirm the level of fatigue among Korean female nurses and to identify factors influencing the onset and worsening of physical and mental fatigue. The study results suggest that Korean female nurses show a moderate level of fatigue with average scores of physical fatigue and mental fatigue being 12.57 and 5.79 points, respectively. In particular, nurses working in special care departments showed higher levels of both physical and mental fatigue in comparison with nurses working in general care departments. In a previous study, nurses working in special care departments such as the ER, ICU, and OR reported higher levels of fatigue, which may be because these nurses must care for patients with greater severities of disease or injury and with higher levels of physical dependency [19]. Psychological and physical fatigue are predictors for medical administration errors. Psychological fatigue, above all, is related to incomplete or incorrect documentation of patients, negatively affecting the tasks performed by nurses [20]. Hence, the regular inspection of nurses' fatigue levels and the development of intervention plans could play important roles in maintaining patient care quality by enhancing nurses' work performance.

Hierarchical multiple regression was chosen to attempt to identify the factors influencing the physical and mental fatigue of nurses. Even after adjusting for confounding variables, work department had a significant influence on nurses' physical and mental fatigue. Some prior studies have reported that the work department is related to nurse fatigue although one study suggested the opposite—that the work department is not a factor influencing the fatigue of nurses [13,19,21]. Such a gap may have occurred due to different classifications of work departments in each study, making direct comparisons between them more difficult. One study suggested that nursing care models may have a bigger impact than the work unit itself on the chronic occupational fatigue of nurses. In particular, nurses in a total patient care model wherein primary nurses perform many functions express a higher level of fatigue than nurses working in a functional nursing care

model, where several nurses are given one or two assignments [21]. In this study, as we did not investigate the nursing care type or model of each department, the interpretation of data may be limited in some respects. However, when the results of prior studies are considered, we can infer that the work department is presented as a predictor of fatigue as each department boasts unique degrees of direct nursing care and physically or mentally demanding tasks. A study on physical activity and the level of fatigue of pediatric nurses working in the pediatric ICU and OR found that more than 50% of the physical activity performed by nurses in special care departments are related to their work [22]. Nurses working in the OR and anesthesia recovery room are also required to set up complicated equipment and often have to work while standing up [23]. Such results show that nurses in special care departments have a higher burden of physical activity, which can contribute to physical fatigue. Moreover, pediatric nurses in special care departments have also reported that they experience higher levels of fatigue from perpetuating interpersonal relationships [22]. Hence, the severity of physical work is considered to be significantly related to not only physical fatigue but also to mental fatigue.

According to a prior study on work-related factors that provoke physical and mental fatigue among nurses, inadequate time available and competing task demands are the factors that most frequently cause mental fatigue. Physical demand tasks, including lifting, pushing, and carrying, were factors that most frequently lead to physical fatigue [24]. Additionally, challenging working conditions, such as the hierarchies among healthcare workers, task orientation, and inflexible divisions of labor, result in occupational health problems among workers [25]. Hence, to reduce both the physical and mental fatigue of nurses, it is important to identify the nature and demands of the work performed within each department. However, in this study, the levels of physical and mental demands or burdens were not investigated and work units such as the ICU, ER, and OR were classified collectively as special departments. Future studies focusing on and further delineating the characteristics and influences of work according to individual work units would be beneficial.

One of the controlled variables, shiftwork, was also identified as a factor affecting mental and physical fatigue. While one study found that nurses working in shifts experience a high level of fatigue, there is also conflicting evidence concerning the nature of the relationship between nurses' shiftwork and fatigue. In a study of nurses working in four centers (pediatric, maternity, general, and emergency) at multispecialty hospitals, there was no meaningful relationship established between shiftwork and fatigue [20,26]. Elsewhere, in a literature review of work schedule characteristics and the fatigue profiles of nurses, an insufficient resting period had a more significant relationship with the level of fatigue relative to the number of night or evening shifts [27]. As such, the relationship between shiftwork and fatigue needs to be reviewed further with consideration of the role of rest periods among nurses working in shifts.

In addition, in this study, the level of depression was found to be an influencing factor for mental and physical fatigue. Few studies have investigated this relationship between the level of depression and fatigue among nurses, despite the higher levels of depressive symptoms exhibited by nurses, compared to other occupations, due to working in shifts [28]. Prior studies on college students revealed that those with moderate or severe fatigue showed significantly higher depressive symptoms and scored higher on a suicide risk measure than those with mild or no fatigue and those with mild fatigue, respectively [29]. Therefore, it is considered that proper management of depressive symptoms among nurses can have a relieving effect on mental and physical fatigue.

Finally, in this study, women in their 20s showed higher mental and physical fatigue than those in their 30s. These results indicate that mental and physical fatigue can be reduced through job adaptation as age and experience increase. However, in this study, nurses' work experience was not included as a covariate in the analysis; therefore, its relationship with fatigue could not be identified. Thus, it is necessary to understand the relationship between nurses' work experience and fatigue in future studies.

Identifying differences in factors that contribute to fatigue in nurses and providing appropriate interventions are important to effectively maintain nurses' health and reduce nurse turnover, especially in special care departments requiring longer staff training periods. Prior studies have suggested the effectiveness of relaxation exercise using deep inspiration and pursed-lip breathing techniques among ER nurses and the conduct of higher levels of physical activity contributing to a decrease in fatigue scores among pediatric nurses in a special care unit, respectively [22,30].

This study is limited due to its cross-sectional nature, which does not allow for an explanation of causal relationships among variables. However, as the KNHS is ongoing, future analyses of collected cohort data are anticipated to potentially shed more light on nurses' fatigue. Other limitations include not being able to control for direct variables (e.g., time spent standing up and the number of heavy objects lifted) when investigating differences in fatigue, according to work department, and selection issues. As this study only analyzed nurses working in internal medicine, general surgery, obstetrics and gynecology, outpatient units, ER, ICU, OR, and post-anesthesia care units, care is warranted when pursuing interpretations for nurses in other work areas. Finally, despite these limitations, the large sample size and wide participation of nurses nationwide provide significant data for understanding nurses' fatigue.

5. Conclusions

Fatigue in nurses can eventually lead to burn out and start a vicious cycle of deteriorating patient care due to turnover among nurses and increased workload for their colleagues. This potential lack of skilled nurses can be particularly detrimental to the services of special care departments. However, efforts to reduce the fatigue of these nurses have been insufficient. Practical policy measures to assess and mitigate fatigue in nurses are required, not only for nurses' wellbeing but also for patient safety. Moreover, it should be considered especially important in the ongoing Coronavirus 2019 (COVID-19) pandemic.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The datasets generated and analyzed during the current study are not publicly available because this government data needs time for data clearing and establishment of guidelines. The Korea Centers for Disease Control and Prevention is planning on opening this data to the public in the future.

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Article

Palliative Care Professionals' Inner Lives: Cross-Cultural Application of the Awareness Model of Self-Care

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Abstract: Compassionate professional qualities traditionally have not received the most attention in either critical or end of life care. Constant exposure to death, time pressure and workload, inadequate coping with personal emotions, grieving, and depression urge the development of an inner curricula of competences to promote professional quality of life and compassionate care. The COVID-19 pandemic highlights the universality of these problems and the need to equip ourselves with rigorously validated measurement and monitoring approaches that allow for unbiased comparisons. The main objective of this study was to offer evidence on the generalizability of the awareness model of self-care across three care systems under particular idiosyncrasy. Regarding the sample, 817 palliative care professionals from Spain, Argentina, and Brazil participated in this cross-sectional study using a multigroup structural equation modeling strategy. The measures showed good reliability in the three countries. When testing the multigroup model against the configural and constrained models, the assumptions were fulfilled, and only two relationships of the model revealed differences among contexts. The hypotheses posited by the awareness model of self-care were supported and a similar predictive power on the professional quality of life dimensions was found. Self-care, awareness, and coping with death were competences that remained outstanding no matter the country, resulting in optimism about the possibility of acting with more integrative approaches and campaigns by international policy-makers with the consensus of world healthcare organizations.

Keywords: compassionate care; compassion satisfaction; compassion fatigue; cross-cultural comparison

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1. Introduction

Person-centered care, as a caring philosophy, holds that there is no appropriate healthcare unless it is compassionate [1]. Compassion or "suffering with"[2] has been defined as "a virtuous response that seeks to address the suffering and needs of a person through relational understanding and action"[3]. Moreover, kindness and equanimity are essential qualities in those who care for the dying. However, there is currently a great concern that these compassionate qualities are not always present in the care of the dying [3–5]. International studies have highlighted important levels of compassion fatigue in healthcare professionals in general [6–9], and in palliative care professionals in particular [10,11]. Specifically, in the Spanish context, 69% of nurses and 77% of physicians had, either first-hand or through close colleagues, experienced being the second victim within the following five years [12].

The latest literature focusing on person-centered care delivery considers the preferences, needs, and values of the receivers of these services [13–18]. The difficulty in

compassionate care is related to several stressors that affect palliative care professionals, such as exposure to death, inadequate time to deal with patients, growing workload and communication difficulties with patients and their families, or inadequate coping with their own emotional response to grieving, depression, and guilt [19,20]. Compassion is also linked to protective factors, such as training in emotional management and spirituality [21–25], self-care [26–29], empathy [30], awareness [31–36], or competency and attitudes toward death [37].

Attending the literature on compassion protectors, specifically based on Kearney and Weininger's awareness model of self-care [38], Sansó et al. [39] tested a mapping model with variables involved in palliative care professionals' quality of life: compassion satisfaction (CS), compassion fatigue (CF), and burnout (BO). The other variables included were self-care and awareness, which were positively related to coping with death. Coping together with awareness were posited as being promoting factors of CS due to their positive relationship, and both of them were shown to work as protectors, given their negative relationship with CF and BO [39].

This study, initially carried out in a national sample of Spanish palliative care professionals, is, to the best of our knowledge, the only attempt to study, in a multivariate framework, the inner life of palliative caregivers. This is of paramount importance, as keeping their equanimity, cultivating compassion, and also developing a strengthened sense of vocation and job satisfaction are recognized as key issues in the healing process [39]. However, a major constraint of this study was its rather specific European context, that is, the Spanish one. In order to strengthen the understanding of the stable effects, as well as those that are specific to different cultural contexts, this research was expanded to include other countries, namely, Argentina and Brazil. Finding the dimensions that are protective for the caregiver, the strength they possess, and the specific international circumstances under which they work may guide national policy-makers to make educated improvements to enhance the ability of professional caregivers to provide compassion.

There were two main reasons for the selection of the abovementioned countries. On the one hand, we wanted to test the generalizability of the awareness model of self-care approaching the relationship between specific aspects of professionals' inner lives through the evaluation of an adaptation of Kearney and colleagues' awareness model [19,38] in non-European countries. Argentina, while having a very different healthcare system, is one of the few South American countries where hospice and palliative care is widely provided throughout the country [40,41]. On the other hand, it was also of interest to test the model in other countries in which palliative care is still facing several obstacles (e.g., funding, establishment of inclusion criteria, and treatment discontinuity) before its complete integration, such as Brazil [40,42]. This country has a short history of palliative care and many of its services have been recently founded, mainly offering palliative care in hospitals [40,41,43]. Thus, both Argentina and Brazil differ from the Spanish palliative care system. Argentina has achieved "a measure of integration with other mainstream service providers together with wider policy recognition," as established by Clark and Wright [44].

In this context, the aim of this research was to test the awareness model of self-care, which integrates background and protective variables to explain professionals' inner lives in terms of quality of life in different countries with different idiosyncratic characteristics in their palliative care attention. For this aim, a multigroup structural equation modeling strategy was used. Compared with other analyses, such as regression analysis, path analysis generates a pictorial representation, which facilitates the interpretation of the model and the hypotheses for the reader, provides means to distinguish effects of one variable from another, and permits standardized errors of the observed variables [45]. In a multigroup context, that is, when studies involve more than one group or population, relationships can vary across these groups, and multigroup models can be used to examine such population heterogeneity [46]. These models study whether the observed variables remain unchanged in different populations—in our case, in the professionals of different countries. The test of equality or invariance of path coefficients across groups enables us

to examine similar behavior across groups [47], and therefore, to potentially generalize theories from one group to another.

Our hypotheses are based on Kearney and Weininger's model [38], whose empirical evidence thus far only exists for Spain [39]:

1. Competence in coping with death and awareness will be positive predictors of CS and negative predictors of CF and BO.
2. Having participated in training programs aimed at facing suffering and death, self-care and awareness will positively predict coping with death, and will indirectly predict professionals' quality of life (through a mediator effect of coping).
3. The three variables (training, self-care, and awareness) will show positive relationships amongst one another.
4. The dimensions of the professionals' quality of life will be interrelated: BO will be negatively related to CS and positively related to CF, whereas CS and CF will be independent.

Figure 1 shows the proposed model.

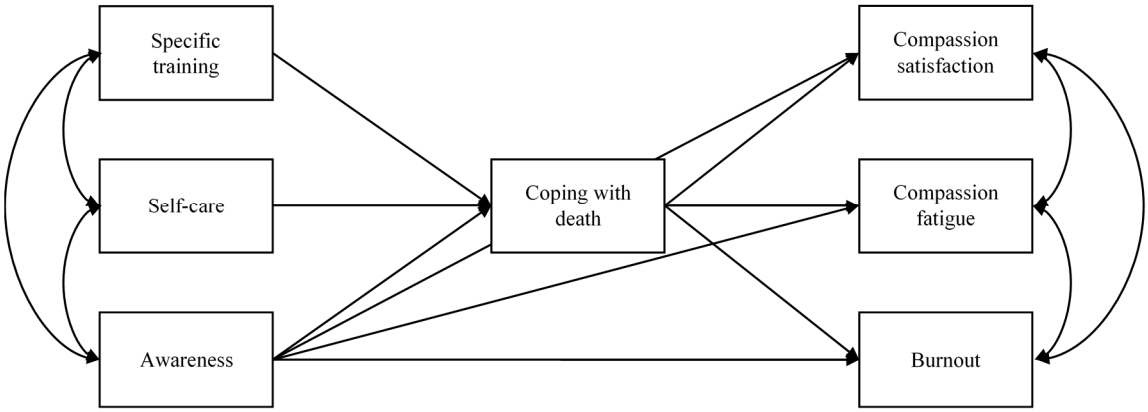

Figure 1. A priori structural model, based on an adaptation of Kearney and Weininger's model [38], validated by Sansó et al. [39] for the Spanish context.

2. Materials and Methods

2.1. Design, Procedure, and Participants

The cross-sectional surveys of Spanish, Argentinian, and Brazilian palliative care professionals were conducted between 2013 and 2016. Prior to these surveys, the research protocols were approved by the ethics committees of the professional associations. Members from the Spanish Society for Palliative Care (Spain), the Brazilian National Academy of Palliative Care (Brazil), and the Pallium Latinoamérica Institute, Argentine Association of Medicine and Palliative Care and the National Institute of Cancer (Argentina) were encouraged to participate.

Data were collected using a secure and anonymous online platform, with participation being voluntary and requiring the responders' informed consent. Regarding the responses, 385 professionals completed the survey in Spain, 271 in Argentina, and 161 in Brazil. The participants' characteristics are described in Table 1.

Table 1. Sociodemographic characteristics of the participants.

Variables and Categories	Spain		Argentina		Brazil	
	M	SD	M	SD	M	SD
Age	46.8	8.87	43.41	9.69	37.22	11.1
Palliative care experience (years)	10.69	6.59	7.95	5.85	4.97	4.42
	N	%	*N*	%	*N*	%
Sex						
Women	297	77.1	214	79.9	141	87.6
Men	85	22.1	51	18.8	18	11.2
Missing	3	0.8	6	2.2	2	1.2
Profession						
Doctors	168	43.6	136	50.2	35	21.7
Nurses	128	33.2	39	14.4	31	19.3
Psychologists	55	14.2	43	15.9	40	24.8
Assistant nurses	15	4.1	3	1.1	0	0.0
Social workers	19	4.9	21	7.7	19	11.8
Other professions	0	0.0	22	8.1	33	20.5
Missing	0	0.0	7	2.6	3	1.9

Notes: M = mean; SD = standard deviation.

There were statistically significant differences among the countries in terms of the mean age ($F(2.786) = 54.589$, $p < 0.001$, $\eta 2 = 0.12$), sex ($\chi^2(2) = 8.674$, $p = 0.013$, Cramer's $V = 0.104$), and profession ($\chi^2(10) = 89.331$, $p < 0.001$, Cramer's $V = 0.233$) distribution across samples.

2.2. Outcomes

Data were collected using the following measures (internal consistency can be consulted in Table 2):

(a) Specific training in dealing with death and dying [39], measured with a single open-ended question: "Have you done specific training to face suffering and death?"
(b) The Professional Self-Care Scale (PSCS) [48], which assesses three dimensions of professionals' self-care: physical, which refers to activities that help to maintain a healthy body; inner, which is related to activities that help to keep a healthy mind; social, pertaining to activities related to social activities that help the individual to maintain social health [48].
(c) The Mindful Attention Awareness Scale (MAAS) [49,50], which is a 15-item instrument that measures the general tendency to be aware and conscious of one's own experiences of daily life.
(d) The Coping with Death Competence Scale, in its Spanish and Portuguese versions [51–53], which is composed of 30 items and measures professionals' mastery when facing death.
(e) The Professional Quality of Life Scale (ProQOL) [54,55], which comprises three subscales: CS, which refers to the positive consequences of helping others; CF, which refers to the negative consequences of helping others; BO, a form of distress manifested by decreased work performance resulting from negative attitudes and behavior.

Table 2. Estimates of the internal consistency, descriptive statistics, and missing data for the variables under study.

Variables and Indicators	Cronbach's Alphas			Means (SD)			Respondents (Missing Data)		
Variables	**S**	**A**	**B**	**S**	**A**	**B**	**S**	**A**	**B**
Self-Care	0.78	0.76	0.79	3.44 (0.84)	3.26 (0.92)	3.33 (0.91)	356 (29)	258 (13)	145 (16)
Awareness	0.90	0.88	0.83	4.71 (0.88)	4.75 (1.02)	4.60 (0.99)	352 (33)	258 (13)	125 (36)
Coping with death Competence	0.89	0.89	0.92	5.33 (0.80)	5.22 (0.85)	5.04 (1.05)	383 (2)	252 (19)	130 (31)
Compassion satisfaction	0.77	0.86	0.78	5.01 (0.51)	5.05 (0.55)	5.17 (0.65)	329 (44)	239 (32)	121 (40)
Compassion fatigue	0.78	0.77	0.75	2.57 (0.52)	2.57 (0.64)	2.50 (0.64)	385 (0)	240 (31)	121 (40)
Burnout	0.54	0.65	0.68	2.26 (0.58)	2.29 (0.63)	2.42 (0.66)	329 (56)	240 (31)	121 (40)
	Frequency, Yes (%)			**Frequency, No (%)**			**Frequency, Missing Data (%)**		
Indicators	**S**	**A**	**B**	**S**	**S**	**S**	**S**	**A**	**B**
Specific training	320 (83.1%)	185 (67.8%)	67 (41.6%)	60 (15.6%)	7 (1.8%)	7 (1.8%)	5 (1.3%)	12 (4.4%)	31 (19.3%)

Notes: S = Spain; A = Argentina; B = Brazil.

2.3. Data Analysis

The structural models were tested in MPLUS version 8 [56] with maximum likelihood-robust estimation, given the lack of multivariate normality. Firstly, the a priori theoretical model [39] was estimated in the three samples (see Figure 1). Once an adequate fit was obtained for each individual sample, multigroup structural models were stablished in order to test for differences between countries. A multisample strategy was used to test the generalizability of the relationships. The multigroup sequence of models started with a configural or baseline model that had the same relationships but no constraints across groups. Then, a second multisample model was estimated, with all of the structural coefficients in the path model constrained to equality (constrained model). If this constrained model fit the data as well as the baseline model, this would indicate no differences between the samples or, in other words, no moderation effects due to the country. If potential interaction (moderation) effects were found, the modification indices of MPLUS were then used to test the adequacy of releasing each imposed constraint.

Model fit was assessed with chi-square, Comparative Fit Index (CFI), Standardized Root Mean Residual (SRMR), and Root Mean Square Error of Approximation (RMSEA). The following cut-off values were used to determine good fit: CFI above 0.90 and SRMR or RMSEA below 0.08. As a multisample context was used, the models were also comparatively assessed using the chi-square difference test (with no statistical differences meaning preference for the most constrained model) and CFI differences (with differences of 0.05 or less considered negligible) [57].

Missing data were dealt with using the full information maximum likelihood (FIML), which is adequate for both missing completely at random (MCAR) and missing at random (MAR) data and is the most recommended method for structural models [58].

We used the STROBE cross-sectional checklist when writing our report [59]. The research protocol received ethical approval from the Pallium Latinoamérica Institute (code 210316).

3. Results

Descriptive statistics for the variables included in the awareness model of self-care can be consulted in Table 2. In general, the means were medium–high for self-care, with higher means for the Spanish group. Moreover, high levels of awareness were found, with higher means for the Argentinian professionals. High levels of coping with death were also found, with higher scores for the Spanish professionals, as were high levels of compassion satisfaction, with higher levels for the Brazilian group. Lastly low–medium levels of compassion fatigue and burnout were found, with higher levels of compassion fatigue for the Spanish and Argentinian samples, and higher levels of burnout for the Brazilian professionals.

The model was independently tested in the samples and fit indices were adequate (see Table 3). Regarding the RMSEA, its performance has proved to be poor in small samples (as in the Brazilian case) and in models with small degrees of freedom, such as the tested

model (six degrees of freedom) [60]; however, our appreciation of the overall goodness of fit of the three samples should not change, despite this particular value.

Table 3. Fit indices of the multisample path analyses.

	χ^2	df	p	CFI	RMSEA	RMSEA CI	SRMR	$\Delta\chi^2$	Δdf	p	ΔCFI
Model in Spain	27.888	6	<0.001	0.950	0.097	0.063–0.135	0.039	-	-	-	-
Model in Argentina	40.636	6	<0.001	0.914	0.147	0.106–0.192	0.053	-	-	-	-
Model in Brazil	10.335	6	0.111	0.969	0.074	0.000–0.149	0.051	-	-	-	-
Configural model	75.312	18	<0.001	0.928	0.110	0.085–0.137	0.046	-	-	-	-
Constrained model	145.229	48	<0.001	0.878	0.088	0.072–0.105	0.107	72.438	30	<0.001	0.050
Most parsimonious model	104.772	45	<0.001	0.925	0.071	0.054–0.089	0.085	33.767	27	0.173	0.003

Notes: CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation; RMSEA CI = RMSEA 90% confidence interval; SRMR = Standardized Root Mean Residual.

Once the adequacy of the model in each sample was established, the baseline model was tested. This model had no constraints across groups; all of the parameters were freely estimated and simultaneously tested in the three samples. This model showed a good fit (Table 3). Then, a model with all of the parameters constrained across the three samples was estimated, i.e., the fully constrained model. This model was the most parsimonious one, as only the Spanish sample was used for the estimation, whereas the estimates for the Argentinian and Brazilian samples were fixed to these first estimates. As Table 3 shows, the model fit was degraded: using a statistical criterion, the chi-square differences were statistically significant; using a subjective criterion, the CFI differences were within the limit put forward by Little [57]. These results provide evidence of some moderation effects of the country. In order to study these effects, modification indices were considered and the relationships penalizing the model's fit were released.

The modification indices pointed to two constrains that, when released, improved the model's fit: the effect of specific training on coping with death in the Spanish sample and the relationship between CS and BO in the Brazilian sample. After releasing these constraints, the chi-square of this last model showed no statistically significant differences to the baseline model, as well as an irrelevant difference of 0.003 between CFIs (see Table 3). Consequently, the model was retained as the most parsimonious one.

The parameter estimates offered evidence of a moderation effect on the relationship posed between specific training and coping with death for the Spanish palliative care professionals. As shown in Figure 1, when compared to the other countries, Spanish palliative care professionals' specific training had no effect on coping with death, whereas this training had a positive effect for both Argentinian and Brazilian professionals. As regards the second released parameter regarding the relationship between CS and BO in the Brazilian sample, the estimates pointed to a greater relationship in this sample when compared to the Spanish and Argentinian professionals. Both estimates were, however, negative and statistically significant, as hypothesized. All parameter estimates, either invariant or variant, are shown in Figure 2.

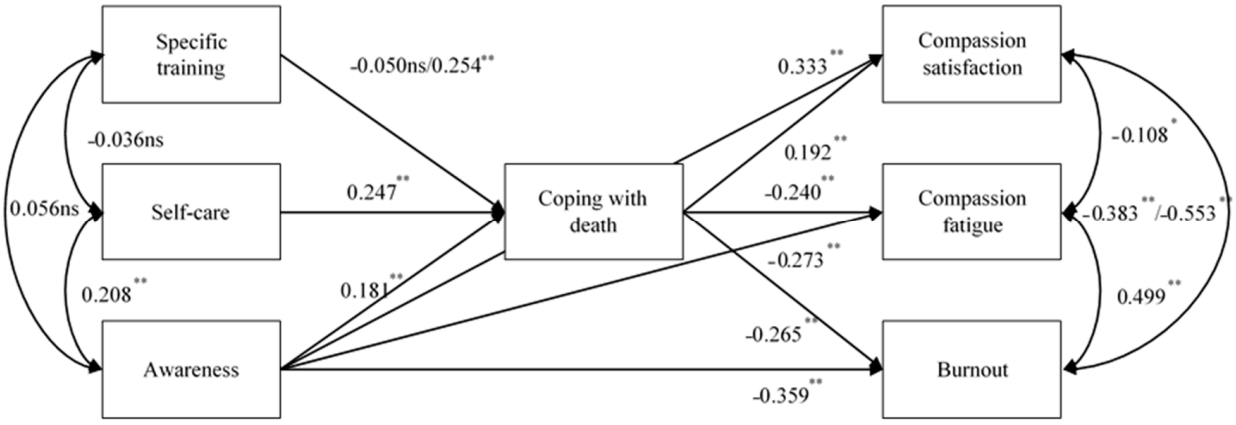

Figure 2. The most parsimonious model with the standardized parameter estimates. Notes: * $p < 0.050$ and ** $p < 0.001$. The non-invariant parameter estimates are those that are duplicated. The first value in the relationship between specific training and coping with death refers to the Spanish sample; the second is that of the Argentinian and Brazilian samples. The first value in the relationship between compassion satisfaction and burnout is for the Spanish and Argentinian samples; the second one is for the Brazilian sample. For the sake of clarity, standard errors are not shown.

Another important result was the considerable and homogeneous amount of variance explained by the most parsimonious model across the three sociocultural contexts (see Table 4). The variance for coping with death ranged from 11.5% (Spain) to 20.8% (Argentina). The protective variables allowed for almost 25% of the prediction of BO, no matter the country. When focusing on countries, a higher explicative power was reached for Argentina.

Table 4. Variance accounted for by the coping with death and professional quality of life dimensions across countries based on the R^2 values.

Variables	Spain	Argentina	Brazil
Coping with death	0.115	0.208	0.133
Compassion satisfaction	0.241	0.259	0.208
Burnout	0.243	0.244	0.244
Compassion fatigue	0.162	0.194	0.186

Notes: Results from the best fit, most parsimonious model.

4. Discussion

Person-centered palliative care is largely based on the attention of compassionate professionals. Despite its practical relevance, the recent literature claims compassionate qualities are not always present in professionals when working with patients at the end of their life and their families [3–5]. In the last decade, few theoretical approaches have tried to explain the reasons for this lack of professional competence [19,20,34], and empirical evidence based on these models, although robust, is yet limited to a particular European healthcare system [39].

The aim of the present research was to investigate the generalizability of the model tested by Sansó et al. [39] in Spanish professionals of palliative care in two additional countries, namely, Argentina and Brazil. By testing a multigroup model, we evidenced the different effects of one variable on another and how these effects vary across our studied groups [46], and we pointed to generalizations in behavior patterns across populations [47]. For such generalization purposes, we used evidence gathered in the previous literature. The model was mostly based on Sansó et al.'s work, although it included some improvements regarding professionals' inner life appraisal: self-care was assessed with all of the items of the Professionals' Self-Care Scale, and awareness was assessed with a shorter and more discriminant measure [50].

The results supported Hypothesis 1: "Competence in coping with death and awareness will be positive predictors of compassion satisfaction and negative predictors of compassion fatigue and burnout." Both competence in coping with death and awareness promoted higher levels of compassion satisfaction and worked as protectors of compassion fatigue and burnout, with negative relationships with these two last constructs. These two relationships, competence in coping with death and quality of professional life and awareness with professional quality of life, have been well documented in the literature [34,37], although this is the first time they have been tested in several countries.

Regarding Hypothesis 2, "Having participated in training programs aimed at facing suffering and death, self-care and awareness will positively predict coping with death, and indirectly will predict professionals' quality of life (through a mediator effect of coping)," the results provided evidence on all of the assumed relationships, particularly between specific training and coping with death. The findings revealed that, while in Brazil and Argentina this relationship is significant, it is not in Spain. This lack of an effect of specific training on coping with death was already found in the Spanish sample studied by Sansó et al. [39]. Although the indicator used was the same in the three countries, "Have you done specific training to face suffering and death?," a possible explanation of the absence of an effect in the Spanish context could be the amount of courses healthcare professionals attend in this country. It is common for palliative care professionals to engage in a vast amount of training throughout their professional lives. This, together with the fact that we investigated an "older" sample, especially in terms of professional experience, could have made the question less discriminant in Spain. An additional result was the one offered by Hypothesis 2a, "These three variables will show positive relationships among one another," which was supported across the countries.

Finally, Hypothesis 3, "The dimensions of the professionals' quality of life, that is, compassion satisfaction, compassion fatigue, and burnout, will be interrelated. Burnout will be negatively related to compassion satisfaction and positively related to compassion fatigue, whereas compassion satisfaction and fatigue will be independent," was also sustained by the model, which also offered additional interesting context-dependent information. There was a stronger relationship between compassion satisfaction and burnout in Brazil compared to the other countries.

To summarize, our results highlighted the model's generalizability, showing that the key elements of professionals' inner lives, such as self-care, awareness, or coping with death, are competences that remain outstanding no matter the country, which suggests the convenience of being universally encouraged. On the contrary, two relationships could not be generalized: the lack of a predictive effect of specific training in the Spanish context of palliative care, and the negative relationship between compassion satisfaction and burnout, which was stronger in Brazil than in Spain and Argentina.

The Global Atlas for Palliative Care [61] indicates higher rates for adults in need of palliative care at the end of their life in the European and Western Pacific regions. Latin American countries show lower rates. Indeed, European and Western Pacific professionals of palliative care work with elderly patients, in comparison to Latin American professionals, where the end of life is a more natural path for younger professionals. This, however, did not affect the majority of the relationships specified in the current research.

The maturity of the palliative care system is another characteristic that could explain differences in the functioning of the model. The biggest variance accounted for by coping with death, satisfaction and fatigue compassion, and burnout, being explained by protectors in Argentina, could be partially understood by their major efforts in developing palliative professionals' inner curricula during the last decade. In addition, the Argentinean palliative system has encouraged specific training due to the role played by the *Pallium Latinoamérica* Institute [62]. If we focus on Latin America, clear differences arise in the palliative care contexts, as Argentinian palliative institutions emerged in the early 1980s, whereas in Brazil, they did not emerge until the late 1990s, with the main association (*Academia Nacional de Cuidados Palitivos,* ANCP) being created in 2005 [41]. Chile, Costa Rica, Argentina, and

Uruguay pioneered palliative care in this area; Brazil, and other countries such as Colombia, Mexico, and Paraguay, are in a medium state of development, while countries such as Honduras, Nicaragua, and Bolivia are the most delayed in this development. The Brazilian palliative care context is especially interesting for three main reasons: (a) professionals work with younger patients than in Europe; (b) they work in a context of great care discontinuity, as home care initiatives are not integrated in primary healthcare services [43], as it is the case in Spain; (c) caregivers' quality of life is strongly affected by the difficulties in home care and work overload because not only do professionals provide medical assistance in hospitals, but they also have to work together with the home-care team [63,64]. A more mature palliative care system would bring higher funding, more specific inclusion criteria, treatment continuity, better integration with other mainstream services, and wider policy recognition for those countries with a great tradition in this care. Moreover, the models did not significantly differ, and thus factors protecting professionals from burnout and compassion fatigue and promoting compassion satisfaction seem non-dependent on how well-established the provision of palliative care is.

Regarding the practical implications of this study, the findings evidence the fact that the practice of self-care, the development of awareness, and specific training enhance professionals' inner lives, directly influencing their quality of life and likely the quality of their caregiving. Working on the variables that increase professionals' quality of life, a double objective can be achieved: professional wellbeing can be improved (understood as the presence of high compassion satisfaction and low burnout and compassion fatigue), and professionals' efficacy as healing agents in the palliative care encounter can be optimized through an enhanced ability to use themselves as healing agents in clinical encounters [32].

This study presents some limitations to bear in mind. The first limitation is the low response rate of this kind of study, with a non-incentivized self-report questionnaire. Despite such difficulties, the sample size obtained provided a robust dataset to explore the validity of the awareness model of self-care in different countries with different idiosyncratic characteristics in their palliative care attention. Secondly, it is worth noting that the possibility of response bias is present. To reduce the likelihood of such a bias, the respondents were informed that the research was anonymous.

5. Conclusions

This study highlights both the similarities and differences across palliative care professionals of different populations. Such similarities in behavior patterns have been assumed many times but were tested in this study for the first time. Therefore, this study offers evidence of the ability to generalize scientific evidence, including the importance of self-care, awareness, and coping with death for palliative care professionals in different parts of the world.

In conclusion, the contribution of this work is its provision of the first cross-cultural evidence (including two languages and three countries) on the suitability of a comprehensive model to address the relationship between protectors and quality of work life, as well as its quantification of the relationships in the model so that policy-makers can prioritize actions. The benefits from recent interventions in contexts, such as palliative care, with high emotional demands to promote professional quality of life are very encouraging [65,66] and are well structured [67].

In light of our results, even when healthcare systems are not mimetic and show great differences, the protectors of professionals' quality of life are the same and have the same quantitative effect. That is, the model is generalizable across countries and health systems. This is of special importance, taking into account that preventing burnout and compassion fatigue and enhancing compassion satisfaction are a requisite for both the quality of patients' care and occupational safety. Compassion is key to meeting patients' needs, including those on the surface as well as those kept more hidden, and is also crucial for institutional benefits. Compassionate professionals are able to work more and work to a better standard, and, most importantly, can provide more and better-quality care.

Thus, interventions attending to the predictors of professionals' quality of life, such as mindfulness-based stress reduction interventions or compassion-based training, must be on the agenda of world health agencies and policy-makers from now on.

Author Contributions: A.O., L.G., N.S., J.L., G.G. and G.d.S. designed the research, to which the rest of the authors contributed. A.O., L.G., J.M.T. and F.A. contributed to the data analysis. A.O., L.G. and N.S. wrote the first version of the manuscript, which was critically reviewed by all signatories, who approved the final version. All authors contributed to the interpretation of the results and a critical review of the manuscript. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Institutional Review Board of Pallium Latinoamérica Institute (code 210316).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data that support the findings of this study are available from the corresponding author, Noemí Sansó, upon reasonable request.

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Conflicts of Interest: The authors declare no conflict of interest.

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Predictors of Health-Related Quality of Life among Healthcare Workers in the Context of Health System Strengthening in Kenya

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Abstract: Kenya is among the countries with an acute shortage of skilled health workers. There have been recurrent health worker strikes in Kenya due to several issues, some of which directly or indirectly affect their health. The purpose of this study was to investigate the predictors of health-related quality of life (HRQOL) among healthcare workers in public and mission hospitals in Meru County, Kenya. A cross-sectional study design was undertaken among 553 healthcare workers across 24 hospitals in Meru County. The participants completed the EuroQol-five dimension-five level (EQ-5D-5L) instrument, which measures health status across five dimensions and the overall self-assessment of health status on a visual analogue scale (EQ-VAS). Approximately 66.55% of the healthcare workers reported no problems (i.e., 11,111) across the five dimensions. The six predictors of HRQOL among the healthcare workers were hospital ownership ($p < 0.05$), age ($p < 0.05$), income ($p < 0.01$), availability of water for handwashing ($p < 0.05$), presence of risk in using a toilet facility ($p < 0.05$), and overall safety of hospital work environment ($p < 0.05$). Personal, job-related attributes and work environment characteristics are significant predictors of healthcare workers HRQOL. Thus, these factors ought to be considered by health policymakers and managers when developing and implementing policies and programs aimed at promoting HRQOL among healthcare workers.

Keywords: health-related quality of life; health measurement; work environment; healthcare workers; health systems

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1. Introduction

In 2014, the United Nations (UN) General Assembly consisting of 193 Heads of State, universally adopted resolution A/RES/70/1 on 'Transforming our world: the 2030 Agenda for Sustainable Development' that envisions "A world with equitable and universal access . . . to health care and social protection, where physical, mental and social well-being are assured" (p. 3) [1]. The resolution contains 17 Sustainable Development Goals (SDGs) and 169 targets. SDG 3 emphasizes healthy lives for all persons of all ages [1]. The sixty-ninth World Health Assembly (WHA) stated that SDG 3, and other health development agendas, could not be achieved without investing in and improving the health workforce [2]. According to a World Health Organization (WHO) report titled, "A universal truth: no health without a workforce" [3], it is paramount to put the health workforce at the center of health policy discourse aimed at strengthening health systems, improving public health outcomes, and achieving health development agendas [3]. The health workforce plays a pivotal role in the achievement of global health agendas such as Universal Health Coverage and SDG 3 by 2030 [3]. However, one of the most significant challenges in the Kenyan health system is a critical shortage of skilled healthcare workers [4].

The WHO recommended minimum threshold of skilled health workers is 2.3 per 1000 population [4]. By 2006, the skilled health workers' density in Kenya was 1.8 per 1000 [4]. A decline was reported in 2018, when the density of skilled health workers was 1.74 per 1000 population (an equivalent of 17.4 per 10,000 population) [5]. In addition to the acute shortage of skilled health workers [6], the health workforce is also facing neglect in health systems development [7]. In Kenya, the "brain drain" [8], migration [9], poor working conditions [10], poor human resources for health management [11,12], low salary, and delayed payment (or non-payment) of salaries [13], are some of the many challenges which the health workforce encounter, which leads to recurrent health worker strikes [14,15]. In 2017, Kenya experienced two countrywide 100-day doctors strikes, and 150-day nurses strikes [13], which also contributed to low health worker retention. Such strikes adversely impact the quality of healthcare [13] and threaten national and devolved health systems development [16].

In 2016, the WHO report titled 'Global Strategy on human resources for health: Workforce 2030′ was published [17], following the adoption of related resolution WHA67.24 in 2014 [18]. One of the principles of this global strategy is to "Uphold the personal, employment and professional rights of all health workers, including a safe and decent working environment . . . " (p. 8) [17]. According to the Constitution of Kenya Article 43 (1) (a): "Every person has a right to the highest attainable standard of health, which includes the right to healthcare services, including reproductive health care." (p. 31) [19]. This signifies that health is a vital component for every individual (including a health worker), as recognized at the organizational, national, and global levels. Researchers and specialists across various disciplines have a unifying belief that health is vital in healthcare service delivery [20], health systems strengthening [21], and overall human development.

The Constitution of the World Health Organization defines health as, "the complete state of physical, mental and social well-being, not merely the absence of disease or infirmity" (p. 1) [22]. In this study, we assess the health-related quality of life (HRQOL). Currently, there is no universal definition of HRQOL [23]. In this study, HRQOL is defined as a multifaceted concept that delves into the assessment of ones' self-perceived health status using a multidimensional classification system [24]. Therefore, HRQOL is a value attributed to life, specifically focusing on health-related functional ability (or inability) and perceptions at an individualistic contextual realm [25]. HRQOL has been assessed among healthcare workers in various countries such as China [26], Pakistan [27], South Africa [28], and Greece [29], among others.

In Kenya, studies on HRQOL have been conducted among various populations such as children in Schistosoma haematobium-endemic areas [30], people living with irrigation schemes [31], women living in informal settlements [32], patients undergoing antiretroviral treatment [33–35], patients on maintenance hemodialysis [36] and patients who have undergone cataract surgery [37]. However, a study on HRQOL among healthcare workers in Kenya is yet to be conducted. Therefore, the present study contributes to bridging the existing knowledge gap in the public and private-not-for-profit (mission) hospitals. This study aims to investigate the predictors of HRQOL among healthcare workers in public and mission hospitals, Meru County, Kenya. The three research questions that this study aims to answer are:

1. What is the average overall self-assessed health status of the healthcare workers?
2. Is there a statistically significant difference between healthcare workers' overall self-assessed health status and hospital ownership?
3. What is the statistically significant relationship between healthcare workers' overall self-assessed health status and personal, job-related, and work environment characteristics?

This study will contribute to the existing literature that policymakers can use to inform the development of an evidence-based health workforce policy. It will also contribute to raising the awareness among policymakers and health development partners on the pivotal role of healthcare workers' HRQOL in health workforce strengthening, development of

resilient health systems, and achievement of the SDG3 target 3.8 on Universal Health Coverage (and indeed attainment of all the remaining 12 targets).

2. Materials and Methods

2.1. Study Design

A cross-sectional study design was used to investigate HRQOL among healthcare workers in public and mission hospitals in the Meru County of Kenya.

The study was conducted between 15 June and 30 July 2020, which was during the Coronavirus Disease 2019 (COVID-19) pandemic. However, at that time, the COVID-19 cases were relatively few in Meru County. By the end of July, a total of 32 cases had been recorded [38]. Therefore, the COVID-19 pandemic did not adversely impact the data collection process. The healthcare workers were highly cooperative during the data collection phase of this study. However, despite there being low numbers of cases in Meru County at the time of data collection, it is important to note that globally, the COVID-19 pandemic shocked health systems and resulted in healthcare workers experiencing psychological distress and psychosomatic symptoms [39]. For example, in China and Singapore, a narrative review revealed that the COVID-19 global pandemic resulted in healthcare workers experiencing enormous stress especially during spikes of cases which were experienced at different periods across different countries worldwide [39].

2.2. Study Setting

Meru County is one of the forty-seven counties in Kenya. The total population by July 2020, was approximately 1,545,714 people [38]. It is primarily a rural area located on the eastern slopes of Mount Kenya and is known for livestock rearing and agriculture, specifically, cash crop and food crop farming [40]. By 2019, there were 183 health facilities across the entire healthcare referral system in Meru County. This study focused on the sub-county and county level, public and mission hospitals (n = 24). In Kenya, the majority of hospitals are categorized according to hospital ownership. In the rural areas, hospital ownership is primarily public and mission. This means that public hospitals are owned and operated by the government. In comparison, mission hospitals are owned and operated by private not-for-profit religious organizations.

2.3. Study Population and Sample

In Meru County, the total number of human resources for health (HRH) in public and mission sub-county and county hospitals was 1872 by 2019. The present study focused on healthcare workers, also known as healthcare professionals. Healthcare workers, in this study, are individuals who have been trained in the medical field to apply evidence-based medical procedures and principles, geared towards achieving quality healthcare delivery [41]. Our focus was on medically trained healthcare workers, excluding auxiliary staff. Thus, the total number of healthcare workers eligible to participate was 954. The sample size (ss) was calculated using the following formula [42]:

$$\mathrm{ss} = \left(\frac{\mathrm{Z}^{2*}\,(\mathrm{p}) * (1-\mathrm{p})}{\mathrm{C}^2} \right) \quad (1)$$

Based on the formula, the total sample size of 566 was determined by the following parameters: the population was 954, Z = Z value at 99% confidence level, C = confidence interval of 3.46, and p = response distribution percentage of 50%.

Using simple random sampling a total of n = 566 healthcare workers were selected across the all the public and mission (n = 24) hospitals to participate in this study. The health professional cadres presented in this study were doctors, clinical officers, nursing personnel, dentistry personnel, pharmaceutical personnel, medical laboratory scientists, nutritionists, public health specialists, mental health specialists, physiotherapists, radiologists, and health records officers.

2.4. Data Collection

2.4.1. Sample Characteristics

Sample characteristics were collected in the socio-demographic section of the instrument. The personal and job-related attributes, and work environment characteristics, constituted the independent variables in this study. The personal and job-related attribute data obtained were in the following categories: hospital ownership, health professional cadre, age, marital status, gender, household size, education attained, years of professional experience, hours worked in a week, in-service training, staff housing, and type of employment. Work environment characteristics data on the healthcare workers' perception of their working environment related to hygiene, water, sanitation, and occupational hazards in the hospital, were also obtained.

2.4.2. The EQ-5D-5L

The EuroQol-five dimension-five level instrument (EQ-5D-5L) developed by the EuroQol Research Foundation [43] was used to measure HRQOL among healthcare workers. By 2019, the EQ-5D-5L had been translated into more than 180 languages and applied globally [43]. The EQ-5D-5L assessed the respondents' self-perceived health across five dimensions, namely: mobility, self-care, usual activities, pain/discomfort and, anxiety/depression [43]. Each respondent indicated what they felt across the five dimensions, depending on the boxes ticked, and a five-digit number, e.g., 11,111 (denoting full health), was generated for analytical purposes as per the EuroQol User Guide [43]. The last question in the instrument is the EQ-VAS (EuroQol Visual Analogue Scale) which required the respondents to assess their overall health status on a scale 0–100, where 0 signifies the worst health one can imagine, and 100 signifies the best health the respondent can envisage [43]. The EQ-5D-5L instrument was used after obtaining permission to use the Kenyan version for this study as instructed by the EuroQol Research Foundation. The research team, consisting of the principle investigator and two research assistants, explained the study both in written form (informed consent form) and verbally. After signing the informed consent form, respondents were given the self-complete paper version of the questionnaire. The respondents were informed that they could ask the research team any questions regarding the study, and they completed the questionnaire anonymously. Upon completing the questionnaire, the respondents would return it to the research team. On average, each respondent completed the questionnaire within 10 min.

Pretesting of the data collection instrument was performed among healthcare workers to evaluate its contextual validity and lucidity. The section of the personal, job-related and work environment characteristics was modified to enhance the contextual applicability in our setting.

2.4.3. Statistical Analysis

Data entry was performed in Excel (Microsoft, Washington, DC, USA) and exported to STATA 15.1® (StataCorp., College Station, TX, USA). Analysis of the EQ-5D-5L self-complete paper version was conducted according to the EuroQol User Guide [43]. From the respondents scores across the five dimensions, the EQ-5D-5L health profiles were obtained. From this, the EQ-5D index values were calculated using the EQ-5D-5L Crosswalk Index Value calculator for Windows [43]. After obtaining the index values, measures of central tendency (including the median and interquartile range) were estimated using STATA 15.1® [43]. Using the EQ-VAS as the dependent variable (i.e., the self-reported overall health status score), analysis of variance (ANOVA) and linear multivariate regression analysis was performed using STATA 15.1®. The linear multivariate regression model estimated was [44]:

$$Y_k = \beta_0 + \beta_1 X_{1k} + \beta_2 X_{2k} + \ldots + \beta_{25} X_{25k} + \in_k \quad (2)$$

where β_0 indicates the constant or intercept term capturing the unexplained variations in the dependent variable Y (i.e., EQ-VAS), β_1 indicates the slope coefficient measuring the amount by which Y will change when X changes by a single unit, k ranges from 1 to n,

in this case the 25 independent variables, X_{1k} = stands for the kth observation value for the independent variable X_1, and $\in_k$ is the error (disturbance) term that captures errors in model specification and other factors that influence healthcare workers' EQ-VAS (overall health status score) but are not explicitly considered in the model.

The predictors of the healthcare workers' overall health status were assessed using this model. A t-test was performed to determine whether each individual variable regression slope coefficient was statistically significant at 90% or 95% level of confidence.

2.5. Ethical Considerations

Following permission from the Meru County Government Department of health [CGM/COH/1/17(50)], permission was sought from all the hospitals that participated in this study. Subsequently, written informed consent was obtained from each respondent, before they anonymously and voluntarily completed the self-administered questionnaire. Before this, the research protocol underwent a sequential three-step approval process. In South Africa, the University of Pretoria, Faculty of Health Sciences Research Ethics Committee approved the protocol of this study [718/2019]. In Kenya, the United States International University Africa, Institutional Review Board, also granted Kenyan ethical approval [USIU-A/IRB/130-2020]. Subsequently, the National Commission for Science, Technology and Innovation, Kenya, granted a national research license number [901924] to perform this study in Kenya.

3. Results

The total number of respondents in this study was 553 healthcare workers out of 566. It yielded a response rate of 97.7% because thirteen questionnaires were excluded from data analysis, due to 50% or more questions not being answered. The response rate could be attributed to various factors, including the fact that the questionnaire was asking about the healthcare workers themselves, thus they were inclined to participate. As mentioned earlier, data collection was conducted during the country's early onset of the COVID-19 pandemic, during which the healthcare workers' workload was less because people generally avoided visiting hospitals, due to fear of contracting the contagious COVID-19 virus. No incentives were offered or given to respondents, they all voluntarily participated in this study.

3.1. Sample Characteristics

Table 1 presents the percentage frequency distributions of the personal and job-related characteristics of the healthcare workers, overall (n = 553), and by hospital ownership (sub-sample). From a total of 553 respondents, 74.48% worked in public hospitals and 21.52% in mission hospitals.

Table 1. Overall and sub-sample percentage frequency distributions of personal and job-related characteristics.

Personal and Job-Related Variables	Overall (n = 553) n (%)	Public Hospitals (n = 434) n (%)	Mission Hospitals (n = 119) n (%)
	Sex		
Male	214 (38.70)	180 (41.47)	34 (28.57)
Female	339 (61.30)	254 (58.53)	85 (71.43)
	Age		
≤25	62 (11.21)	52 (11.98)	10 (8.40)
26–35	220 (39.78)	177 (40.78)	43 (36.13)
36–45	181(32.73)	134 (30.88)	47 (39.50)
46–55	67 (12.12)	57 (13.13)	10 (8.40)
≥56	23 (3.80)	14(3.23)	9 (7.56)

Table 1. *Cont.*

Personal and Job-Related Variables	Overall (n = 553) n (%)	Public Hospitals (n = 434) n (%)	Mission Hospitals (n = 119) n (%)
	Marital status		
Single	179 (32.37)	140 (32.26)	39 (32.77)
Married	349 (63.11)	275 (62.67)	74 (62.18)
Divorced	12 (2.17)	8 (1.84)	4 (3.36)
Widowed	13 (2.35)	11 (2.53)	2 (1.68)
	Years of experience		
<5	146 (26.40)	113 (26.04)	44 (36.97)
5–10	197 (35.62)	157 (36.18)	29 (24.37)
11–20	137 (24.77)	103 (23.73)	34 (28.57)
21–30	61 (11.03)	52 (11.98)	9 (7.56)
>30	12 (2.17)	9 (2.07)	3 (2.52)
	Income range per month in Kenyan Shilling (KES)		
≤14,999	25 (4.52)	23 (5.30)	2 (1.68)
15,000–24,999	56 (10.13)	40 (9.22)	16 (13.45)
25,000–44,999	65 (11.75)	48 (11.06)	17 (14.29)
45,000–64,999	119 (21.52)	90 (20.74)	29 (24.37)
65,000–74,999	65 (11.75)	50 (11.52)	15 (12.61)
75,000–84,999	62 (11.21)	45 (10.37)	17 (14.29)
85,000–104,999	83 (15.01)	73 (16.82)	10 (8.40)
≥105,000	78 (14.10)	65 (14.97)	13 (10.92)
	Education attained		
Certificate	28 (5.06)	20 (4.61)	8 (6.72)
Diploma	335 (60.58)	260 (59.91)	75 (63.03)
Bachelor's degree	157 (28.39)	128 (29.49)	29 (24.37)
Honors degree	1 (0.18)	1 (0.23)	0 (0)
Master's degree	30 (5.42)	24 (5.53)	6 (5.04)
Doctor of Philosophy (PhD) degree	2 (0.36)	1 (0.23)	1 (0.84)
	Health professional cadres		
Physician or Specialist Doctor	31 (5.61)	18 (4.15)	13 (10.92)
Nursing professional	169 (30.56)	134 (30.88)	35 (29.41)
Pharmaceutical professional	41 (7.41)	30 (6.91)	11 (9.24)
Dentistry professional	52 (9.40)	37 (8.53)	15 (12.61)
Clinical officer	100 (18.08)	76 (17.51)	24 (20.17)
Medical laboratory scientist	54 (9.76)	41 (9.45)	13 (10.92)
Public health specialist	40 (7.23)	37 (8.53)	3 (2.52)
Nutrition and dietetics	17 (3.07)	16 (3.69)	1 (0.84)
Radiographer	12 (2.17)	10 (2.30)	2 (1.68)
Health records officer	20 (3.62)	20 (4.61)	0 (0)
Physiotherapist	12 (2.17)	10 (2.30)	2 (1.68)
Mental health specialists	5 (0.90)	5 (1.15)	0 (0)
	Type of employment		
Full-time	517 (93.49)	406 (93.55)	111 (93.28)
Part-time	36 (6.51)	28 (6.45)	8 (6.72)

Table 1. *Cont.*

Personal and Job-Related Variables	Overall (n = 553) n (%)	Public Hospitals (n = 434) n (%)	Mission Hospitals (n = 119) n (%)
	Hours worked per week		
≤10	47 (8.50)	42 (9.68)	5 (4.20)
11–20	5 (0.90)	4 (0.92)	1 (0.84)
21–30	11 (1.99)	10 (2.30)	1 (0.84)
31–40	407 (73.60)	316 (72.81)	91 (76.47)
41–50	45 (8.14)	34 (7.83)	11 (9.24)
≥51	38 (6.87)	28 (6.45)	10 (8.40)
	Household size		
1–2	181 (32.73)	127 (29.26)	54 (45.38)
3–4	200 (36.17)	161 (37.10)	39 (32.77)
5–7	159 (28.75)	133 (30.65)	26 (21.85)
8–0	13 (2.35)	13 (3.0)	0 (0)
	Upgrade in-service training		
Yes	365 (66)	283 (65.21)	82 (68.91)
No	188 (34)	151 (34.79)	37 (31.09)
	Staff housing		
Yes	74 (13.38)	39 (8.99)	35 (29.41)
No	479 (86.62)	395 (91.01)	84 (70.59)
	Type of housing		
Permanent housing	64 (11.57)	35 (8.06)	29 (24.37)
Semi-permanent housing	9 (1.63)	3 (0.69)	6 (5.04)
Temporary housing	1 (0.18)	1 (0.23)	1 (0.84)

Note: The exchange rate as of 22 December 2020, was, USD 1 = KES 110.38.

3.2. Work Environment Characteristics

Table 2 presents the frequency distributions and percentages of the work environment characteristics measured among the healthcare workers, in three categories overall (n = 553), public (n = 434) and, mission (n = 119) hospital ownerships.

Table 2. Overall and sub-sample percentage frequency distribution of work environment characteristics (n = 553).

Work Environment Variables	Overall (n = 553) n (%)	Public Hospitals (n = 434) n (%)	Mission Hospitals (n = 119) n (%)
	Constant supply of water		
Yes	459 (83)	353 (81.33)	106 (89.08)
No	94 (17)	81 (18.66)	13 (10.92)
	Occurrence of unavailable water (≥1 day)		
Yes	220 (39.78)	161 (37.10)	59 (49.58)
No	333 (60.22)	273 (62.90)	60 (50.42)
	Safe drinking water		
Yes	413 (74.68)	310 (71.43)	103 (86.55)
No	140 (25.32)	124 (28.57)	16 (13.45)

Table 2. *Cont.*

Work Environment Variables	Overall (*n* = 553) *n* (%)	Public Hospitals (*n* = 434) *n* (%)	Mission Hospitals (*n* = 119) *n* (%)
Acceptable main source of water			
Yes	461 (83.36)	353 (81.34)	108 (90.76)
No	92 (16.64)	81 (18.66)	11 (9.24)
Type of toilet facility			
Flush or pour flush	420 (75.95)	323 (74.42)	97 (81.51)
Pit latrine	133 (24.05)	111 (25.58)	22 (18.49)
Risk when using toilet facility			
Yes	141 (25.50)	120 (27.65)	21 (17.65)
No	412 (74.50)	314 (72.35)	98 (82.35)
Type of risk			
Injury	16 (2.89)	15 (3.46)	1 (0.84)
Harassment	15 (2.71)	15 (3.46)	0 (0)
Health (infections)	99 (17.90)	80 (18.43)	19 (15.97)
≥2 types of risk	11 (1.99)	11 (2.53)	0 (0)
None	412 (74.50)	313 (72.12)	99 (83.19)
Hospital disposal of waste			
Formal collection service	100 (18.08)	75 (17.28)	25 (21.01)
Informal collection service	15 (2.71)	9 (2.07)	6 (5.04)
Disposal in designated area	181 (32.73)	144 (33.18)	37 (31.09)
Disposal within the hospital compound	138 (24.95)	102 (23.50)	36 (30.25)
Disposal elsewhere (burning, burying or other)	52 (9.40)	45 (10.37)	7 (5.88)
Unknown	67 (12.12)	59 (13.59)	8 (6.72)
Constant availability of handwash soap			
Yes	508 (91.86)	396 (91.24)	112 (94.11)
No	45 (8.14)	38 (8.76)	7 (5.88)
Constant availability of water for handwashing			
Yes	468 (84.63)	361 (83.18)	107 (89.92)
No	85 (15.37)	73 (16.82)	12 (10.08)
Appropriate distance of handwashing station from the toilet (≤5 m)			
Yes	499 (90.24)	389 (89.63)	110 (92.44)
No	54 (9.76)	45 (10.37)	9 (7.56)
Workplace safety and health committee			
Yes	313 (56.60)	262 (60.37)	51 (42.86)
No	240 (43.40)	172 (39.63)	68 (57.14)
Overall safety of hospital work environment			
0–2 (not safe)	11 (1.99)	11 (2.53)	0 (0)
3–5 (slightly safe)	99 (17.90)	90 (20.74)	9 (7.56)
6–8 (moderately safe)	300 (54.25)	229 (52.76)	71 (59.66)
9–10 (very safe)	143 (5.86)	104 (23.96)	39 (32.77)

3.3. EQ-5D-5L Health Profile, Index Value and EQ-VAS

The EQ-5D-5L health profile showed that approximately 66.55% of all the respondents reported no problems across all the five dimensions. Nevertheless, 33.45% of the healthcare workers in this study reported problems within the dimensions assessed. In public hospitals (*n* = 434), about 64.75% of the healthcare workers had no problems across the dimensions,

but 35.25% experienced health problems across the dimensions. In mission hospitals (n = 119), 73.11% of the respondents did not experience any problems across the five dimensions, leaving 26.89% who confirmed experiencing health-related problems; thus implying that not all healthcare workers are at their best health state, with approximately more than 30% experiencing problems across all the dimensions assessed.

The median of the EQ-5D-5L index (IQR) value was 0.900 (0.595–0.900, on a scale of 0 to 1) overall and in both public and mission hospitals. This implies that the healthcare workers' health profiles were relatively high, with a median score of 0.900, which was 0.1 below 1, where 1 signifies full health. However, there is room for improvement, because the EQ-5D-5L index value scores fell short of full health by a value of 0.1.

The EQ-VAS presented the results of the healthcare workers' self-assessed overall health status, on a scale of 0–100 [43]. About 68.72% of the healthcare workers rated their overall health greater than 90 (where 100 indicates the best health you can imagine). The 553 respondents had a median of 90, first quartile = 80, third quartile = 100, minimum = 20 and maximum = 100, and four outliers = 20, 36, 40 and, 49. Figure 1 presents the box-and-whisker plots of EQ-VAS by hospital ownership.

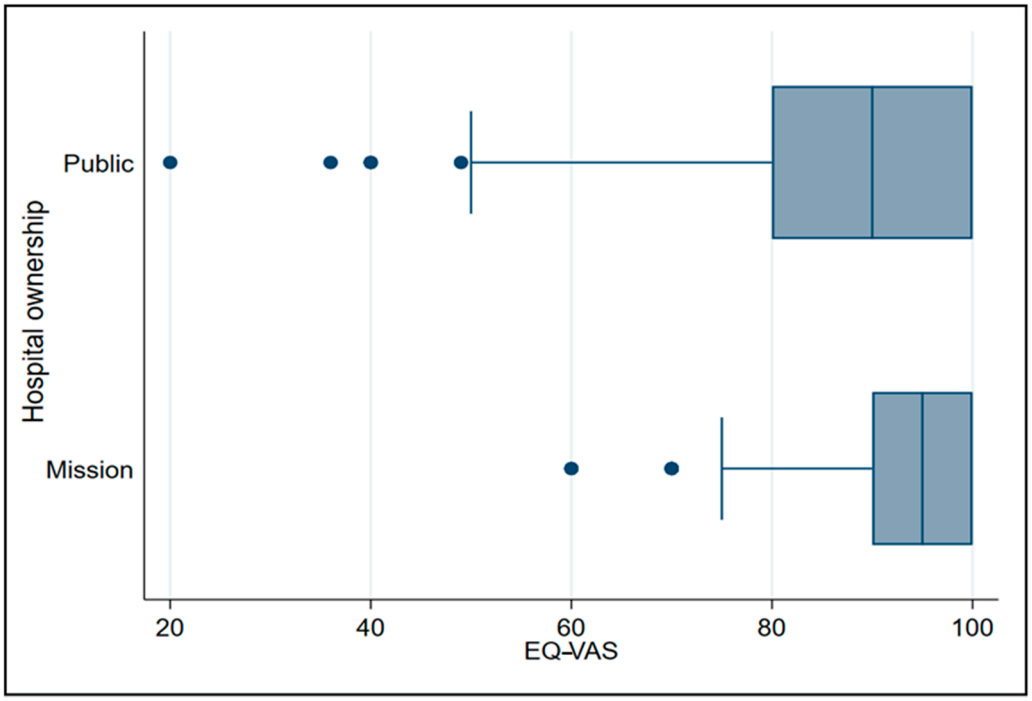

Figure 1. Box-and-whisker plot of EuroQol Visual Analogue Scale (EQ-VAS) by hospital ownership.

Among the public hospitals (n = 434), the median (IQR) was 90 (80–100). Approximately 25% of the healthcare workers' overall self-rated health status in public hospitals, was lower than 80. About 75% of the healthcare workers' overall self-rated health status was rated more than 80, with four outliers. The healthcare workers in the mission hospitals (n = 119), the median of their overall self-rated health status was 95 (90–100). About 25% of their overall self-rated health status was rated lower than 90. Approximately 75% of their overall self-rated health status was rated more than 90, with two outliers.

3.4. Overall Self-Reported Health Status by Hospital Ownership

The ANOVA results revealed a statistically significant difference between the public and mission hospital healthcare workers' overall self-reported health status (EQ-VAS) (p = 0.0057). Hospital ownership explained 1.38% of the variance in healthcare workers' overall health status (see Table 3).

Table 3. ANOVA of EQ-VAS and hospital ownership.

	n	R^2	Adjusted R^2	F	Sig. F Change
EQ-VAS	553	0.0138	0.0120	7.69	0.0057 *

* $p < 0.05$ indicates statistical significance.

3.5. Predictors of Overall Health Status

The linear multivariate regression model showed that approximately 13.73% of the variance in the overall health status among the respondents was explained by the personal, job-related and, work environment characteristics ($p < 0.01$) (see Table 4).

Table 4. Linear multivariate regression model results.

	n	R^2	Adjusted R^2	F	Sig. F Change
EQ-VAS	553	0.1373	0.964	3.35	0.0001 *

* $p < 0.01$ indicates statistical significance.

Table 5 presents the results of the linear multivariate regression model, including the twenty-five independent variables assessed association with the EQ-VAS (overall self-rated health status). The model showed six statistically significant predictors of overall health status among the healthcare workers ($n = 553$). Hospital ownership ($p = 0.029$), age ($p < 0.001$) and income ($p = 0.069$) were the three significant personal and job-related predictors associated with the healthcare workers' self-assessed health status. Moreover, the availability of water for handwashing ($p = 0.018$), presence of risk when using the toilet facilities ($p = 0.015$), and the overall safety of the hospital work environment ($p = 0.001$) were the three work environment-related predictors of healthcare workers' overall health status (see Table 5). Twelve of the twenty-five independent variables had negative coefficients, which implies that as values of those independent variables increase, the healthcare workers' overall health status decreases. On the other hand, thirteen variables had positive coefficients, meaning as the independent variables increase the overall health status of the healthcare workers increase.

Table 5. Results of linear multivariate regression of overall health status, and independent variables ($n = 553$).

Independent Variables	Coef.	Std. Err.	T-Value	Sig.	95% Conf. Interval	
Hospital Ownership	3.079	1.407	2.19	0.029 *	0.316	5.843
Sex	−0.072	1.093	−0.07	0.947	−2.220	2.075
Age	−0.431	0.103	−4.18	0.000 *	−0.634	−0.229
Income	2.550	1.401	1.82	0.069 **	−0.202	5.303
Marital status	1.329	1.245	1.07	0.286	−1.117	3.775
Education attained	0.006	1.170	0.01	0.996	−2.293	2.305
Years of experience	0.181	0.120	1.51	0.132	−0.055	0.416
Health professional cadre	0.435	1.208	0.36	0.719	−1.937	2.807
Type of employment	−0.599	2.226	−0.27	0.788	−4.974	3.773
In-service training	−0.440	1.180	−0.37	0.709	−2.757	1.877
Hours worked per week	0.021	0.039	0.53	0.595	−0.056	0.098
Household size	0.065	0.328	0.20	0.843	−0.579	0.708
Staff housing	−1.703	1.612	−1.06	0.291	−4.871	1.464
Consistent supply of water	0.602	1.698	0.35	0.723	−2.733	3.938

Table 5. *Cont.*

Independent Variables	Coef.	Std. Err.	T-Value	Sig.	95% Conf. Interval	
Occurrence of water unavailability	−0.956	1.148	−0.83	0.405	−3.211	1.299
Safe drinking water	−0.177	1.407	−0.13	0.900	−2.941	2.587
Acceptable main source of water	−1.020	1.675	−0.61	0.543	−4.310	2.670
Type of toilet facility	−0.951	1.265	−0.75	0.453	−3.437	1.535
Presence of risk when using toilet facility	−3.126	1.287	−2.43	0.015 *	−5.654	−0.597
Hospital dispose of garbage	0.038	1.373	0.03	0.978	−2.660	2.736
Availability of water for hand washing	4.478	1.895	2.36	0.018 *	0.756	8.200
Constant availability of soap	2.284	2.258	1.01	0.312	−2.153	6.721
≤5 m of handwashing station from the toilet	−1.767	2.112	−0.84	0.403	−5.917	2.382
Workplace safety and health committee	−1.238	1.211	−1.02	0.307	−3.617	1.141
Overall safety of hospital work environment	1.030	0.309	3.34	0.001 *	0.423	1.637
Constant	90.257	4.630	19.49	0.000	81.160	99.354

* $p < 0.01$ indicates statistical significance at 95% confidence level; ** $p < 0.01$ indicates statistical significance at 90% confidence level.

4. Discussion

HRQOL is based on an individuals' perception of their ability to execute functions associated with their health; related to the physical, psychological and occupational dimensions of life [24,43]. In this section, we discuss the HRQOL among healthcare workers in this study, compared to prior studies.

Overall, more than 30% of the healthcare workers studied reported experiencing problems across the dimensions. A study in South Africa found that up to 45% of the healthcare workers under study experienced problems across the five dimensions [28], thus the issue of HRQOL is in force. Both the South African study [28] and this study dispel the misconception that healthcare workers are automatically always in perfect health, due to their medical background. Thus, there is room for more action-oriented research to be done on healthcare workers' HRQOL. Health managers should consider implementing programs on health promotion behavior, and self-efficacy, which have been reported to have a positive impact on HRQOL [45], and thus, could enhance the healthcare workers' HRQOL.

In this study, a statistically significant difference between overall health status among healthcare workers in public and mission hospitals was revealed. As the hospital ownership changed from public to mission, the overall health status of healthcare workers increased by 3.079%. Healthcare workers in mission hospitals reported experiencing higher overall health status (73.11%) compared to their counterparts in public hospitals (64.75%). A study in Brazil revealed that healthcare workers in public hospitals had the lowest HRQOL scores compared to the private and philanthropic hospitals [25]. It appears that there is a need for interventions to increase HRQOL, especially in the public health sector. Most of the respondents in this study were from the public health sector, therefore policymakers and hospital managers should consider developing and implementing policy based on these research findings. Details regarding the predictors and possible solutions are discussed below.

Age was found to be a significant predictor of healthcare workers' HRQOL in this study. As the age of the healthcare workers increased, their overall HRQOL decreased by 0.431%. However, a study in Brazil revealed the older health workers were, the better their HRQOL compared to their younger counterparts [29]. The differences between the results in Kenya and Brazil may be attributed to contextual or cultural differences which influence

the perception of age. Based on these findings, age-friendly employment policies need to be developed and implemented within the hospitals and the health system at a large scale. Age-friendly employment policies, such as creating an ergonomic work environment supporting older healthcare workers, will enhance their health [46]. Guaranteed financial incentives, and relatively flexible work schedules that allow work–life balance are some age-friendly strategies that could promote older healthcare workers' health and encourage them to work in the health system longer [46].

Income was positively and significantly associated with HRQOL among healthcare workers in this study. The higher the income of the healthcare workers under study, the higher their overall HRQOL. At an individual level, an association has been reported between income and health, particularly in situations where there are scarce goods and services available to the public [47]. In this context, this may partly explain the recurrent health worker strikes due to delayed or missed payments [13], which elicit feelings of scarcity and uncertainty of payment of the income for which they have worked and on which they greatly depend. Kenya's age dependency ratio of 71.3% in 2019 indicates that children (0–14-year-olds) and the elderly (65 years and above) are dependent on those working for survival [48]. Therefore, delayed pay and missed pay among healthcare workers jeopardizes survival of health workers and their dependents, and aggravates the income inequalities which adversely affect population health [49] especially, in a lower-middle income such as Kenya with approximately 33.4% of the population living below the international poverty (Int$) line of Int$1.9 per day [50]. Thus, national and county policymakers should develop and implement strategies that facilitate timely payment and provide equal opportunities for promotions and incentives. This kind of action could potentially increase the HRQOL and eventually the retention of healthcare workers, especially in rural and remote areas in Kenya.

Previous studies revealed contrary results regarding the personal and job-related characteristics among healthcare workers. For instance, sex was a significant factor among health professionals in Turkey, where males had a higher HRQOL compared to their female colleagues [51]. This study revealed that sex was inversely related to HRQOL but was a non-significant characteristic among the respondents. In this study, the health professional cadre was also non-significant. A Turkish study on the other hand, reported higher HRQOL scores among physicians and health technicians compared to nurses and midwives [51]. Similarly, in Italy, the professional role significantly impacted the HRQOL, where nurses reported lower HRQOL scores compared to doctors and occupational safety and health technologists [52]. Although the professional cadre was a non-significant predictor in our study, further research needs to be done country-wide, to ascertain if this is similar or different in other locations. In addition, more studies on HRQOL across health professional cadres will inform future directions of health development, specific to the professional cadre needs [51].

In this study, length of work experience was a non-significant characteristic of healthcare workers' HRQOL; this was similar to a Turkish study [51]. On the contrary, in Italy, the longer a healthcare workers' career, the lower their general health score [52]. The differences in results could be attributed to contextual factors such as culture, location, and the period of study. As much as length of work experience was a non-significant predictor of HRQOL, age was a significant predictor in this study. The healthier healthcare workers are, the longer they are likely to work [46]. Hence, diversification of hospital organizing services, policies, and strategies such as age-friendly benefit packages promoting their health for example assistive devices were necessary: for example, comprehensive health insurance covers that facilitate restorative surgery, and acquisition of nutritional supplements [53], are some ways that could promote their health and, enable them work longer in the health system. However, the authors recognize that more research needs to be done in multiple settings to inform evidence-based policy and strategies towards promoting healthcare workers' HRQOL for longer job retention.

A healthy and safe work environment is valued by health providers and is paramount to the health worker performance and retention [54]. Improved performance among healthcare workers has been attributed to safety and hygiene; this subsequently has increased client satisfaction [54]. In this study, as the overall safety of the hospital work environment increased, the overall HRQOL of the healthcare workers increased. The presence of risk when using the toilet facility decreased the overall HRQOL among the respondents. This finding implies that the higher the perceived risk of the hospital work environment, the lower the healthcare workers' perception of their HRQOL. The healthcare workers' availability of water for handwashing increased the overall health status by 4.478%. Weinberg and colleagues [55] reported that the high-performance work environment in hospitals significantly correlated with better performance, better retention, and better-quality healthcare among the healthcare providers. Thus, policymakers and hospital managers need to consider the benefits and importance of designing a high-performance work environment because of its potential benefits related to the quality of healthcare delivery and patient outcomes [55].

According to Herzberg's Two Factor Theory on job attitudes [56], the predictors of healthcare workers' HRQOL are income or salary and work environment. Following this theory, hygiene factors are also known as job dissatisfiers. Hygiene factors are extrinsic to the job [57]. In this study, low salary and poor work environment were major dissatisfiers. Thus, hospital managers and health authorities should be explicit in the implementation policies of salary increment, financial incentives and payment of healthcare workers [57]. In relation to the environment, hospital managers and health policymakers should eliminate the dissatisfaction contributing to a poor working environment. Based on the findings, this could be achieved through improving the hospital safety, hygiene and work environment, in order to make the work environment in hospitals satisfying for healthcare workers to have a better HRQOL and to perform optimally.

The healthier healthcare workers are, the better the relationship they will have with colleagues, and they will deliver better healthcare services to patients they encounter daily [52]. The results in this study should be viewed with some limitations in mind; hence, opportunities for future research.

Firstly, this was a cross-sectional study; therefore, only correlations could be reported. Future studies using a longitudinal approach to monitor and evaluate the HRQOL of healthcare workers are essential to capture the trends accurately and modify health policy accordingly. The second limitation is that the sample reflects the healthcare workers in one of the forty-seven counties in Kenya, thus limiting the generalizability of these results to the entire country. Future studies need to be done in the other 46 counties in order to assess the similarities and variations in HRQOL among the healthcare workers in the different localities countrywide. Thirdly, due to the self-reported nature of the questionnaire used, the possibility of response bias is present. To reduce the likelihood for such a bias, respondents were informed that the research was anonymous, and their honesty would be valued. In future research, the HRQOL could be assessed alongside government and mission programs aimed at improving the health and wellbeing of the health workforce.

5. Conclusions

This study highlighted personal, job-related, and work environment predictors of HRQOL among healthcare workers in public and mission hospitals Meru County, Kenya. It is evident that some personal, job-related, and work environment characteristics are significant predictors of HRQOL among healthcare workers. The majority of the respondents reported perfect health, thus through evidence-based policy development and implementation of HRQOL programs, other health workers with problems stand a chance of attaining a higher HRQOL. This study emphasizes the importance of involving the healthcare workers in the decision-making process of promoting their HRQOL, because some of our results differed with prior studies also among healthcare workers. It is evident that not every healthcare worker is in perfect health, as is the misconception based on their medical

background. This finding implies that health policymakers and managers should aim at empowering and enhancing the changeable HRQOL among healthcare workers at the individual, organizational, and health system levels. Designing evidence-based medium- and long-term policies and programs would ensure effective implementation, and health workforce strengthening. In order to ensure sustainability within the national and county health systems, an inter-sectoral collaboration between the public and private sectors is recommended during the development (and revision) of health workforce policy aimed at HRQOL and wellbeing among healthcare workers in Kenya.

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Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available until this article is published.

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Article

The Managerial Implications of the Key Performance Indicators in Healthcare Sector: A Cluster Analysis

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Abstract: The aim of the paper is to identify a set of the key performance indicators (KPIs) in order to provide managers and employees from the healthcare system with recommendations for evaluating, monitoring, and controlling the critical factors that influence the performance of the healthcare sector in Algeria during a pandemic crisis. During February–August 2020, a cross-sectional survey design was administrated to medical employees from hospitals situated in the northeastern part of Algeria. Our findings proved that the four groups of KPIs correlate to each other, and during this period, the triple relationship among human factor-technology-medication plays a decisive role in reducing the pressure on the medical system and overcoming the crisis. In order to increase the efficiency of the decision-making process, a hierarchy of KPIs is recommended in terms of their impact on the performance of medical staff. The practical importance of our research consists in ranking KPIs on four clusters that support managers to focus on both the human factor (clinical errors, infection rate, and medication errors) and the technical elements of maximum importance (laboratory test time, location of the facility, and sufficient air).

Keywords: key performance indicators; healthcare system; pandemic crisis; COVID-19; Algeria

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1. Introduction

The recent crisis that the entire world is facing caused by COVID-19, a pandemic that has forced all organizations, whether public or private, to rethink their mission and vision. Thus, the efficacy of the healthcare sector depends greatly on the rapidity to adapt to the new dramatic situation. Before the World Health Organisation (WHO) had declared the COVID-19, a pandemic crisis, on 11 March 2020, Algeria had the situation under control, although the first two cases were registered on 25 February 2020. The rapid evolution of the pandemic coronavirus crisis requires that the common strategies should be oriented toward ensuring the health of the population and a continuous assessment of the events to give priority to future needs. The situation in Algeria is not far from the rest of the world, with a total of 55,081 cases and 1880 deaths recorded until 22 October 2020, with a mortality rate of 11.70% [1]. This high rate represents a threat to the national health situation of the country that leads to making a study to understand how the healthcare sector is dealing with this crisis and what are the available and efficient managerial tools to help managers and healthcare staff to better control facilities [2].

The international statistics of WHO [3] place Algeria in the fourth position in Africa (with 50,914 cases) after South Africa (with 669,498 cases), Ethiopia (with 72,700 cases), and Uganda (with 7364 cases) with a total of 1,172,342 confirmed cases and 25,481 deaths in the continent as the last update.

Watkins et al. [4] analysed the impact of the pandemic situation on SMEs from Australia and they observed that only six per cent of Australian SMEs had a plan for avoiding the pandemic crisis. Thus, the other 39 per cent consider that the pandemic has no impact

on their business and over 60 percent called upon the need to prepare a viable strategy to tackle a pandemic situation. As a result, in 2007, the Australian SMEs were not prepared for a pandemic situation and 13 years later SMEs worldwide are in the same situation.

Watkins et al. [5] considered that a strategy for the pandemic situation among SMEs depends on the perception of the risk level and the resources that are available to prepare and frame the strategy.

Ivo Hristov and Antonio Chirico [6] identified the impact of key performance indicators (KPIs) on company performance in the framework of sustainable strategies and they arrived at the conclusion that existing literature does not provide ample evidence about how to address the crises from managerial perspective.

At this moment, healthcare managers, officials, and policymakers are seeking to answer the following questions:

How will we manage to streamline the healthcare sector in real-time to overcome this pandemic generated by the novel coronavirus?

Can KPIs be used as a tool enabling a quick reaction of the healthcare sector's facilities to the adverse effects of COVID-19?

What is the possible set of KPIs that leaders in the healthcare sector are required to check in order to deal with the consequences of the virus and re-establish "normality" in the social and business environment?

The answers to these questions were found in the last months from many scholars around the world from economic point of view, but not from the healthcare sector perspective [7–10]

These analyses motivated us to approach this pandemic crisis from another perspective based on KPIs as instruments of human competencies in the fight against this enemy.

The range of factors affecting sustainability performance is varied, from the small details to the big issues in healthcare facilities. Thus, most of them are not obvious to the decision makers (e.g., maintenance and building design) because of lack of technical skills (e.g., attention towards the aspects of bioclimatic passive strategies and incorrect architectural and flexible layouts, which often limit the clinical processes and causes the decrease of performance and sustainability criteria) [11].

The use of KPIs as tools to improve the effect of public health measures and as indicators of the measures that need to change in function of true morbidity and mortality rates.

2. Literature Review and Premises of Research

Mohamed Khalifa and Parwaiz Khalid [12] classified KPIs on three levels of performance (operational, tactical, and strategic indicators), six levels of performance dimensions (safety, effectiveness, efficiency, timeliness, patient-centeredness, and equity) and three levels of system components (structure, processes, and outcomes). They have identified fifty-eight KPIs, classified into ten categories.

According to the literature review and based on our preliminary research, considering the particularities of the pandemic COVID-19, 41 indicators were selected for the KPI of the healthcare system in Algeria. The structure of the KPI is the following: ten indicators for social sustainability, eight indicators for economic sustainability, nine indicators for the internal process and fourteen indicators for the technical domain.

2.1. Social Sustainability Indicators

Social sustainability indicators (SSI) for healthcare facilities facing a crisis can be ambiguous to define and apply. Vallance et al. [13] (p. 342) affirm that SSI is "a concept in chaos". SSI have been organized under the broad categorical concerns of well-being, values, agency, and inequality [14].

Some researchers consider that SSI can be used to measure the performance in a state of overall well-being [15], and that KPIs should mainly contribute to improvement of the people's life [16].

In consequence, we need to be very specific while setting the indicators for social sustainability that helps track the critical metrics within a facility during a global pandemic crisis. As a result, there have been many attempts to categorize the various approaches to social sustainability indicators (Appendix A).

2.2. Economic Sustainability Indicators

The assessment of sustainability performance is assumed to be appropriate to the healthcare industry. Many studies were carried out with the scope of identifying an initial set of potential KPIs from an economic perspective [17] that could be used for sustainability performance evaluation to keep facilities operating with the minimum regular conditions of sustainability while facing the global pandemic (Appendix B).

A detailed explanation of ESI from a company point of view (Novo Nordisk A/S) was realized by Morsing et al. [18] and they arrived at the conclusion that KPIs are related to social and economic objectives, but are reflected on internal environment and also external environment.

2.3. Indicators of Internal Process

The indicators of internal process (IIP) in healthcare facilities are a well-defined performance measure used to monitor, analyse, and optimize all relevant processes and practices of the facility's staff to increase patient satisfaction and diminish any possible errors or damages (Appendix C).

2.4. Technical Indicators

Because of the complex technical and architectural nature of healthcare facilities, it requires a special set of indicators that suit the specific strategic objective's action plan. When facing a global pandemic such as COVID-19 every detail becomes important and overlooking, even the thinnest element such as insulation or air quality may lead to losing control over the crisis (Appendix D).

The KPI's constitute a management control tool that is used for planning and prioritizing actions, for making decisions and responding to problems in real time [19,20]. Elmar Hörner [21] arrived at the conclusion that one of the most important KPIs for measuring the success of the areas that need improvements in the pharmaceutical domain (e.g., Merck KGaA) is "Decision Making". The continuous monitoring of KPIs makes possible to answer the question of whether the objectives are achievable and, if yes, to what extent, which constitutes the basis for evaluation of the performance of contemporary facilities.

As the main role of a KPIs' system is tracking the performance and sustainability in the healthcare facility for the interest's spot; thus, it is fundamental to make an analysis of the facility's needs, strategy and goals. Therefore, in the case where the urgent need of crisis management is the main strategy, KPIs should serve this objective.

According to Schmidt et al. [22] (p. 760): "In order to successfully create new KPIs, it is crucial to analyse and understand the underlying cause and effect relationships as well as interdependencies between processes, equipment, and energy efficiency".

Recently, Daria Mikhailova [23] has chosen the KPIs to assess the performance of Pharmaceutical Project Management Quality System Effectiveness and she arrived at the conclusion that KPIs proved a practical support for both system monitoring and system interventions. Moreover, David Parmenter [20] underlines the importance of KPIs selection in the healthcare system and he advised us never underestimate the negative consequences of the choice of an inadequate KPIs.

Fernandes et al. [24] stated that all panellists finally accepted only eight KPIs. We allocated the eight KPIs of Fernandes et al. to our KPIs classes (e.g., SSI: providing in-person disease and medication education to patients; participating in interprofessional patient care rounds; providing discharge patient medication education; ESI: performing discharge medication reconciliation; and IIE: performing admission medication reconciliation (in-

cluding best-possible medication history); completing pharmaceutical care plans; resolving drug therapy problems; and providing bundled, proactive direct patient care activities).

Matsuoka and Hirai [25] used the KPIs for explaining the core principles of Society 5.0 based on three factors (structural transformation, technological innovation, and quality of life). In addition, Re Cecconi et al. [26] used the KPIs to underline the importance of the technical indicators as strategic tools for improving the decision-making process. Jiang et al. [27] starting from the premise that performance measurement is of vital importance for the healthcare systems, especially during crisis periods, they proposed a model based on KPIs to help managers to make good decisions under time pressure. In the same line, Niemi et al. [28] consider the mean lead-time (MLT) as one of the most important KPI.

Ramzi Shawahna [29], (p. 2) affirms that KPIs "are often developed for capturing the performance of healthcare providers and the provision of services. These KPIs are supposed to monitor if healthcare services were provided with consistency and efficiency".

Based on both theoretical and practical arguments, we propose the following hypotheses:

Hypothesis 1. *The economic sustainability indicators directly influence the indicators of internal process*.

Hypothesis 2. *The social sustainability indicators directly influence the economic sustainability indicators.*

Hypothesis 3. *The social sustainability indicators directly influence the indicators of internal process*.

Hypothesis 4. *The technical indicators directly influence the economic sustainability indicators*.

Hypothesis 5. *The technical indicators directly influence the indicators of internal process*.

Hypothesis 6. *The technical indicators directly influence the social sustainability indicators.*

3. Methodology

To select the KPIs, we have conducted in-depth interviews with four health management experts and one assistant professor from the Faculty of Medicine of Constantine 3 Salah Boubnider University to discuss and identify a list from the extracted indicators of literature review (185). The first set of indicators was developed from the literature review: 158 indicators were extracted from the discussions with the experts and were selected, then 62 indicators were divided into four main domains for sustainability assessment: social, economic, technical, and internal processes. The selected indicators were used to design the questionnaire for the first round of the Delphi method.

In the second stage, in consensus with Galanis [30], we employed the Delphi method in two rounds. In the first round, 20 public hospitals and managers for each hospital have been chosen to participate in the research, as they were involved in sustainability. The questionnaires were distributed to managers to investigate the implication of KPI's for primary healthcare facilities' sustainability performance.

In the second round, we distributed the questionnaires to the same hospitals' managers, and, in this stage, we eliminated the indicators with the lowest mean scores. After we received the feedback from the managers, we reduced the number of KPIs (we eliminated 22 indicators) and 41 KPIs were included in the final setup of our research.

This quantitative study has been conducted from the first week of recording the first three cases of COVID-19 disease in Algeria until the end of August 2020; investigation was made in two main wilayas: El Taref and Constantine, including different type of facilities: university hospital, public hospital centers, and neighbourhood's healthcare facilities.

During February–August 2020, a total of 300 questionnaires were distributed to Algerian hospitals that were identified as very important hospitals in the framework of the pandemic coronavirus. In total, 210 completed responses (response rate of 70 percent)

were collected from medical staff who are directly involved in the battle with this invisible enemy. Respondents were required to evaluate the importance of every KPIs using a five-point Likert scale (1—not important at all to 5—very important).

We chose to use the SmartPLS [31] method to analyse the data and we started the research by assessing the measurement model to ensure that each construct's KPIs are reliable and valid.

3.1. Sample

The 88 respondents (41.9%) were from facilities situated in El Taref and 122 respondents (58.1%) from facilities situated in Constantine. The gender of the respondents was balanced with 96 females (45.7%) and 114 males (54.3%). The age of the respondents was distributed as follows: 21.4% between ages of 25 and 35 years, 37.6% between ages of 36 and 45 years, 24.3 between ages of 46 and 55 years, and 16.7% between ages of 56 years and over (M = 2.36; SD = 0.999).

A total of 109 respondents participated in the pilot study and at the final of this study all 41 KPIs were retained because they registered a loading factor above the threshold of 0.70 (Appendix E), in consensus with Sarstedt et al. [32].

3.2. Measures

We started the research by assessing the measurement model to ensure that each construct's KPIs are reliable and valid.

Internal consistency of the research model was assessed by partial least squares structural equation modelling (PLS-SEM), we started by examining the indicator loadings [32], ranging from 0.701 to 0.866 and indicating that the KPIs have a very good degree of reliability (Appendix E).

Next, we calculated the "reliability indicators" and higher values indicate increased levels of reliability. The main indicators exceed the minimum threshold of 0.7 [33] as follows: Cronbach's Alpha that measures internal consistency reliability ranged from 0.903 to 0.932 and represent good to very good reliability levels of KPIs, Dijkstra-Henseler's rho_A ranged from 0.907 to 0.934 [34] and composite reliability (CR) ranged from 0.920 to 0.940. Thus, all the values exceed the minimum threshold value of 0.7 for all variables indicating that the measurement model has good reliability (Table 1).

Table 1. Descriptive Statistics, and Reliability and Validity of Measurement Model.

KPIs	Mean	Std. Deviation	Cronbach's Alpha	rho_A	Composite Reliability (CR)	Average Variance Extracted (AVE)
ESI	3.86	0.648	0.914	0.933	0.929	0.622
IIP	4.01	0.670	0.918	0.922	0.932	0.606
SSI	3.81	0.776	0.903	0.907	0.920	0.534
TI	3.83	0.673	0.932	0.934	0.940	0.530

Source: Authors' own contribution based on SmartPLS.

The descriptive statistics indicate the values of the mean and we observe that a mean value of 4.01 out of 5 suggests that most of the respondents mainly agreed that IIP is very important KPIs for the healthcare system in a pandemic situation. Meanwhile, the SSI registered the lowest value (3.86) and an explanation consists of the particularity of this period and on pressure existing on medical personnel.

The pressure is reflected on value of loading factor of the IIP-C6 (Medical errors = 0.860), followed by IIP-C5 (Clinical errors = 0.847); IIP-C1 (Medication errors −0.822); IIP-C3 (Mortality rate = 0.789); IIP-C4 (Infection rate = 0.770) and finally IIP-C9 (Laboratory test time = 0.720).

The standard deviation shows that there are no relevant differences among the KPIs as the values are close to one another for ESI, IIP, and TI (ranged from 0.648 to 0.673); only SSI registered a value above 0.770.

We evaluated the extent to which any selected construct differs from the others and we tested the "convergent validity" and we used the average variance extracted values that are greater than 0.5 (from 0.530 to 0.622) and validate the latent variables for our model composition, in consensus with Hair et al. [35].

Average variance extracted (AVE) analysis was conducted for evaluating if we have a good convergent discriminant validity and if each construct exceeds the threshold value of 0.50. The result proves that all KPIs are retained.

The results prove that the indicators of internal process have the highest value of Cronbach alpha (0.918) which highlights the importance of this group of indicators in the context of the current pandemic coronavirus crisis.

We continued to assess the "discriminant validity" by calculating the Fornell and Larcker [36] criterion and for proving the relevance of the structural model. The highest correlation was registered between ESI-ESI (0.788) and the lowest correlation was registered between ESI-SSI (0.423).

In order to consolidate the assessment of the discriminant validity in variance-based structural equation modelling we used Heterotrait–Monotrait ratio (HTMT), which is considered superior to previous indicators [37] as Fornell–Larcker criterion and (partial) cross-loadings (Table 2).

Table 2. Heterotrait–Monotrait Ratio (HTMT) Test.

KPIs	Heterotrait–Monotrait Ratio (HTMT)				Fornell–Larcker Criterion			
	ESI	**IIP**	**SSI**	**TI**	**ESI**	**IIP**	**SSI**	**TI**
ESI	-	-	-	-	0.788	-	-	-
IIP	0.511	-	-	-	0.496	0.778	-	-
SSI	0.420	0.848	-	-	0.423	0.784	0.731	-
TI	0.608	0.739	0.714	-	0.594	0.697	0.679	0.728

Source: Authors' own contribution based on SmartPLS.

The results show that the values of HTMT were smaller than 0.90 (ranged from 0.420 to 0.848), which means that this ratio meets the requirements of the Henseler et al. [38]. In order to sum, the model assessments prove a good evidence of validity and reliability.

4. Results and Discussion

The correlation between KPIs was used for verifying the relationship between all variables (Table 3).

The correlations between variables reveal to us that the age of respondents negatively influences three KPIs (IIP, ESI, and TI) and prove that under pressure the experience of the medical personnel is important for the decision-making process. The age of respondents is positively correlated with patient satisfaction, because no matter their age, the healthcare system employees are devoted to their job and to their patients.

The gender of respondents and the location directly and negatively influence two KPI's (ESI and TI) and directly and positively influence the other two KPIs (SSI and IIP). These correlations prove that the practical KPIS as ESI and TI are perceived as having a negative influence on decision-making process under pressure.

Table 3. Correlations between KPIs.

Variables	Correlations	Age	Gender	Location	SSI	ESI	IIP	TI
Age	Pearson Correlation	1	0.050	0.192 **	0.084	−0.069	−0.005	−0.059
	Sig. (2-tailed)		0.467	0.005	0.226	0.320	0.948	0.392
	N	210	210	210	210	210	210	210
Gender	Pearson Correlation	0.050	1	−0.189 **	0.092	−0.065	0.001	−0.028
	Sig. (2-tailed)	0.467		0.006	0.185	0.348	0.986	0.689
	N	210	210	210	210	210	210	210
Location	Pearson Correlation	0.192 **	−0.189 **	1	0.060	−0.101	0.063	−0.060
	Sig. (2-tailed)	0.005	0.006		0.386	0.146	0.364	0.388
	N	210	210	210	210	210	210	210
SSI	Pearson Correlation	0.084	0.092	0.060	1	0.392 **	0.783 **	0.666 **
	Sig. (2-tailed)	0.226	0.185	0.386		0.000	0.000	0.000
	N	210	210	210	210	210	210	210
ESI	Pearson Correlation	−0.069	−0.065	−0.101	0.392 **	1	0.475 **	0.562 **
	Sig. (2-tailed)	0.320	0.348	0.146	0.000		0.000	0.000
	N	210	210	210	210	210	210	210
IIP	Pearson Correlation	−0.005	0.001	0.063	0.783 **	0.475 **	1	0.685 **
	Sig. (2-tailed)	0.948	0.986	0.364	0.000	0.000		0.000
	N	210	210	210	210	210	210	210
TI	Pearson Correlation	−0.059	−0.028	−0.060	0.666 **	0.562 **	0.685 **	1
	Sig. (2-tailed)	0.392	0.689	0.388	0.000	0.000	0.000	
	N	210	210	210	210	210	210	210

**. Correlation is significant at the 0.01 level (2-tailed); Source: Authors' own contribution based on SmartPLS.

The location is an important variable, because the patients with COVID-19 are in some regions and they are treated in hospitals specially designated for this disease. Algeria has a public healthcare sector and it is accessible and free of charge for all citizens, financed by the government, given Algeria's young population. In close alignment with this long-term strategy, the government maintains an intensive immunization program.

The correlations between IIP and the other three KPIs are positive and prove that internal process is developed for the purpose of patient satisfaction (0.783) and considering the consequences of the infection with COVID-19, IIP is related to facilities of the hospital (0.685) in terms of qualitative and especially, quantitative KPIs.

We analyse the results and we first test the collinearity of the research model and we observe that the variance inflation factor VIF values ranged from 1.897 (Hospital readmission rate) to 3.852 (Indoor air quality) and is within the limits recommended by Hair et al. [35].

The results prove that there is no collinearity problem interfering with our KPIs and we continued to evaluate the research model by interpreting the coefficient of determination (R2), f^2, and P. The coefficient of determination between 0.25 and 0.50 is considered good and above 0.50 are considered very well. Figure 1 shows values of R^2, ranged from 0.254 to 0.673. In conclusion, the predictive power of the model and R^2.

We arrived at the conclusion that all the KPIs are valid and reliable and we assess the research model and test the hypotheses (Table 4).

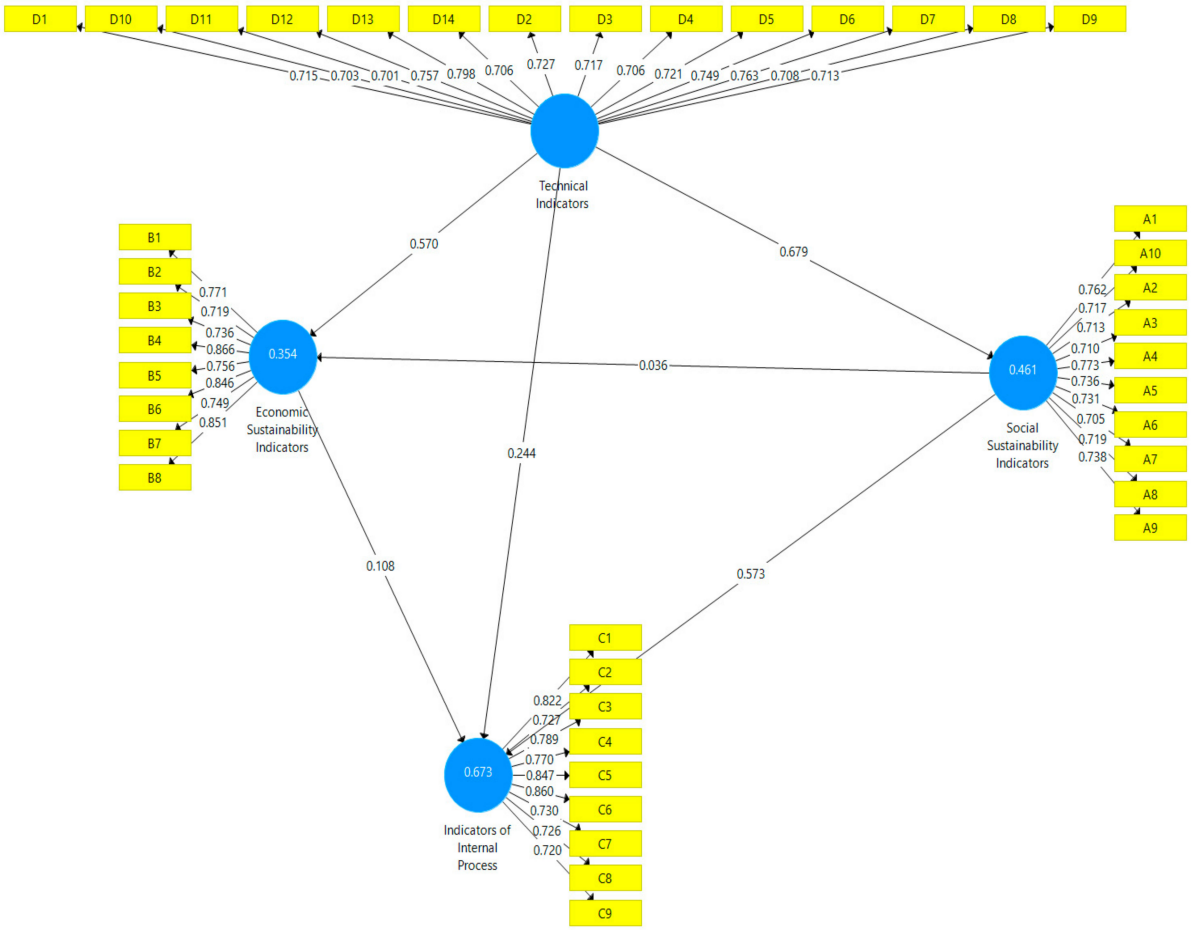

Figure 1. The Path Coefficients of the research model for KPIs. Source: Authors' contribution based on SmartPLS.

Table 4. Path Coefficients.

Relations	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	f^2	*p*-Values	Confidence Intervals		Conclusion
							2.5%	97.5%	
ESI -> IIP	0.108	0.106	0.044	2.445	0.023	0.015	0.012	0.184	Supported
SSI -> ESI	0.036	0.040	0.073	0.491	0.001	0.623	−0.096	0.188	Not Supported
SSI -> IIP	0.573	0.571	0.051	11.262	0.540	0.000	0.474	0.666	Supported
TI -> ESI	0.570	0.570	0.066	8.590	0.271	0.000	0.441	0.697	Supported
TI -> IIP	0.244	0.248	0.064	3.826	0.077	0.000	0.131	0.373	Supported
TI -> SSI	0.679	0.683	0.035	19.380	0.855	0.000	0.611	0.744	Supported

Source: Authors' own contribution based on SmartPLS.

The resulting effect size value of each KPI in the model ranges from 0.001 to 0.855, which are included in the category of very small to large [39]. The value of goodness of fit that is generated through the standardized root mean squared residual (SRMR) is equal to 0.08, which means that our model fits the empirical data [40]. We also tested our hypotheses with the coefficient parameter and the significant value generated from the 95% bias-corrected confidence intervals of each KPI.

The path coefficients provide significant value (at the *p* 0.05 level), only the relationship SSI -> ESI is not supported. Thus, the value of the coefficient (T) to the relationship SSI -> ESI is 0.491 with a *p*-value < 0.623. In conclusion, all hypotheses are supported except for the second hypothesis.

The particularities of our study due to the pandemic crisis do not allow us to affirm that our results support previous studies, because not many studies related to KPIs were developed during the pandemic crisis.

We can link these results to the pandemic crisis when the communication process and human factors are more important than economic and material factors. Hospital performance is a reference to key performance indicators (KPIs), especially to IIP and TI as promoters of ESI and SSI, because in this period quantitative assessments of hospitals became an indicator of the capacity of them to achieve the new goals by making efficient use of the limited resources available in the crisis period. This signifies that TI can be used to improve SSI and the ESI have a positive effect on IIP.

Healthcare facilities all over the world are dealing with major challenges to keep operating in a performing way during crisis time especially when it's facing a world pandemic such as Covid-19. This pandemic coronavirus took by surprise both the decision-makers and the employees who faced an unpredictable enemy and impossible to be controlled. The fact that many organizations, public or private, were forced to discontinue their activity for an unspecified period of time has created a state of panic and uncertainty, upsetting society at all levels.

Our findings proved that KPIs play an important role in increasing the performance of healthcare systems, and, especially during the pandemic coronavirus crisis (Appendix F).

Figure 2 shows the four clusters of KPIs that can be a priority for hospital managers in a crisis period and every cluster includes different KPIs ranked by importance.

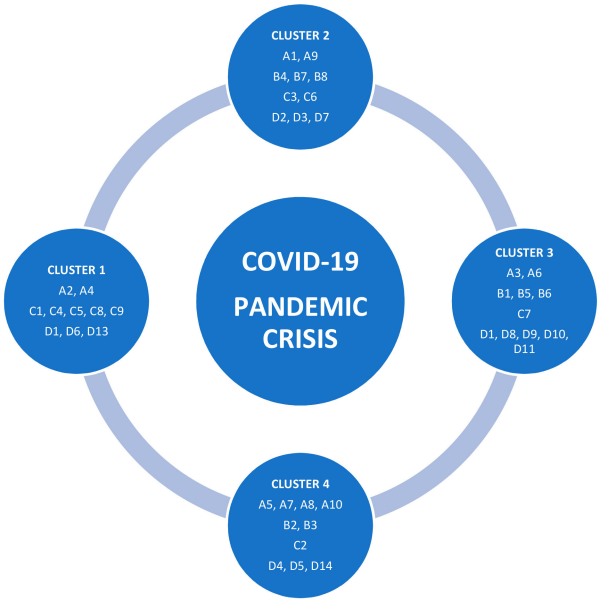

Figure 2. The Clusters of the key performance indicators (KPIs) as a managerial decision support during pandemic crisis. Source: Authors' own contribution

The first cluster includes 10 KPIs, two KPIs of SSI (related to the average hospital stay and on patient waiting time), five KPIs of IIP (related to clinical and medication errors, infection rate, average length of stay in the emergency room, and laboratory test time), and the other three KPIs are from TI as indoor air quality, sufficient air conditioning, and location of the facility.

This cluster proves the importance of this indicator in a crisis because under pressure and in very stressful conditions the decisions made by doctors concerning medical prescriptions or dozes might be mistaken [41]. Clinical errors tracking and assessment appears to be significant in crisis time and can affect the medical staff and equipment's effectiveness. The sufficient air conditioning allows checking the sufficiency of air out of the facility's HVAC system to ensure the well-being of staff and patients inside the healthcare facility. This indicator is crucial for the patients because one of the causes of death is insufficiency respiratory. Waiting time in the emergency room shows the value of assessing this metric in order to set less waiting time targets in crisis time.

These findings are in consensus with the findings of Mohamed Khalifa and Parwaiz Khalid [12] who considered that patient safety and infection control rates are very important indicators to gauge the quality of the healthcare system.

The second cluster comprises the other 10 KPIs as follow: two KPIs of SSI that measure the patient satisfaction and patient transfer rate to other facilities, three KPIs of ESI that indicate average care costs of insured patients, cost of work-staff and current cost per bed; two KPIs of IIP related to mortality rate and to medical errors, and three KPIs of TI concerning natural light penetration, vertical circulation and degree of thermal comfort. Patient satisfaction measures the degrees to which the medical service responds to patients' expectations is a high priority for the management strategy in a pandemic crisis. Mortality rate measures the rate of deaths while in a world pandemic and it is considered a structural tool for decision-making and setting the facility's strategy to deal with the crisis according to the given number. The degree of thermal comfort could affect or be affected by other technical and internal processes indicators related to the wellbeing inside the facility.

The third cluster includes 11 KPIs structured by categories as following: two KPIs of SSI (related to hospital readmission rate and to waiting time in the emergency room); three KPIs of ESI including average hospital expenses, cost of drugs, and equipment and also average care costs; one KPI of IIP (waiting time for admission to the operating room), and five KPIs of TI (waste management, energy and emissions control, quality of the building envelope, artificial lighting, and water consumption).

The cost of drugs and equipment needs to be taken into consideration because of the increasing of needed medicines, supplies, and special equipment as in a crisis, and to be correlated to the patient waiting time in a crisis that is also important because every patient needs medical care as soon as possible when he/she arrives at the facility to avoid any complications could expose his/her lives to danger. Quality of the building envelope plays a key role in the healthcare environment inside the facility as it controls directly other technical indicators ranked.

The fourth cluster includes 10 KPIs as follows: four KPIs of SSI (patient safety, rate of vacant patients in beds, patient complaint rate, and the number of new patients); two KPIs of ESI concerning average maintenance costs and costs per payer; one KPI of IIP related to bed occupancy rate and three KPIs of TI (acoustic insulation, distributions of medical devices, and hierarchy of functional spaces). The rate of vacant patients in beds allows the facility managers to set their priorities and to make decisions like patients transfer to other departments or facilities. The number of new patients indicates the particularity of this pandemic crisis because it is limited to receive more patients in the facility, because of the virus, which needs to be followed to make sure that the facility is ready for offering care to an expected number of patients. The hierarchy of functional spaces underlines every daily movement of the staff between rooms, controlling, services, and departments. As a result, such a metric gives more flexibility and performance in hard times where every second counts inside the healthcare facility.

The respondents considered as very important two indicators: infection rate and patient safety, because controlling infection rates and applying protocols in healthcare facilities is considered a key practice when facing pandemics. In this situation, patient complaint rate, like the patient's satisfaction, is not a high priority for healthcare facilities in a pandemic situation.

Waiting time for admission to the operating room gives the facility's managers a clear vision about the target time to set surgical operations to increase the internal processes performance, going to cost of work-staff that is considered as a lower priority in these circumstances.

Laboratory test time was not considered as a high priority indicator, and this might be justified by the healthcare facilities protocols in case of a pandemic crisis as test samples and results are oriented to the big test labs in the country such as Pasteur Institute.

Our results confirm the findings of McCance et al. [42] that analysed the eight KPIs clustered within the person-centered processes domain of the framework, and these KPIs

were related to patient satisfaction, confidence, and implication in the decision-making process about his/her care.

To prepare action plans for in time strategies and to implement them successfully, the healthcare facilities continue to look for appropriate strategy implementation tools. Consequently, the measurement systems are used to evaluate the effects of the healthcare facilities actions. The role of such system is to support the management process as well as the process of implementation of the hospital's strategy, which should include not only solid technical and economic factors (particularly financial measures), but also the requirements of the corporate social responsibility and sustainable development standards, as well as the employee relations and value management requirements [43].

One solution is to use KPIs and keep controlling performance and sustainability through dashboards and scorecards to make frequent and continuous evaluation for the outputs to ensure a better crisis management for healthcare facilities and to make the strategic objectives to be achieved clearer and more convenient. In the case of Algeria, we did not find previous studies about KPIs for evaluation in healthcare facilities from a managerial perspective. For this reason, we consider this study important and it can add a real value to the research, because it helps the managers to evaluate sustainability performance of healthcare facilities in crises.

5. Conclusions

Our findings prove the opportunity for healthcare system employees and not only for hospital managers, to identify critical KPIs in a short period of time and with lower costs. It is very important to consider that the IIP are situated in the first place, which gives us an idea about the priorities of healthcare staff in a crisis. We recommend focalizing the improvements in the areas with high potential to propagate the factors of the pandemic crisis.

In the framework of a pandemic crisis, the performance of healthcare systems is related to its capacity to quickly respond to danger generated by COVID-19. In this period, it is difficult to adapt to an existing model, because the variables are completely different, and the weaknesses of hospitals are also different.

The practical implications are underlined by our model that provides hospitals' manager's solutions for the decision making process under pressure indicating the ways of improvements of quality of medical services by implementing suitable KPIs. Thus, these clusters of KPIs can be used as tools for developing sustainable healthcare systems not only in Algeria but also in developing countries that need financial material and human support to overcome the pandemic crises.

Our study fills the gap in the literature concerning the correlations between KPIs in the healthcare sector during a pandemic crisis. Moreover, the managers can establish realistic goals by using KPIs taking into account their level of importance as early-warning indicators that can point out forthcoming changes in the evolution of the crisis. Healthcare managers can use the clusters KPIs to evaluate executive performance and to develop strategies for saving lives.

In the last years, the KPIs were found as representative of overall healthcare systems around the world [24]. Paradoxically, the qualitative differences between healthcare systems around the world are reduced by the particularities of the crisis, because a crisis is a negative phenomenon at globally level and its repercussions are more or less evaluated by KPIs [27]. Moreover, during a pandemic crisis, the information plays an important role in reducing physiological and mental impact on the people [44] and for this reason, it is necessary to use the KPIs clusters in a flexible way and to adapt them to healthcare facilities [45].

The results could provide a guide to hospitals' decision-makers in order to have under control the situation of the Algerian healthcare system [46] and for the other countries healthcare systems, because our findings are in consensus with the results of the other researchers [47–49]

The limitations of our study are related to the sample size, because, considering the short period of analysis, we used a relatively small sample size, from Algerian hospitals and the findings should be critically analysed by considering the specificity of Algeria.

This study only analysed the relationship between four groups of KPIs without testing the direct impact of these KPIs on the performance of the Algerian hospitals.

Our Clusters of KPIs model can be adapted to healthcare systems from different countries, but it is important that every healthcare facility choose its own KPIs taking into account their human, financial and technical resources [50].

Future research should be oriented to testing the role of KPIs in the improvement of the hospitals' performance in relationship with the social responsibility and with the improvements of the commitment of the healthcare systems employees.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Social Sustainability Indicators (SSI).

Indicators	Definition
A1—Patient satisfaction	It is an important indicator of healthcare performance [51], and it measures the degrees to which the medical service responds to patients' expectations [52].
A2—Average hospital stay	It shows how quickly medical staff can diagnose and prescribe treatment that does not require a further stay. Moreover, helps the facility predict how many patients they can bring into the facility during a specific period [53].
A3—Hospital readmission rate	This indicator calculates the rate of patients who come back to the facility shortly after they were seen. If high, it can indicate a lack of staff, experience, or attention during [53].
A4—Patient waiting time	It indicates the time a patient waits in a facility's waiting room before being seen by one of the medical staff. It measures the average length of time patients spend in the hospital, per admission category [54].
A5—Patient safety	This indicator displays a healthcare facility's ability to keep patients safe from contracting infections, complications, and other issues by tracking it in a recorded period that helps to recognize what areas are causing issues that can be improved [55].
A6—Waiting time in the emergency room	It gauges the time that the patient stays waiting in the emergency room until he gets a care service in the area [53].
A7—Number of new patients	This indicator measures the number of unique individuals who were first-time patients during the reporting period [53].
A8—Rate of vacant patients in beds	It shows the average rate at which beds in the facility are vacant [53].
A9—The patient transfer rate to other facilities	It tracks the number of patients being transferred to other healthcare facilities during the reporting period.
A10—Patient complaint rate	It logs the number of complaints filed by patients before, during, or after their period of care.

Appendix B

Table A2. Economic Sustainability Indicators (ESI).

Indicators	Definition
B1—Average care costs	It is an image of the average out of pocket cost paid by the patient to the healthcare facility.
B2—Costs per payer	It reflects the averages of the cost that the patients pay for care services
B3—Average maintenance costs	Measures the direct and indirect costs to maintain equipment throughout the facility.
B4—Current cost per bed	Averages of the cost that the facility incurs for a patient's entire stay.
B5—The cost of drugs and equipment	The cost that the facility pays for the total of drugs, medicines, and medical equipment during the reporting period.
B6—Average hospital expenses	Records the overhead expenses for direct operations of the facility. They affect the pricing of services.
B7—Cost of work-staff	Assembles the total cost of salaries, wages, and employee benefits. It affects the price of treatment for patients as well as the satisfaction of employees [53].
B8—Average care costs of insured patients	Averages of the cost that the facility incurs for a patient's care after the elimination of costs % paid by insurant.

Appendix C

Table A3. Indicators of Internal Process (IIP).

Indicators	Definition
C1—Medication errors	It can be used to improve the medical process by reporting mistakes made in the medication of inpatient and outpatient services [53].
C—2 Bed occupancy rate	Assesses the number of the occupied beds in the facility from all the departments divided by the number of actually available beds by a predefined number of days recorded [56].
C3—Mortality rate	A critical indicator that measures the number of deaths by the actual number of patients per the time of measuring the metric [57].
C4—Infection rate	It's an indicator used in healthcare facilities to predict the probability of being infected, it measures the frequency of occurrence of new infection cases within patients during the recorded period [58].
C5—Clinical errors	Measures the frequency of clinical mistakes in the facility, which indicated the medical staff and equipment's effectiveness [53].
C6—Medical errors	Measures the frequency of making a mistake of medications or dosage in prescribing medication within the facility [53].
C7—Waiting time for admission to the operating room	Measures. The mean time from presentation to the emergency department to the first surgical consultation [59].
C8—The average length of stay in the emergency room	Measures the average time from the patients arrive at the ER until discharge aftercare service in the facility [60].
C9—Laboratory test time	Measures the average amount of time it takes to run a test in the laboratory [53].

Appendix D

Table A4. Technical Indicators (TI).

Indicators	Definition
D1—Quality of the building envelope	Measures the efficiency of the technical metrics with the purpose to improve the quality of *envelope* indicator in a recording period [61].
D2—Natural light penetration	Measures the amount and distribution of natural light needed for the good practices inside the healthcare facility's different spaces [62].
D3—Degree of thermal comfort	Measures the degree of satisfaction with the thermal environment inside the facility [63] dissatisfaction may be caused by the thermal non-comfort of the body expressed by the medical staff or the patients, which could be tracked with the PMV and PPD indices [64].
D4—Hierarchy of functional spaces	Measures the degree of movement's flexibility of the medical staff inside the facility, expresses the existence and the strength of direct and indirect needed relations between the spaces and departments.
D5—Distributions of medical devices	The metric assesses the availability and the distribution of the medical devices in the facility during the recorded period.
D6—Sufficient air conditioning	Measures the sufficiency of air out of an HVAC system compared to the standard norm for the room volume and the general well-being of staff and patients inside the facility.
D7—Vertical circulation	Assesses the availability and the distribution of automatic and non-automatic ways of vertical circulation inside the healthcare facility.
D8—Water consumption	Measures the average individual water usage calculated on a daily basis, at the facility's level to provide an indication of the water consumption level and set the facility's needs and strategies [65].
D9—Artificial lighting	Measures the sufficiency and the distribution of the artificial lighting depending on technical metrics: number of units, power per unit, and type of lamps used for each space to meet the minimum requirements [66].
D10—Energy and emissions control	Measuring the total energy consumption in the facility as well as the Greenhouse gas emission (GHGs) by setting tracking counters in the facility [67].
D11—Waste management	Measures the amount of waste collected and/or recycled by the facility, estimated intones. It takes into account any waste specific to the healthcare activities [68]. "Healthcare waste (HCW) is a by-product of healthcare that includes sharps, non-sharps, blood, body parts, chemicals, pharmaceuticals, medical devices and radioactive materials and toxic materials" [69] (p. 150).
D12—Location of the facility	Location is the physical geographical positioning of the facility; the indicator assesses metrics of the distance between the facility and main residential places, availability of public transportation to arrive at the facility, quality of the roads to be used by ambulances, and accessibility [70].
D13—Indoor air quality	Measuring this indicator allows maintaining the optimum indoor air quality using ventilation standards, Perceived Air Quality: (PIAQ) by having feedbacks from people's perceptions of indoor air quality and particle measurements: PM.
D14—Acoustic insulation	Measuring the ability of sound insulation % for the use of the rooms and spaces that prevents unreasonable disturbances, for the Protection against disruptive noises has a significant impact on the well-being and the good practices environment for patients and staff.

Appendix E

Table A5. Code, Factor Loading and Variance Inflation Factor of KPIs.

KPIs	Code	Factor Loading (FL)	Variance Inflation Factor (VIF)
Social Sustainability Indicators			
Patient satisfaction	A1	0.762	2.488
Average hospital stay	A2	0.713	2.353
Hospital readmission rate	A3	0.710	1.897
Patient waiting time	A4	0.773	2.291
Patient safety	A5	0.736	1.907
Waiting time in the emergency room	A6	0.731	2.152
Number of new patients	A7	0.705	2.291
Rate of vacant patients in beds	A8	0.719	2.229
Patient transfer rate to other facilities	A9	0.738	2.103
Patient complaint rate	A10	0.717	1.990
Economic Sustainability Indicators			
Average care costs	B1	0.771	2.651
Costs per payer	B2	0.719	2.289
Average maintenance costs	B3	0.736	2.356
Current cost per bed	B4	0.866	3.627
The cost of drugs and equipment	B5	0.756	2.063
Average hospital expenses	B6	0.846	2.747
Cost of work-staff	B7	0.749	2.391
Average care costs of insured patients	B8	0.851	2.808
Indicators of Internal Process			
Medication errors	C1	0.822	2.885
Bed occupancy rate	C2	0.727	1.900
Mortality rate	C3	0.789	3.389
Infection rate	C4	0.770	3.317
Clinical errors	C5	0.847	3.808
Medical errors	C6	0.860	3.608
Waiting time for admission to the operating room	C7	0.730	2.232
Average length of stay in the emergency room	C8	0.726	2.264
Laboratory test time	C9	0.720	1.921
Technical Indicators			
Quality of the building envelope	D1	0.715	2.611
Natural light penetration	D2	0.727	2.508
Degree of thermal comfort	D3	0.717	2.581
Hierarchy of functional spaces	D4	0.706	2.261
Distributions of medical devices	D5	0.721	2.207
Sufficient air conditioning	D6	0.749	2.565
Vertical circulation	D7	0.763	2.393

Table A5. *Cont.*

KPIs	Code	Factor Loading (FL)	Variance Inflation Factor (VIF)
Technical Indicators			
Water consumption	D8	0.708	2.328
Artificial lighting	D9	0.713	2.101
Energy and emissions control	D10	0.703	2.477
Waste management	D11	0.701	2.902
Location of the facility	D12	0.757	3.112
Indoor air quality	D13	0.798	3.852
Acoustic insulation	D14	0.706	2.593

Appendix F

Table A6. The importance of KPIs in pandemic crisis.

KPIs	Code	Coefficient	Rank1	Rank2
Social Sustainability Indicators				
Patient satisfaction	A1	0.964	3	14
Average hospital stay	A2	0.980	1	4
Hospital readmission rate	A3	0.894	5	23
Patient waiting time	A4	0.977	2	7
Patient safety	A5	0.828	7	32
Waiting time in the emergency room	A6	0.894	5	23
Number of new patients	A7	0.728	10	38
Rate of vacant patients in beds	A8	0.815	8	33
Patient transfer rate to other facilities	A9	0.930	4	18
Patient complaint rate	A10	0.746	9	37
Economic Sustainability Indicators				
Average care costs	B1	0.841	6	30
Costs per payer	B2	0.695	8	40
Average maintenance costs	B3	0.793	7	34
Current cost per bed	B4	0.948	3	17
The cost of drugs and equipment	B5	0.885	5	27
Average hospital expenses	B6	0.901	4	22
Cost of work-staff	B7	0.959	2	15
Average care costs of insured patients	B8	0.966	1	12

Table A6. *Cont.*

KPIs	Code	Coefficient	Rank1	Rank2
Indicators of Internal Process				
Medication errors	C1	0.967	5	10
Bed occupancy rate	C2	0.785	9	35
Mortality rate	C3	0.922	6	19
Infection rate	C4	0.984	3	3
Clinical errors	C5	0.993	1	1
Medical errors	C6	0.913	7	20
Waiting time for admission to the operating room	C7	0.891	8	26
Average length of stay in the emergency room	C8	0.987	2	2
Laboratory test time	C9	0.980	4	4
Technical Indicators				
Quality of the building envelope	D1	0.893	8	25
Natural light penetration	D2	0.967	4	11
Degree of thermal comfort	D3	0.958	6	16
Hierarchy of functional spaces	D4	0.650	14	41
Distributions of medical devices	D5	0.711	13	39
Sufficient air conditioning	D6	0.969	2	8
Vertical circulation	D7	0.966	5	13
Water consumption	D8	0.878	10	29
Artificial lighting	D9	0.881	9	28
Energy and emissions control	D10	0.841	11	30
Waste management	D11	0.902	7	21
Location of the facility	D12	0.969	2	8
Indoor air quality	D13	0.980	1	4
Acoustic insulation	D14	0.754	12	36

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Published Research on Burnout in Nursing in Spain in the Last Decade: Bibliometric Analysis

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Abstract: Scientific production in the last decades has evidenced an increase in burnout syndrome in healthcare professionals. The objective of this bibliometric study was to analyze scientific productions on burnout in nurses in 2009–2019. A search was made on the Web of Science database on burnout in nursing. The variables evaluated were number of publications per year, productivity based on the journal and relationships between authors. Data were analyzed using Bibexcel software, and Pajek was used to visualize the co-authorship network map. A total of 1528 publications related to burnout in nurses were identified. The years with the most productivity were 2016 to 2017, when the publication rate increased noticeably over previous years. The Spanish journal with the most production on the subject was *Atención Primaria*. The co-authorship network analyzed illustrated collaboration patterns among the researchers. Scientific publications on the subject have increased in recent years due to problems in the healthcare system, which is in need of prevention and intervention programs for healthcare professionals.

Keywords: burnout; nursing; bibliometrics; co-authorship network

1. Introduction

Hospitals are working daily to improve the quality of patient-centered medical attention [1–3] and factors that predict it [4], and employees providing such care perceive work as more emotional when they manage their own feelings and emotions [5]. Thus, nurses are not only in charge of attention and care of patients but are also a therapeutic tool in user care [6] and, therefore, carry a heavier load and are under greater pressure, and are even sometimes the subject of violence from users [7]. Emotional work has negative effects on members of medical attention organizations, such as lower job satisfaction [8,9], increased intention of rotation with coworkers [10], poor sleep quality due to the negative relationship between the components of emotional intelligence [11–13] and burnout [14].

In recent decades, scientific evidence has demonstrated increased burnout in different populations [15–18], especially in healthcare personnel [19], so it is a challenge to healthcare systems in view of the global phenomenon that has driven such research in many countries [20,21].

This syndrome refers to the response to stressful factors in the workplace, although it is how individuals cope with and manage these factors that causes burnout [22]. It is also defined by emotional fatigue and feelings of detachment from work and of inefficacy [23]. It is important to study the

presence of this severe occupational risk in employees because of its consequences to the individual and their work [24–26]. Thus, in public health and the institutions themselves, it becomes necessary to understand the variables that influence its development, prevention and treatment, to be able to increase productivity and lower job absenteeism [27,28].

The prevalence figures for burnout in healthcare differ, as it depends on the criteria employed to evaluate the construct [29,30] and related variables [31]. For example, the study by Rusca and Setyowati [32] showed high prevalence of burnout syndrome in nurses in eastern Java (Indonesia). In South Korea, nurses in an intensive care unit also showed high burnout levels—in particular, the youngest with less work experience [33]. Prevalence scores of 66.6% of healthcare workers affected by burnout were found in Spain [34], while a study by Grau-Martin, Flichtentrei, Suner, Prats and Braga [35] found the prevalence in Spanish healthcare workers to be 14.9%. Álvarez, Mori and Gómez [36] also found a high percentage of nursing professionals (43.67%) with burnout. Several studies in the same country have also shown high levels of prevalence of burnout in nursing professionals [37,38]. Thus, the prevalence of burnout in Spanish nurses would be around 18% to 33%, showing the magnitude of the problem [39].

Burnout in nurses is linked to work overload, while self-efficacy and self-esteem act as protective variables [40]. Molero, Pérez-Fuentes, Gázquez, and Barragán [41] found that the level of nurses' self-esteem differentiates them with respect to burnout and were able to identify different burnout profiles by self-esteem, empathy and social support. Empathy, job satisfaction and personality also influence burnout, which negatively intervene in the quality of care, derived from lack of self-confidence, lack of attention, low self-esteem [42–44] and job dissatisfaction [45].

The presence of this subject in the media has contributed to increasing knowledge, which can be measured through the various studies. Lately, qualitative and quantitative studies have been found in the literature on already published documents. These are metric studies that measure production by querying documents and analyzing such literature [46]. Such bibliometric analyses can evaluate the impact and number of publications in journals about a subject of study over time [47]. At the same time, co-authorship networks in the production are analyzed to find out their relationship in the most important studies in the field.

Bibliometric analyses have been done on many subjects in health [48–50], and some have undertaken burnout as the main theme [51,52]. However, up to now, burnout syndrome has been analyzed along with other constructs and in different professions, so the subject is receiving more international attention, and productivity on it in the literature is high. The most visible countries in scientific production are those considered most productive worldwide. The United States is in the lead [52], while scientific production on burnout in Spain has grown with daily increase in the syndrome's presence in Spanish society. In the last decade, after the financial crisis of 2008, caused by the collapse of the real estate bubble in the United States in 2006, work conditions changed, and not only in that country—the repercussions were felt around the world, and also in Spain. Disproportional cuts were made in resources and in services, negatively affecting the quality and efficiency of healthcare and increasing the impact of burnout [53,54], especially in service professions such as nursing [55]. Those first government measures reduced material and human resources, lengthened the workday, decreased nursing personnel, lowered salaries, and so forth. This generated deterioration in attention to users at health centers and a work overload for employees. All these measures configured a new scenario, where the work environment caused demotivation and deterioration of healthcare professionals [56]. In 2019, the World Health Organization [57] called the burnout syndrome a work-related illness that worsened people's physical and mental health. Therefore, scientific production has a fundamental role in the development of health policies [58,59], as these publications can form the basis for informing and contextualizing public health debates. At the same time, this type of bibliometric publication not only answers to the study of science and the evolution of scientific production, it also shows editorial management. The study of scientific production enables inquiry and comparison of changes that have

been occurring in the burnout syndrome in the scope of nursing and the commitment and collaboration networks that have been established based on the parameters developed in each publication.

Studies in Spain have analyzed the burnout syndrome in the healthcare environment. However, it must be known what research on burnout in nurses in the country has been published and what variables related to this construct have appeared in articles in recent years before this public health problem can be approached. Thus, the objective of this study was to perform a metric analysis of the scientific production on burnout in nurses in Spain in 2009–2019.

This metric analysis also proposed the following specific objectives: (1) identify the journals where articles related to the subject are published, (2) determine the productivity of authors and their collaboration networks and (3) find out the study variables related to this syndrome.

2. Methods

To respond to our objectives, this study used the scientific method in which analysis provides indicators for analyzing the progress and current state of a certain subject matter. It was therefore carried out in five stages: recovery, migration, analysis, visual representation and interpretation.

In the first stage, *Recovery*, the sources and resources were selected; search and selection. The second stage, *Migration*, extracted, loaded, screened and processed the data. *Analysis* involves the scientific analysis and quantitative treatment of scientific and bibliometric indicators. *Visual Representation* of the parameters and identification follows. Finally, *Interpretation* is where the data are described, compared and contextualized.

First, a search was made on the Web of Science database for publications containing the words "burnout" and "nursing" in the title published anywhere in the world during 2009–2019, and then only studies done in Spain.

A series of filters were applied to the search based on the objective: as for the type of document, only articles were considered, and in a search period from 2009 to 2019. The type of source was limited to articles in English and Spanish published in journals. Furthermore, to find the publications only in Spain, it was also filtered by country. The results extracted were imported as unformatted text.

The following search equation was used for the Web of Science: TS = (burnout AND nursing), which found a total of 1528 articles. Filtering by country resulted in 123 studies carried out in Spain, all of them open access.

Based on the objectives posed, the inclusion search criteria set were: (1) English or Spanish language; (2) on burnout in nursing; (3) empirical studies only. For exclusion, criteria were: (1) not in English or Spanish; (2) public information articles, letters to editor, Ph.D. theses or documents not published in scientific journals; (3) duplicate studies; (4) related to subjects other than burnout syndrome in nursing.

Then, an in-depth review of these 123 studies was conducted to select only quantitative studies and analyze the type of research, instruments and related variables. The following inclusion criteria were set for this: only quantitative empirical studies that included the descriptors "burnout" and "nursing" in the title or in the abstract, thereby discarding 64 studies because they did not include both descriptors and 11 more because they were systematic reviews or meta-analyses. In the end, 48 studies were selected.

2.1. Procedure

Indicators for study variables selected were chronological production, production by document type, institutional production, editorial production, production by language and distribution according to the most commonly used scientific production laws.

2.2. Data Analysis

The analyses of the ISIWoS database were performed separately, as they were downloaded in different files to be able to read them with that program. Bibexcel software (HistCite Software LLC,

New York, USA) [60] was used for this because of its flexibility and capability for managing a large volume of data and preprocessing them, and because the studies were extracted as text. The data found in Bibexcel were then processed by the Pajek program [61] to develop network maps. Given the large number of authors, the Pajek program was set to select only those with three or more co-authorships to form the co-authorship network. That is, authors who did not have at least three publications with another author were excluded.

The ATLAS.ti software (ver. 8.4, Scientific Software Development, Berlin, Germany) was used for analysis of the content, classifying input by the variables dealt with in the articles found in the first stage of the study.

3. Results

The results of the search showed that there were 1528 documents in the Web of Science database on scientific production related to burnout in nursing, and of these, after filtering, 123 documents pertained to research carried out in Spain. When the results had been extracted, their relevance was analyzed to see if the publications found were related to the main subject of our study, and three of them were eliminated from the search due to not meeting the inclusion criteria.

The results are presented below in three sections. Section 3.1 analyzes all the scientific production on burnout, the number of publications per year, the journals where these articles were published and the production level of journals and authors, using the 123 studies to do so. In Section 3.2, of the 123 documents, only the 48 which were quantitative studies are analyzed for type of research, instruments, and number of related variables. Finally, in Section 3.3, co-authorships and the variables related to burnout are analyzed (n = 123).

3.1. Number of Publications Per Year and Selection of Journals

Figure 1 shows that international and national scientific production has been increasing over the years. In less than four years, the number of studies related to burnout in nursing has doubled. The first five years, 2009–2013, were less productive than the second five, in 2014–2018, for which the number publications was not representative (Table 1). Furthermore, the biggest boom in production was in 2016 to 2017, when 57 more studies were published internationally than in the previous year, and 13 more Spanish articles. Although in Spain, the number of articles on this subject was also found to increase over the years. Of the 123 documents found in Spain, 87 were published in English and 36 in Spanish. The trend in the number of publications in upcoming years will also increase as the R^2 is 0.863 and 0.809.

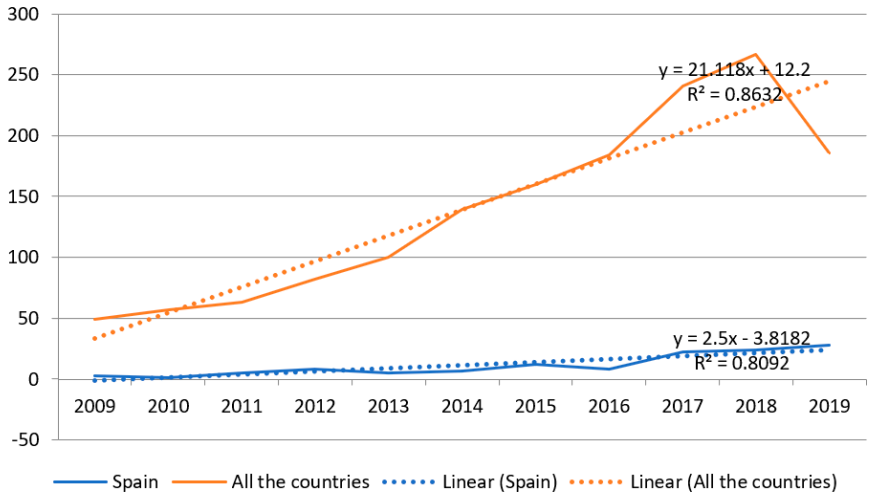

Figure 1. Scientific production on burnout in nursing based on the Web of Science (WOS) database and its trend during the years analyzed.

Table 1. Number of publications per year.

Year	Number of Publications	Number of Publications in Spain
2009	49	3
2010	57	1
2011	63	5
2012	82	8
2013	100	5
2014	139	7
2015	160	12
2016	184	8
2017	241	22
2018	267	24
2019	186	28
Total	1528	123

Table 2 shows the Price Index by number of bibliographic references of articles published in 2009–2010 and the number of publications in Spain each year. With the exception of the last three years, the Price Index has remained rather low at 8.83% of total references.

Table 2. Price Index (% of references published less than five years ago).

Year	Number of Publications in Spain	Number of References	N References <5 Years	Price Index (%)
2009	3	75	(2005–2009) 1	1.33
2010	1	1	(2006–2010) 0	0
2011	5	209	(2007–2011) 3	1.43
2012	8	193	(2008–2012) 3	1.55
2013	5	183	(2009–2013) 6	3.27
2014	7	122	(2010–2014) 3	2.45
2015	12	244	(2011–2015) 9	3.68
2016	8	59	(2012–2016) 2	3.38
2017	22	259	(2013–2017) 33	12.74
2018	24	135	(2014–2018) 21	15.55
2019	28	38	(2015–2019) 38	100
Total	123	1518	119	7.83

In addition, a total of 62 journals published articles on burnout in nurses, 65.04% of them in the journals shown in Figure 2. The journal with the most publications in the period 2009–2019 was the *International Journal of Environmental Research and Public Health*. In Spain, the leading journal with the most production on the subject was *Atención Primaria.*

The productivity data found in the journals on Spanish studies on burnout in nursing were compared applying Lotka's law. During this period, a single journal had 15 publications on this subject, while 43 journals only had one. The R^2 is 0.878, which is very close to 1, so the line is practically identical to the literature (Figure 3).

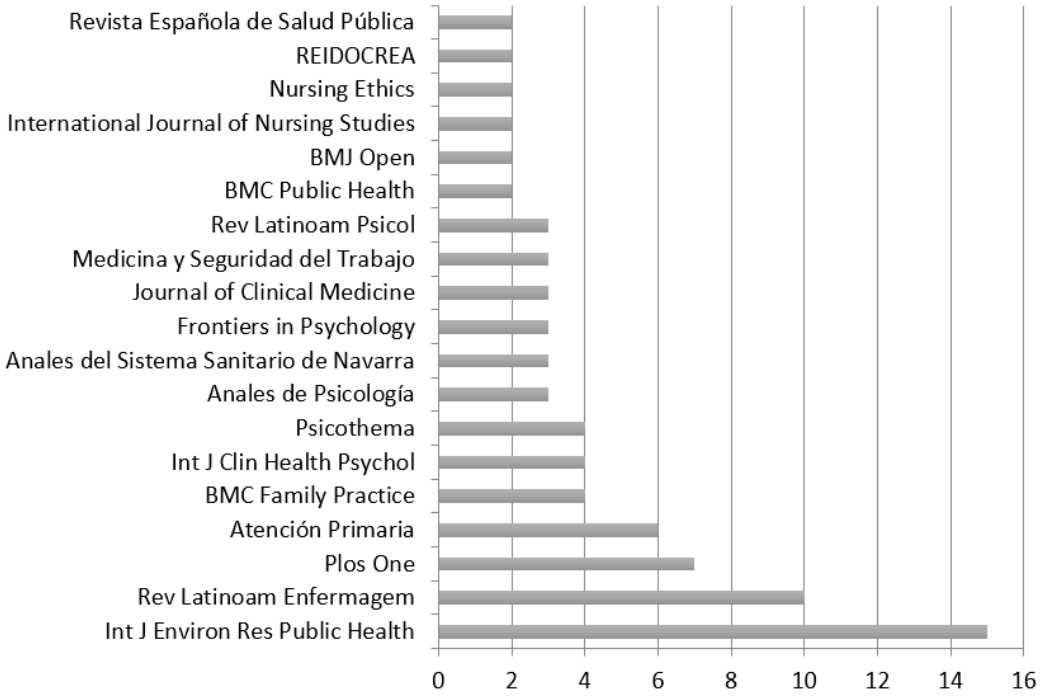

Figure 2. Journals that published the most Spanish studies of burnout in nursing.

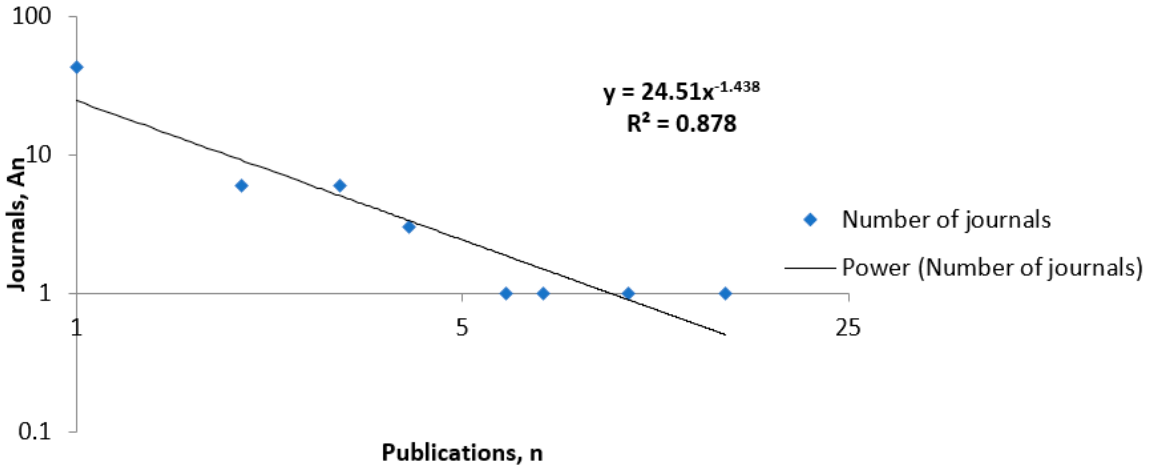

Figure 3. Application of Lotka's law to productivity of journals on burnout in nursing.

Similarly, Figure 4 shows the result of applying Lotka's law to the productivity of the authors, where the line is similar to the theoretical with an R^2 near 1, at 0.830. Therefore, for both distributions, Lotka's law shows that the number of authors or journals "*An*" who have published "*n*" studies on this subject is inversely proportional to *n* squared.

Table 3 shows author distribution by productivity, where most of them pertain to Productivity Level 1, which represents 86.67% of the total, and only 1.43% are on Productivity Level 3, with a total of six authors.

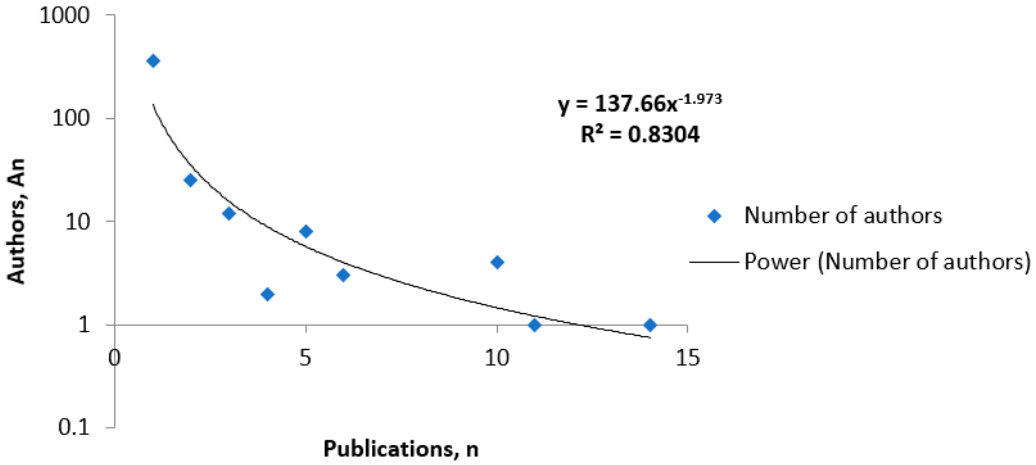

Figure 4. Distribution of Lotka's law of productivity of authors.

Table 3. Distribution of authors by productivity level.

Productivity Level	N Studies	Authors	
		n	%
3	> or =10	6	1.43
2	2 to 9	50	11.9
1	1	364	86.67
Total		420	100

3.2. Review of Studies Performed in Spain

Of the 123 studies on the Spanish population, 48 were finally chosen for their analysis (see Table 4). Of these, 44 are cross-sectional or longitudinal studies on healthcare professionals, specifically nurses and/or certified nursing assistants. The majority of the studies were comprised of samples of nurses, and only four were conducted with a sample of nursing students. It should also be mentioned that 87.5% (n = 42) of the articles on burnout employed a cross-sectional design while only 4.2% (n = 2) were longitudinal.

Table 4. Type of studies and instruments with samples of nurses.

Study Design					
Observational				**Experimental**	
Cross-sectional		Longitudinal		Clinical trials	
n	%	*n*	%	*n*	%
42	87.5	2	4.2	4	8.3
Instruments					
MBI		CBB		Other questionnaires	
n	%	*n*	%	*n*	%
36	75	6	12.5	6	12.5
Number of variables per study					
Analyses with one variable		Analyses with two variables		Analyses with three variables	
n	%	*n*	%	*n*	%
14	29.2	16	33.3	10	20.8
Analyses with four variables		Analyses with five variables		Analyses with seven variables	
n	%	*n*	%	*n*	%
3	6.3	4	8.3	1	2.1

The instruments used to evaluate burnout in these professionals in each of the studies were: 75% (n = 36) the various versions (MBI-GS, MBI-HSS and MBI-SS) of the Maslach Burnout Inventory

(MBI); in 12.5%, the Brief Burnout Questionnaire (BBQ) and its multifactorial version CBB-M were used; the remaining 12.5% (n = 6) used questionnaires such as the Cuestionario Breve de Burnout (CBB) (Spanish Burnout Inventory), the Cuestionario de Burnout de Granada (GBQ) (Granada Burnout Questionnaire) or burnout questionnaires by the authors.

Table 4 shows that only 8.3% of experimental studies were controlled, randomized clinical trials which carried out an intervention with nurses and student nurses. One of them evaluated the effect of a mindfulness program and self-compassion on burnout and stress levels and the other evaluated the efficacy of intervention for the prevention and treatment of burnout in primary attention professionals.

Table 4 shows the number of variables used in the 48 studies, where the analysis found that 33% (n = 16) of the studies evaluated burnout along with another variable, which, in most cases, was empathy, followed by personality and job satisfaction, engagement, resilience and matters related to the conditions of effectiveness and communication at work. Overall, 20.8% (n = 10) of the studies related the syndrome with two of the variables above or, in their absence, added questionnaires and scales that measure health status, stress, anxiety and depression or intrapersonal variables, such as self-esteem, self-efficacy and emotional intelligence.

In the studies that employed four variables (6.3%), burnout, emotional intelligence, personality and perceived social support were related. Finally, in those that examined five or more variables, self-compassion, perceived stress, social and emotional loneliness were included, and scales other than the MBI were used to evaluate burnout.

3.3. Co-Authorship Map of Studies Done in Spain and Variables Related to Burnout

Co-authorship networks were found as a bibliometric indicator of collaboration to find out collaboration in each article—that is, how many authors wrote each article.

Figure 5 shows only six different co-authorship networks, as the Pajek program was set to show only three or more co-authorships. This figure shows that the co-authorship networks are different and not formed by the same number of authors. Therefore, each group was analyzed separately. The first co-authorship network was made up of researchers at the University of Granada who all belonged to the Information Processing and Decision-Making Group at the University of Granada in collaboration with the University of Valencia. The second network was made up of researchers in the University of Almería Psychology Department.

There is another mini-network made up of authors in Belgium and Pennsylvania, and finally, there are mini-networks made up of four or fewer authors belonging to institutions and universities in Catalonia and Madrid.

Most of the documents were written by more than one author, and so not only the national but also the international collaboration that configures these networks should be emphasized.

Finally, the content was analyzed for variables related to burnout in nursing and the number of studies found that contained those variables related to burnout. A total of 40 variables related to burnout were found, as shown in Table 5. The variables studied most in the studies analyzed were anxiety and depression (n = 4), emotional intelligence (n = 5), engagement (n = 5), empathy (n = 8), general health (n = 5), job satisfaction (n = 8), personality (n = 7), resilience (n = 4), self-efficacy (n = 4) and job stress (n = 3).

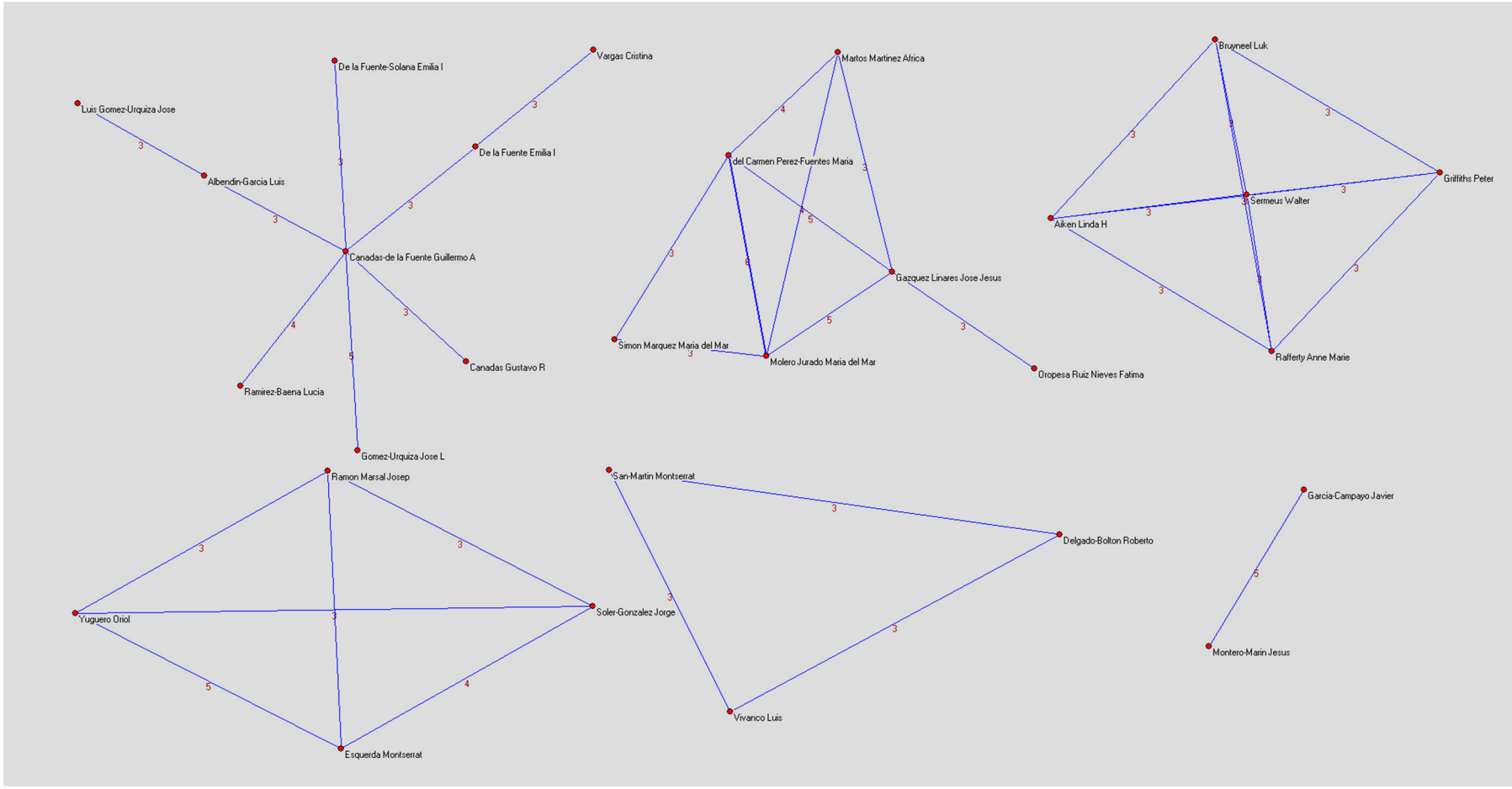

Figure 5. Co-authorship networks.

Table 5. Analysis by subject related to burnout in the publications.

Variables	Number of Studies	Variables	Number of Studies
Aggressive behavior	1	Organizational behaviors	1
Altruism	1	Perceived social support	2
Anxiety or depression Disorders	4	Personality profiles	7
Autonomy	1	Positive and negative effect	1
Care assessment	1	Practice environment of the nurses	1
Communication skills	2	Psychological disturbance	1
Competence	1	Relatedness	1
Compliance	1	Resilience	4
Coping	2	Satisfaction	3
Emotional intelligence	5	Self-compassion	2
Empathy	8	Self-concept	1
Empowerment	1	Self-conduct	1
Engagement	5	Self-efficacy	4
General health	5	Self-esteem	1
Health problems	1	Self-perceived health	1
Job satisfaction	8	Sleep quality	1
Job strain	1	Subjective social support	1
Loneliness	1	Trauma screening	1
Mental health	1	Wellness in the academic context	1
Mindfulness	1	Work stress	3

Table 5 shows that the majority of the variables related to burnout were not only factors associated with work. Many are individual or personal in scope, as these factors are determinant in its appearance. This is the case with anxiety or depression, personality, engagement, empathy, emotional intelligence, resilience, self-concept, self-efficacy, self-esteem, subjective social support and positive and negative effect. Depending on how they relate to burnout, they may act as protective or risk factors. On the other hand, the most important variables connected to the organizational context were job satisfaction, job tension and organizational behavior, and the variable which was fundamental in developing this syndrome was job stress. Most of the variables in the table are mainly related to emotional exhaustion.

4. Discussion

Burnout is one of the main problems found today in user attention and care professionals. Therefore, studies related to this syndrome in healthcare are of special interest. Burnout is increasingly present in scientific journals, especially starting in the last decade [54–56], and in particular since this syndrome has been considered an occupational disease [57]. Thus, this increase in production in recent years may respond to the prevalence of the syndrome in nursing, as shown by Álvarez et al. [36], who estimated that 43.67% of nurses have the syndrome. Although prevalence of the burnout syndrome is high in nurses in Spain [37,38], from around 18% to 33% [39], these percentages are similar to other countries [32,33].

This study showed uninterrupted growth in the number of publications, demonstrating the interest that the burnout syndrome generates in the national and international scientific community [58,59]. However, it should be kept in mind that although the figures found in 2019 on publications on this subject are no lower than in the year before, they may still be higher, as that was the year when this study was done and, therefore, the number of publications may have increased by year end. A bibliometric analysis on a subject enables major times or events related to the subject of study to be identified [46]. The percentages found by the Price Index are proportionate to the number of publications, since the boom in this subject began in 2016 to 2017 in Spain, so the highest values in references less than five years old were found in 2017 and later. However, this index is lower than for

other studies in the field of occupational health [7], which may be because the search was limited to one database and, therefore, the range of references was reduced.

The *International Journal of Environmental Research and Public Health* was by far the most productive journal publishing articles on burnout in nursing [52]. This is because this journal publishes, annually, many more articles than the others. Furthermore, it is an interdisciplinary open-access journal, dealing with subjects on public health, environmental health, occupational hygiene, general health, etc., where the publication of manuscripts is faster than in other journals. In Spain, the journal with the highest production on the subject is *Atención Primaria*, which is devoted to primary health care.

The results also showed that studies done in Spain to-date are mostly cross-sectional observational studies where the prevalence is on knowing the condition of nurses with respect to the burnout syndrome, risk factors and protection from this symptom and its relationship with other variables [36,39], rather than studies conducted to prevent and intervene in symptoms or trials to reduce job stress and exhaustion. The instrument of excellence for measuring or evaluating burnout in these professionals was the Maslach Burnout Inventory (MBI) and two or three variables were employed in most cases, including the burnout syndrome, although it is true that a high percentage only evaluated burnout with descriptive analyses or validated a burnout questionnaire for healthcare professionals.

The results of the analysis of variables related to burnout found that empathy and job satisfaction had been studied most in recent years, as burnout is associated with therapeutic relations and care quality [42,43], followed by personality, in which low self-esteem and lack of self-confidence negatively affect job performance [44].

Part of the analysis was to find out the collaborations existing between authors in co-authorship networks in Spain [47]. In fact, a large number of networks were found but results were limited to show only collaborations between three or more authors in each article. Six of these were found. This is one of the limitations of this study, since it reduced the number of co-authorship networks, and therefore, data were excluded from the analysis that might have been relevant, as there are more collaborations by pairs of authors than by large groups. Another one of the main limitations of this study was the database search, as only publications in the Web of Science were included. Therefore, future research should widen the search to other databases to check whether the number of publications is the same or higher and also to see whether the authorship network is similar or. on the contrary, differs in the number of authors and collaborations. This study is a turning point for the preparation of future research which can take the scientific literature on the subject up to this time as a basis and see how it evolves. The results of bibliometric studies, such as this one, have also acquired considerable importance in elaborating scientific research policies and their management in the field of health.

The purpose of publications is so that the scientific community can compare, verify or reject the value of each study. Thus, knowing indicators in the areas of health sciences, such as co-authorship networks, journals and the research variables related to the burnout syndrome, gaps in the publications on the subject can be detected as well as what has to be designed and included in a new study with these indicators known as a reference. The findings of such a bibliometric study may be represented precisely and analyzed and will be of great use to society and the scientific community. It may be observed that, insofar as editorial management is concerned, scientific journals back studies related to the subject. Concerning research groups, it was observed that those specializing in this subject approached the analysis of burnout from different perspectives. Finally, knowing the variables related to this syndrome opens a range of possibilities in proposing new lines of research.

5. Conclusions

This study analyzed the literature on burnout in nurses, using the inclusive bibliometric search method. It also provided a first analysis of authorship collaboration networks in publications on burnout in nurses in Spain. Bibliometric studies provide a general view of the current state of a subject matter and the repercussion it has on society. Therefore, if we found that the number of publications on burnout in nurses has increased, it is because society and researchers are observing that there is

a problem in the healthcare system which has to be analyzed and worked on for its prevention and intervention, as it is important to have an overview of the subject in order to be able to focus on valid strategies and open new lines of research.

Therefore, the results of this study have practical implications for both the individual and for healthcare organizations. There is still work to be done in identifying the factors that affect and/or relate to the burnout syndrome. This study shows the areas on which most studies have concentrated up to now, and based on this analysis, those where fewer studies have been done can be traced, and the direction can be provided for continued exploration after finding out other paths for creating tools that facilitate and reinforce the work of healthcare professionals. This would reduce the consequences derived from this syndrome and improve organizational and personal measures.

Finally, it may be said that bibliometric analysis can make a positive contribution to initiatives in the field of public health.

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Work Potential and Work Performance during the First Try-Out of the Person-Centred Return to Work Rehabilitation Programme ReWork-Stroke: A Case Study

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Abstract: Background: This case study explores changes in work potential and work performance for ten people who worked before their stroke while participating in the ReWork-Stroke programme. It describes measures performed by the occupational therapists to enhance work potential and work performance and the participants' level of work re-entry nine months after the start of their work trial. Methods: Ten people who had experienced a mild or moderate stroke participated. Changes were assessed using the Worker Role Interview and the Assessment of Work Performance. Logbooks relating to work potential and work performance were analysed using content analysis. Results: The participants' work potential was in general supportive to returning to work at baseline and remained so at the three-month follow-up. Most changes occurred in the environmental factors regarding the participants' belief that adaptations at the workplace would make re-entry possible. Changes concerning work performance were predominately in a positive direction. Seven of the participants returned to paid work. Conclusion: The ReWork-Stroke programme seems promising for promoting changes in work potential, work performance, and return to paid work. However, further studies are needed to evaluate changes in work potential and work performance and the programme's effectiveness for increasing work re-entry for people who have had stroke.

Keywords: rehabilitation; vocational; stroke; occupational therapy; work

1. Introduction

Work plays an important role in peoples' lives and is essential for their health [1]. Furthermore, work is closely connected to a person's identity [2], and thus an important issue in rehabilitation. Not participating in working life after a stroke is a major consequence [3] that negatively impacts quality of life and leads to personal economic consequences [4], and brings high costs for society [5].

The incidence of stroke in those of working age is increasing [6]. About 20% of those having a stroke in Sweden are younger than the general retirement age of 65 years [6]. Approximately half of those at a younger age return to work [7], and those who do, continue to return to work for years post stroke [8]. Return to work has been described as a long process, encompassing a series of transitions and phases beginning at stroke onset and concluding when work re-entry or another satisfactory outcome has been achieved [9]. During the return-to-work process, several factors, interrelated and dependent of one another, influence the ability to work. These factors are, for example, health and functional capacity; competence; the individual's attitudes and motivation towards work, as well as the content of the actual work and its organization; and the co-workers and management [10]. Changes in work ability are, according to Lederer et al. [11], a dynamic and relational phenomenon resulting from the interaction of multiple dimensions that overlap and influence each other. These interrelated factors are of importance for performing work tasks, as well as for the performance of other everyday occupations. Information regarding factors influencing work ability, such as work potential and work performance, is needed in order to understand how to support a return-to-work process.

Research on return-to-work programmes for people with stroke is scarce [12]. However, two small randomized controlled trials showed that return-to-work programmes after stroke, which use coordinators, were more effective as compared with usual rehabilitation [13,14]. For return-to-work programmes, recommended components include early contact with the workplace, tailored work tasks and workplace adjustments, involvement of the employer as well as co-workers, and work practice [12].

This study is part of a research project where a newly designed person-centred rehabilitation programme for return to work, ReWork-Stroke, was tried out in a rehabilitation context. The ReWork-Stroke was provided by an occupational therapist (OT) by measures to support the person that had experienced a stroke, to collaborate with other stakeholders involved and to coordinate the various measures in the return-to-work process. The components in the ReWork-Stroke programme are presented elsewhere [15]. There is limited knowledge regarding which measures can bring about change during a rehabilitation programme. Therefore, in the first test of the ReWork-Stroke programme, the aim of the present case study was to explore changes in work potential and work performance for ten people who worked before their stroke while participating in the programme. Furthermore, the aim was to describe measures performed by the occupational therapists (OTs) to enhance work potential and work performance during the programme, and the participants' level of work re-entry nine months after the start of their work trial.

2. Materials and Methods

This study used a multiple case-study design [16] including participants who have had a stroke depicted in their daily contexts during their return-to-work (RTW) process. Both quantitative and qualitative data were used to explore the return-to-work process. A case-study methodology is useful when one wants to understand a real-life phenomenon in depth that is too complex for a survey or experimental design. Therefore, for this study, a multiple case design with two or more cases was chosen in order to cover different characteristics of the phenomenon [16]. The Regional Ethical Review Board, Stockholm, Sweden approved the study (2012/101-31/1).

2.1. Study Context

2.1.1. Stakeholders in the Return-to-Work Process

The cases in this study are drawn from the Swedish context with its particular set-up and systems for the return-to-work-process. In Sweden, four stakeholders share the responsibility of supporting return to work. These stakeholders are the employer, healthcare staff, and representatives from the Swedish Social Insurance Agency (SSIA) and the Swedish Public Employment Service (in case the person does not have employment). The employer has a responsibility, in cooperation with the

employee, to facilitate return to work through rehabilitation and workplace adjustments. This process is sometimes supported by a healthcare team/physician, while the SSIA has the overall responsibility for the administration of sick leave compensation during the return-to-work rehabilitation.

2.1.2. The Intervention

The return-to-work rehabilitation programme, ReWork-Stroke, is based on existing knowledge [17–19] and is person-centred [20,21] but contains some generic elements [15]. Two OTs who were skilled in rehabilitation after a stroke, with clinical experience of 14 and 25 years, respectively, coordinated the return-to-work programmes. They were part of specialist brain injury teams at two different hospitals in the middle of Sweden.

The programme started with a preparation phase of varying length (reported in Table 1), where the client´s family and living situation, routines in daily life, as well as resources and obstacles for going back to work were mapped out. The prerequisites for return to work and the client´s goal for the rehabilitation were discussed together with the participant. Information on stroke and work-related rehabilitation was provided to the employer, co-workers, close relatives, and other involved stakeholders. A plan concerning a work trial and time for follow-up were elaborated at the client´s workplace in cooperation with the other stakeholders involved. This plan included the start time for the work trial, work tasks to start with, and routine for feedback and support. During the work-trial phase, the OTs made regular visits to participants' workplaces, i.e., twice a month during the period of the three-month work trial, to support the participants and their employers/managers/co-workers. Individual advice and solutions were discussed, regarding how to handle the consequences of a stroke in situations at work, for example, the OTs contacted the stakeholders involved regularly and information on the rehabilitation process was continuously exchanged.

Collaboration between all stakeholders was encouraged throughout the entire process. An evaluation of the participants' work ability was performed and the plan for return to work was adjusted according to the individuals' needs and conditions, and the opportunities at the workplace.

2.2. Participants

People eligible for inclusion were those who had experienced a stroke and who (1) were referred for rehabilitation to specialized brain injury rehabilitation units in two cities in Sweden, (2) were 20–63 years of age, (3) worked before stroke, (4) wanted to return to work, (5) were estimated by the rehabilitation team to be in the phase of return-to-work rehabilitation, and (6) had the ability to communicate in Swedish. Exclusion criteria included the following: diagnosed with dementia or diagnosed with other neurological or psychiatric disorders. The present study was based on ten participants who received rehabilitation at the specialist brain injury units. They were consecutively included and completed the return-to-work programme, including a three-month follow-up and a call concerning work re-entry at nine months after start of the work trial. Demographic characteristics of the participants are presented in Table 1. Stroke severity at onset was calculated based on ability in daily life activities (ADL) and the Barthel index was used with the categories mild stroke (50–100), moderate stroke (15–49), or severe stroke (<14) [22]. The participants consequences of stroke were retrieved from the medical records

Table 1. Demographic characteristics, information on stroke severity and consequences, and time for inclusion in ReWork-Stroke for the participants (n = 10).

Participants	A	B	C	D	E	F	G	H	I	J
Age at stroke onset	40	52	42	44	57	55	52	50	54	48
Gender	Female	Male	Male	Male	Female	Female	Female	Male	Male	Male
Civil status	Single	Married	Married	Married	Married	Married	Married	Married	Single	Single
Children living at home		1 child	3 children	1 child				2 children		
Profession	Instructor	Transport organizer	Craftsman	Social service person	Manager	IT advisor	University admin	Craftsman	Craftsman	IT advisor
Consequences of stroke	Fatigue Vision Aphasia	Fatigue	Fatigue Memory	Fatigue Memory Attention Balance Dizziness	Fatigue Attention Vision Aphasia	Fatigue	Attention Vision Aphasia Muscle weakness in one arm	Memory Vision Balance	Muscle weakness in one leg	Fatigue Muscle weakness on one side of the body
Stroke severity (BI)	Mild	Mild	Moderate	Moderate	Mild	Mild	Mild	Moderate	Mild	Mild
Onset to inclusion, months	14	4.5	7.5	7.5	8.5	8	19	7	5.5	9.5
Inclusion to start of work-trial, months	4	2	3	8,5	3	5	5	8	3	5
Fatigue severity scale, mean (1–7), baseline/3 months	4.1 */4.1 *	1/1.9	6 */4.7 *	5.4 */4.7 *	6.4 */5.9 *	5.7 */6.6 *	1.9/1.4	3.1/2.3	3.1/3	4.3 */5.9 *

* Indicates a score above the cut-off score for severe fatigue = 4. BI, Barthel index; IT, information technology.

2.3. Data Collection

Multiple data sources were used to collect information sufficient to describe changes during the work trial phase in the ReWork-Stroke programme. The data comprised information on work performance, work potential, fatigue and perceived impact of stroke, and information in logbooks on the measures taken by the occupational therapists. Data were collected at the preparation phase (baseline) and at follow-up, which took place three months after the start of the work trial. Two data collection phases were used in order to detect changes during the return-to-work process. The baseline information was also used to target specific challenges to deal with during the work trial. Logbooks were continuously written by the OTs regarding measures they provided in the rehabilitation for each participant during the whole programme. Data from the medical records regarding activities of daily living (ADLs) and bodily functions were collected at baseline and used to describe the sample. The Assessment of Work Performance (AWP) and the Worker Role Interview (WRI) were conducted by two independent vocational specialists from the Swedish Public Employment Office not involved in the execution of the RTW programme. These specialists were skilled in conducting the assessments and interpreting the results. The OTs providing the ReWork-Stroke had access to the interpretation of the results of these assessments as a basis for their interventions during the rehabilitation. The Fatigue severity scale (FSS) and the Stroke impact scale (SIS) were administrated by the OTs. Information on level of work re-entry was collected in follow-up calls conducted by the OTs, nine months after the start of the work trial.

2.3.1. Instruments

Work performance, defined as the individuals' ability to satisfactorily handle and carry out different work activities and tasks, was measured using the AWP. The aim of the AWP is to identify clients' work skills by observing how efficiently and appropriately the client performs a work task. The AWP is theoretically founded on the Model of Human Occupation and assesses clients' work performance in the following three domains: motor skills, process skills, and communication and interaction skills [23]. The items in the motor skills and process skills domains are presented in Table 4. The domain, communication and interaction skills, consists of four items, but none of these were used. In this study, the AWP assessments were conducted in a constructed environment where the assembly and the administrative tasks, two structured work tasks developed for the AWP assessments, were used. The assembly task was comprised of assembling shelves and placing materials on them in a logical order. The administrative task was comprised of registering orders of nameplates in an Excel file. The performance on each work task was scored on a Likert scale where 1 = incompetent performance, 2 = limited performance, 3 = questionable performance, and 4 = competent performance. The AWP has presented good psychometric properties [24–26].

Work potential was measured using the Swedish version of WRI-S. The WRI is also theoretically founded on the Model of Human Occupation and aims to identify psychosocial and environmental factors that influence a person's ability to return to work after injury or illness. The WRI interview, conducted by using a non-standardized semi-structured interview guide, is designed to collect data concerning the content areas of motivational factors, lifestyle factors, and environmental factors [23]. After the interview, a therapist-administered rating scale is used to assess the client's work potential in 16 items (see Table 3) with standardized definitions, each item corresponding to one of the content areas. The items are assessed on a Likert scale where 1 = strongly interferes with, 2 = interferes with, 3 = supports, and 4 = strongly supports the client's possibilities of returning to work. Psychometric properties of the Swedish version of the WRI have been shown to be sound [27–29] and the WRI has been found to be a clinically useful and person-centred assessment [30].

Fatigue was assessed using the self-report instrument FSS-7 item version (FSS-7). This is a valid instrument for evaluating changes in fatigue over time among people that have had a stroke. The final score is the mean of the seven items graded from 1 (strong disagreement) to 7 (strong agreement) with having fatigue. The cut-off score used for the presence of fatigue post stroke is a mean score of 4 [31].

Perceived impact of stroke. SIS 3.0 was used to assess perceived impact of stroke. The SIS 3.0 consists of 59 items representing eight domains, i.e., strength, memory and thinking, emotions, communication, activities of daily living (ADL)/instrumental activities of daily living (IADL), mobility, hand function, and participation [32,33]. The person who has had a stroke scores the items on a scale from 1 to 5. By using an algorithm, aggregated scores for each domain are calculated. The domain score ranges from 0 (maximum perceived impact of stroke) to 100 (no impact) [32]. The SIS includes one further item regarding the perceived global recovery after stroke, rated on a visual analogue scale ranging from 0 (no recovery) to 100 (full recovery). The psychometric properties of the SIS have been shown to be good [32–34].

2.3.2. Logbooks

The OTs documented the content of the intervention for each participant in the rehabilitation programme. These logbooks were continuously written during the preparation and work trial phases. The material comprises, in total, about 100 pages of written text. Data from the logbooks were expected to give an understanding of what happened in the cases during the participation in the ReWork-Stroke regarding their work potential and work performance, in relation to the measures performed by the OTs in the programme. These measures could, for example, be the use of strategies and adjustments such as working hours, work environment, as well as cooperation with others.

2.4. Data Analysis

The data analysis was performed by the authors in two steps. First, all data from the instruments were analysed. Thereafter, data from the logbooks were analysed with a focus on additional information related to the performed measures in the programme in order to describe changes for the participants during their return-to-work process. Descriptive statistics were used for the demographic data. Aggregated domain scores were generated for each SIS domain. Clinically meaningful changes in SIS domain scores were considered as positive (+15 points or more), negative (−15 or lower), or no change with a difference between −14 and +14 [33]. In the analyses of work potential (WRI) and work performance (AWP), data were analysed on an individual level to describe changes for each participant. Concerning the WRI, a positive change to a supporting item was identified when an item rating of 1 or 2 (interfering) had changed to a rating of 3 or 4 (supporting) at follow-up, and negative change was identified when the item rating had changed in the opposite way. Concerning the AWP, a positive change to a competent performance was identified when the rating of the performance between baseline and after three months of work trial had reached 4 on the actual item. A negative change was identified when the rating had decreased into a lower rating. Details in the changes in ratings in WRI and AWP are reported in Tables 3 and 4 and explained in footnotes. On the basis of these changes, three cases were identified for in-depth description of their return-to-work process during the ReWork-Stroke programme.

A manifest deductive content analysis [35] was applied in the analysis of the logbooks for the three cases chosen. Firstly, the text in the logbooks was read through by three of the authors (U.J., G.E., A.Ö.N.) to become familiar with the OTs' information. Thereafter, the unit of analysis was identified based on the factors of motivation, lifestyle, and environment originating from the WRI, and the domains of motor and process skills originating from the AWP. In the next step the text was divided into meaning units, which considered capturing content in the factors and domains. Then, the meaning units were condensed and coded [36] into words close to the OTs' text. The codes describing the OTs' measures from the three logbooks were ordered, consistent with the different factors and domains in WRI and AWP, to be used in the three case descriptions. During the analysis process, the authors (UJ, GE) moved back and forth to compare the text in the logbooks and the text in the emerging analysis.

3. Results

In this study all participants reached changes in work potential and work performance, of which the majority were positive during the ReWork-Stroke, shown in Tables 3 and 4. The majority of the

participants had returned to part-time work nine months after the start of the work trial. Details on work re-entry are reported in Table 5. A variety of the OTs' measures were identified in three case descriptions. These measures supported the participants in their individual work situation and contributed to enable the positive changes.

Time from inclusion and start of a work trial varied from 4.5 to 19 months due to different circumstances, such as difficulties in finding suitable work tasks that fitted the participant's cognitive limitations (see Table 1). The impact of stroke among the participants was perceived as relatively similar while they were in the programme. The stroke impact scale domains of emotions, participation, and stroke recovery were affected (domain score about 60) at baseline for nearly all participants and continued to be affected at follow-up. The motor domains were affected for some participants, as well as memory, communication, and ADL/IADL (See Table 2).

3.1. Work Potential

Changes in work potential between baseline and after three months of the work trial are presented in Table 3. For the majority of the participants, all three factors were supportive for their abilities to return to work as early as when starting their work trial. To a great extent, these factors remained supportive at the three-month follow-up. Half of the 10 participants had a sustained supportive factor in 14 out of 16 items in WRI from baseline to the three-month follow-up. Additionally, two participants had a sustained supportive factor in 13 of the 16 items. Eight of the participants had one to six positive changes in work potential during their participation in the work trial in ReWork-Stroke. Six of the participants had one or two negative changes during this time period.

3.2. Work Performance

Changes in work performance between baseline and after three months of work trial are presented in Table 4. All participants reported a positive change to a competent performance on one or more items. Six participants had positive changes on one or more items but did not reach a competent performance. Changes were predominantly in a positive direction from incompetent to competent performance for both motor and process skills. Still, four participants had negative changes. Nine participants had competent performance both at baseline and after work trial on several items.

3.3. Work Re-Entry

Three participants reported that they were still on work trial nine months after the beginning of the work trial, while seven participants had returned to paid employment to some extent. The self-reported work re-entry levels among the ten participants, nine months after the beginning of the work trial, are presented in Table 5.

3.4. Case Descriptions

3.4.1. Participant E: Elisabeth

Elisabeth was nearly 60 years old and lived with her husband when she experienced a mild stroke. She worked as a manager at the time of stroke and the organization at the workplace was in the middle of a large change. Elisabeth was included in the ReWork-Stroke programme 8.5 months after her stroke. Due to her stroke, she had difficulties with reading, writing, fatigue, and ability to concentrate. These consequences after her stroke made it difficult for her to remain in a management position, which is why another person took this role. Elisabeth enjoyed being back at the workplace again and was looking forward to her return to work. She was supported by one of her colleagues and they had a close cooperation with the OT who came to the workplace regularly.

Table 2. Impact of stroke at the baseline and after three months of the work trial in the stroke impact scale 3.0 (SIS) domains, and clinically meaningful changes between these phases (n = 10).

SIS Domains	Participants									
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**
Strength		100/-		75/75		75/75	50/50		**44/63**	38/44
Memory	93/100	82/89	68/68	75/75	100/96	50/54		**46/82**		100/96
Emotions	**61/78**	**75/97**	**61/92**	**56/83**	**61/78**	**64/94**	**61/78**	**53/72**	61/75	**58/75**
Communication	69/79	69/79	97/96	91/93	50/57	75/64	91/89	81/89		97/96
ADL/IADL			95/100	88/95		88/75	65/78	85/98	100/98	63/63
Mobility				**83/100**		100/89	97/94	97/100	89/97	61/75
Hand function		100/-		90/100		100/89	0/10			15/20
Participation	86/84	**71/91**	57/57	**61/97**	61/72	54/50	79/91	**46/100**	79/91	**39/91**
Stroke recovery	61/67	97/85	60/60	71/85	**65/50**	70/60	30/40	92/86	50/60	70/80
Participants	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**
Total change based on all SIS domains:	P:1 N:0	P:2 N:0	P:1 N:0	P:3 N:0	P:1 N:1	P:1 N:0	P:1 N:0	P:3 N:0	P:1 N:0	P:2 N:0

P, positive clinically meaningful change; N, negative clinically meaningful change; empty spaces, a domain score of 100 at both data collection points. Bold numbers indicate clinically meaningful changes between baseline and three months of work trial.

Table 3. Participants' changes in work potential between baseline and after 3 months of work trial assessed with the worker role interview (WRI).

Content Area	WRI Items	Participants									
		A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**
MOTIVATIONAL FACTORS Personal causation, item 1–3 Values, item 4-5 Interests, item 6–7	Assesses abilities and limitations		P			N	P	I	P		
	Expectation of job success			N		I		P			
	Takes responsibility							P			
	Commitment to work					I		P			
	Work-related goals					I		P			
	Enjoys work							I			
	Pursues interests			I				I	P	N	
LIFESTYLE FACTORS Roles, item 8–9 Habits, item 10–12	Appraises work expectations										
	Influence of other roles			P							
	Work habits			–		–					
	Daily routines				P			N			
	Adapts routine to minimize difficulties			P		N		N			

Table 3. *Cont.*

Content Area	WRI Items	Participants									
		A	B	C	D	E	F	G	H	I	J
ENVIRONMENTAL FACTORS Workplace related items, 13, 15, 16	Perception of work setting		P	I	P	P		P			
	Perception of family and peers	P				P	N			–	
	Perception of boss	I				I		P			N
	Perception of co-workers			P	P	P		I	P		N
	Total change based on all WRI items:	P:1 N:0	P:2 N:0	P:3 N:1	P:3 N:0	P:3 N:2	P:1 N:1	P:6 N:2	P:3 N:0	P:0 N:1	P:0 N:2

P, positive change in actual work potential factor between baseline and follow-up, i.e., change from interfering (score 1,2) to supporting (score 3,4); N, negative change in actual work potential between baseline and follow-up, i.e., change from supporting (score 3,4) to interfering (score 1,2); I, still an interfering factor for the participant's work potential, i.e., no change between baseline and after 3 months of work trial; empty space, still a supporting factor for the participant's work potential, i.e., no change between baseline and after 3 months of work trial; –, missing data.

Table 4. Participants´ changes on assessment in work performance between baseline and after three months of work trial, assessed with the Assessment of Work Performance (AWP).

AWP Items	Participants									
	A	B	C	D	E	F	G	H	I	J
Posture	B	B		P	P	N	P	P		P
Mobility		P		P	P		–	–		P
Coordination				P	P		MP	P		P
Strength					P		P			P
Physical energy	P	N	B	P	MP	N	B	P	B	P
Mental energy	MP	P	P	P	MP	B		B	P	P
Knowledge		N	MP	P	B		P	B		
Temporal organization		N	P	P	B		P	N		
Organisation of space/objects	N	B	P	MP	MP	P		N	P	
Adaptation		MP	P	MP	B	P	P	B	P	
Total change per person based on all items	P = 1 MP = 1 N = 1	P = 2 MP = 1 N = 3	P = 4 MP = 1 N = 0	P = 7 MP = 2 N = 0	P = 4 MP = 3 N = 0	P = 2 MP = 0 N = 2	P = 5 MP = 1 N = 0	P = 3 MP = 0 N = 2	P = 3 MP = 0 N = 0	P = 6 MP = 0 N = 0

P, positive change in AWP item, reached a competent performance between baseline and after three months of work trial; MP, positive change in AWP item, but not reached a competent performance between baseline and after three months of work trial; N, negative change in AWP item between baseline and after three months of work trial; B, no change (same) in AWP item between baseline and after three 3 months of work trial and below competent performance; empty space, competent performance both at baseline and after three months of work trial; –, missing data.

Table 5. Levels of work re-entry at 9 months after start of the work trial.

Participants	A	B	C	D	E	F	G	H	I	J
Work status	In work trial	75%	50%	25%	In work trial	50%	50%	In work trial	75%	25%

The WRI scores at baseline showed that some items concerning motivation for work were interfering with the return to work, i.e., expectation of job success, commitment to work and work-related goals, and they did not improve during the work trial. The logbooks revealed that Elisabeth was unsure about her possibilities to return to work. Her concerns about how to manage work tasks were discussed several times. Strategies on how to deal with the consequences of her stroke were suggested by the OT. The other work potential factors were mostly supportive or became supportive during the work trial. The AWP showed that Elisabeth had positive changes on all motor items between baseline and follow-up and reached competent performance on all except physical energy. However, on the process items, there was no change in three of the five items, i.e., knowledge, temporal organization and adaptation, and competent performances were not achieved.

Different strategies and aids were proposed and discussed during the work trial and were also successively implemented and used by Elisabeth. Strategies were, for example, tape recording of meetings to substitute for memory problems, use of a speech dictation device instead of writing minutes, writing down of main points before calling someone, use of to-do lists to get structure and support for memory, and taking small breaks to stay more alert. Technical aids that facilitated her work were installed on her computer.

During the work trial, ongoing discussions were conducted to find suitable work tasks that were manageable for her and that could be paid for in the long run. For example, she tried out working with bookkeeping as numbers were easier for her to work with than words. These tasks worked out well for her but were very tiring. She also tried some of her ordinary work tasks such as planning for and leading meetings.

It also became evident to co-workers during the work trial that Elisabeth had some difficulties to remember information. This was an interfering factor at work as she could, for example, forget to do work tasks that should have been done before meetings.

Discussions about her possibility to return to her former job duties despite her aphasia continued during the work trial.

At the follow-up nine months after the start of the work trial, Elisabeth was still in a work trial.

3.4.2. Participant G: Gina

Gina was a 52-year-old administrator who was included in the ReWork-Stroke programme 19 months after stroke onset. On her inclusion, she still had some physical impairment, as well as aphasia and she also described an impact on cognitive functions such as concentration.

Her WRI scores indicated a difficulty in working out abilities and limitations and this was one area that, according to the logbook, has been central during the work trial. Together with Gina and her employer, the OT discussed and planned for work tasks, working hours, and the social environment.

At the end of the work trial, the WRI showed both some positive and some negative changes. Most of the positive changes were for motivational factors, while negative change occurred for lifestyle factors that addressed daily routines. The logbook indicated that work demanded a lot of energy for Gina, which affected her life outside work.

AWP showed a positive change in motor items with the exception of physical energy, which was below a level supporting return to work at the end of the work trial. This was, as underpinned in the notes of the logbook, an indication of the balancing between her strong wish to return to work and her energy to do so. During the OT's recurrent visits to the workplace, subjects such as the pace of expanding working hours were often on the agenda. Gina wanted to hasten the process, but her boss and the OT were helping her to take it step-by-step by evaluating and discussing her achievements.

The other motor and process items showed unaltered competency or change to competent performance after the work trial.

Gina was working 50% at follow-up nine months after start of the work trial.

3.4.3. Participant H: Henry

Henry was 50 years old when he experienced a moderate stroke. He was married, had two children, and worked as a craftsman. After his stroke, he had both physical and cognitive difficulties. His balance was affected as well as his memory and vision. Due to his vision impairment, he was not allowed to drive which was a concern when discussing returning to work and the bus option was mentioned. The time from stroke onset to inclusion in ReWork-Stroke was seven months. Henry realized that his work tasks at his former workplace were too difficult due to the consequences of his stroke. He therefore used his contacts and found another workplace where he could start his work trial.

It was mainly the motivational factors, lifestyle factors and environmental factors in the WRI that supported his return to work. However, according to the WRI assessment Henry was unsure about his abilities and limitations after his stroke. This was also a focus during the work trial where his boss collaborated with Henry and the OT to find suitable work tasks for him. During the work trial, he could try out both his severity of work tasks and working hours.

The AWP scores showed a change to competent performance on three motor items. This was an important improvement, as Henry had physically demanding work. The AWP process items were all scored as incompetent performance after three months of the work trial. Two of the items, temporal organization and organization of space/objects, had changed from competent to incompetent. Strategies to handle the consequences after the stroke at work were discussed and suggested by the OT during the three months of the work trial. Henry was recommended to take short breaks and to only focus on one task at a time. His co-workers were supportive and assisted in reminding him about taking breaks and to adjust his working pace (work slower). Henry also needed to use different strategies and techniques to reduce the impact of impaired memory, such as to-do lists and the use of a calendar, both at work and in household chores at home.

Henry tried to work full days and physically it worked out all right. He even had the energy to walk the dog after work, but his memory problems became worse. In cooperation with the OT and the workplace, the schedule was changed so that Henry could have a day of rest between two working days. The WRI item "pursues interest", showed that he had enhanced his ability to seize opportunities to make his life stimulating and meaningful both in and outside work.

At the follow-up nine months after the start of the work trial, Henry was still on work trial.

4. Discussion

The findings in this study identified a variety of changes in both work potential and work performance, and the majority of these were positive. Still, the case study revealed that the changes were individually influenced without any clearly emerging pattern among the participants. Furthermore, the measures taken by the OTs varied to a great extent, which implicate that a person-centred approach in a return-to-work programme for people who have had a stroke is needed. The findings will be further discussed below.

To the best of our knowledge, exploring changes in work potential and work performance during a return-to-work programme by using assessment instruments, in combination with documentation from logbooks, has not been done before. Findings from this study revealed that many work potential items were assessed as supportive in the preparation phase and remained supportive. One reason for some of these supportive WRI scores was probably because willingness to return to work and being estimated as ready to start the return-to-work process were inclusion criteria for the project. Still, the motivational factors in the WRI were the most frequently reported items as being interfering factors, both at baseline and at follow-up. This indicates that the motivational factors are difficult to target in a return-to-work programme. Even so, it is highly necessary to reflect on these results, as

previous research has found that being motivated to work was of great importance for returning to work for people who have had a stroke [36]. The fact that, in some cases, the motivational factors were interfering may have reflected the participants' growing awareness of their new situation and how the consequences of a stroke impacted their abilities to perform work tasks and, by extension, their opportunities to return to their former workplace and working life per se. These results are in line with the findings from Braathen et al. [37], who described the process their participants went through when learning about changes in work ability and improving coping strategies in interaction with the workplace. Still, this needs to be investigated further in future research.

The perceived impact of stroke, measured with SIS, was rather similar between the measuring points, which is not surprising as more than a year had passed since stroke onset for seven of the participants. However, in the domain of emotions, most of the participants reported clinically meaningful changes. These changes might reflect the fact that beginning the work trial was beneficial to their mood. Earlier studies [38–40] have highlighted the importance of employment for quality of life. The clinically meaningful changes in the domain participation for four of the participants might indicate a positive experience of having returned to work and being back in the social context at work.

The differences in the results of the AWP assessments between the participants illustrate that the consequences of a stroke can influence work performance in several ways. Different patterns were also found among the participants in the WRI, which highlights the complexity of work ability [10]. The decision to return to work or not cannot be explained by any single factor in this sample. As revealed in the logbooks, individualized support was needed to meet the heterogeneity in the sample, i.e., stroke severity, cognitive as well as motor impairments, time since onset, time for preparation before start of work trial, varying social support, distances from home to workplace, and profession. The OT suggested various strategies for dealing with the consequences of a stroke at the workplace. The variety of strategies used, and the solutions developed in collaboration at the workplace are in line with a person-centred approach [20,21] and might entail the positive changes in work potential and work performance. Furthermore, the findings, in the present study, revealed that the experienced OTs supported participants in their specific work situation. Thereby, the workplaces became natural platforms for discussions between the participants and other stakeholders on strategies and adaptations needed. This feature has previously been highlighted as very important [41].

Interestingly, it became evident in the present study that it was not enough to discuss strategies to cope at work, as the logbooks revealed that strategies targeting lifestyle balance [42] were also discussed. These results might be understood in relation to the results of the WRI, which identified that there were still a few interfering factors within the area of lifestyle factors at follow-up, despite the fact that the new routine "to work" was initiated. The importance of focusing on a variety of factors regarding perceived work ability has also been reported elsewhere [10].

Methodological Considerations

This study used a multiple case-study design to obtain in-depth information about work potential and work performance during a return-to-work process. Both quantitative and qualitative data were used to illuminate the return to work process.

The use of field notes from logbooks added examples on measures during the programme, and thereby complemented the quantitative data. This gave an increased understanding concerning work performance and work potential on an individual level. The underpinning of this choice was the complexity of the phenomenon, i.e., return to work after a stroke. As described in the literature, work ability consists of and, relies on, many factors that are personal, workplace related, and environmental [10]. A case study design is suitable when studying different characteristics in-depth [16]. The more detailed presentation of three cases was intended to give examples of different situations. It also demonstrates the variety of factors impacting a successful return to work after a stroke. One strength of the study was that the participants represent different professions, educational backgrounds, living areas, and family situations. Therefore, we could ascertain the richness of the data illustrating the phenomenon from different aspects.

In this study, the AWP and WRI assessments of work ability were performed by two vocational specialists from the Swedish Public Employment Office, who were skilled in using these assessments and not involved in the rehabilitation of the participants, which was one strength of the study. The AWPs were performed in a constructed setting at a clinic. It would have been interesting, as a complementary aspect to the study, to perform AWPs at the participants' specific workplaces with their real work tasks, as has been proposed by Karlsson and co-authors [25]. In that case, the information from the assessment would probably have been more directly connected to the challenges at the workplace. The high scores on AWP might be because the majority had experienced a mild stroke. One limitation was that communication and interaction skills in AWP were not assessed, as each participant was assessed separately. Thus, interaction with other individuals was not possible. Other limitations to this study were the sample size that did not allow any generalization from the results and the relatively short time that the participants were followed in their return-to-work process. A longer follow-up period might have contributed valuable information concerning changes in work potential and work performance, as the ability to work might change, even after several years [8]. The inclusion criteria to be motivated to return to work is reflected in scores on WRI area Motivational factors. This probably affects the potential for positive change in scores during the work trial period.

The OTs, in this study, had extensive knowledge and experience of stroke and vocational rehabilitation, which was important to be aware of and to be considered when providing the ReWork-Stroke programme. They were familiar with providing individual support in the work environment connected to specific situations. In this study, they were able to increase our understanding about measures in the programme that could bring about changes in work ability and return to work after a stroke.

5. Conclusions

Changes in work potential and work performance, of which the majority were positive, occurred for the participants while taking part in the ReWork-Stroke programme. It became evident that the changes occurred in various domains in line with the functional and activity limitations of the participants. On the basis of this variety, it was also clear that the OTs' measures varied across cases, but all had a close collaboration with the manager and colleagues at the workplace. In this study, seven of ten persons had paid employment to some extent nine months after starting the work trial. This is, however, the first study on the ReWork-Stroke programme and further studies are needed to evaluate changes in work potential and work performance and the programme´s effectiveness in increasing work re-entry for people who have experienced a stroke.

Important implications drawn from this study are, thus, the importance of gathering information regarding work potential and work performance when planning the measures taken. Another important conclusion is that the measures need to be planned based on the patients' abilities, the demands of the workplace, as well as the patients' life situation. When taking all these factors into account, a process of co-creating work ability might occur by means of the person-centred approach in the return-to-work programme and by means of the collaboration with all involved at the workplace.

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Article

Emergency Healthcare Providers' Perceptions of Preparedness and Willingness to Work during Disasters and Public Health Emergencies

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Abstract: This study evaluates the perceptions of preparedness and willingness to work during disasters and public health emergencies among 213 healthcare workers at hospitals in the southern region of Saudi Arabia by using a quantitative survey (Fight or Flight). The results showed that participants' willingness to work unconditionally during disasters and emergencies varied based on the type of condition: natural disasters (61.97%), seasonal influenza pandemic (52.58%), smallpox pandemic (47.89%), SARS/COVID-19 pandemic (43.56%), special flu pandemic (36.15%), mass shooting (37.56%), chemical incident and bombing threats (31.92%), biological events (28.17%), Ebola outbreaks (27.7%), and nuclear incident (24.88%). A lack of confidence and the absence of safety assurance for healthcare workers and their family members were the most important reasons cited. The co-variation between age and education versus risk and danger by Spearman's rho confirmed a small negative correlation between education and danger at a 95% level of significance, meaning that educated healthcare workers have less fear to work under dangerous events. Although the causes of unsuccessful management of disasters and emergencies may vary, individuals' characteristics, such as lack of confidence and emotional distractions because of uncertainty about the safety issues, may also play a significant role. Besides educational initiatives, other measures, which guarantee the safety of healthcare providers and their family members, should be established and implemented.

Keywords: confidence; disaster; emergency; healthcare; family member; preparedness

1. Introduction

A disaster is defined as "a serious disruption of functions in a community or a society resulting in widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its resources" [1,2]. The Centre for Research on the Epidemiology of Disasters (CRED) reported that about 205 million people suffer from the negative outcomes of disasters

each year [3]. These numbers of people continue to increase each year, with the increasing in the number of casualties and the severity of disasters such as volcanic eruption, earthquake, storm, flood, etc. [4]. The myriad of disasters and public health emergencies has compelled countries to rethink their security paradigms and preparedness to reduce the number of fatalities and the severity of destruction and disruptions [5].

Disaster preparedness should involve all levels of response systems [6]. The readiness to cope with a disaster encompasses all planning activities which take place at the state, institutional, and individual levels. Countries such as Sweden have maintained a societal security orientation in a bid to safeguard people and property and sustain resilience in planning and preparedness for unforeseen incidents and issues which may cause societal instability [7]. However, a number of stressors and an increased focus on danger may be demotivating factors for all agencies, but in particular healthcare professionals who work to help those in need in times of disasters and emergencies. Therefore, the perceived concerns of healthcare personnel should be highlighted and addressed.

While there are guidelines to assist practitioners in responding to emergency situations, the confidence of healthcare staff might be affected by factors such as individual characteristics and preparedness, training, family support, and communication [7,8]. Several studies have shown that various personal characteristics, such as age, experience, and education, have an effect on or are associated with how individuals perceive the importance of the risks [8,9]. Furthermore, certain factors such as the type of disaster, concern for family, concerns about personal safety, pet care needs and the lack of personal protective equipment (PPE) may influence the willingness (or lack of willingness) of staff to work during disasters [10]. For instance, some staff failed to return to their duties during the Bangkok flooding in 2011, as they were worried about the safety and locations of their relatives [11]. Although hospitals must be functional and appropriately staffed to receive the injured, hospital response plans seem to fail in considering the destruction of the hospital itself and the physical and emotional conditions of the healthcare workers during an incident. Thus, while healthcare workers are expected to be willing to respond to disasters, in reality, they might be reluctant to do so when the situation poses a threat to their safety [12].

The success of disaster plans is predicated on the willingness of the responders, whose perceptions of disaster preparedness are influenced by institutional and individual preparedness, experience of previous incidents, and family support [13,14]. A worker who feels physically unequipped and unsafe, or is not mentally prepared to respond to a disaster due to lack of experience may be reluctant to engage in risky attempts to save others, and to handle the challenges associated with emergency responses [10]. Moreover, as several studies have reported, a hospital's level of preparation also influences the confidence of the employees [13,15,16]. Consequently, while hospitals may be prepared, staff members such as nurses may not be confident in their ability to respond to a disaster.

It is, thus, not clear to what extent healthcare workers feel prepared or perceive the importance of staying prepared in the face of unprecedented disasters. A good understanding of disaster preparedness perceptions among healthcare workers can help considerably in the design and development of operational strategies, including training and exercises on how to respond to different types of disasters in both developed and developing countries [13].

The World Health Organization (WHO) stresses the need for healthcare institutions to prepare their workforce, including nurses and physicians, among others, to ensure preparedness and speed in dealing with different types of emergencies which may occur in the course of their practice [17]. The Kingdom of Saudi Arabia (KSA) has classified the levels of health service according to the Model of Care (MoC) description, which is divided into Activated people, Healthy communities, Virtual care, Primary care, Secondary care, Tertiary care, and Quaternary care. MoC describes a comprehensive care system for meeting health needs, which shifts the focus from curative care to preventive care. Systems of Care will operate less in hospitals and more in people's homes and communities [18]. Both governmental and private sectors offer healthcare. In the government sector, all levels of health care are provided free of charge [19]. The Ministry of Health (MOH) covers around 80% of the costs,

and the remaining costs is covered by other agencies, such as the Armed Forces Military Services (AFMS), Health Services for Royal Commission in Jubal and Yanbua, the Saudi Arabian Oil Company (ARAMCO) Health Services, and others. The private sector provides all levels of health care to Saudi and non-Saudi for a fee [20].

The KSA has recorded a number of disasters such as flooding and fires. Although some measures to increase the degree of preparedness and responsiveness to various types of disasters, such as yearly exercises by many different agencies, have been suggested by the government, a recent fire at Jazan General Hospital revealed response deficiencies and a lack of disaster planning and preparedness [21]. Despite the collective approach in different exercises, a lack of vital skills and competencies may be associated with an inability among the KSA's healthcare workers to adequately plan and prepare for unpredicted events [22]. A recent study of this group showed that the majority of emergency staff at hospitals in the southern region of the KSA had good theoretical knowledge but insufficient practical knowledge. The study also showed that staffs with greater educational knowledge were more confident to act in emergencies and disaster events [23].

2. Aim

The aim of this study was to evaluate healthcare workers' perceptions of their preparedness and willingness to work during disasters and public health emergencies in the southern region of the KSA.

3. Materials and Methods

3.1. Study Design

This study employed a quantitative research design. A survey was used to generate a numeric representation of specific scenarios in healthcare. The behavioral characteristics, opinions, and attitudes of various stakeholders in healthcare were analyzed.

3.2. Survey

The study employed a validated English-language version of the (Fight or Flight) survey, provided by one of the authors (L.M.). The survey was developed and described in earlier studies [24,25]. The original version of the (Fight or Flight) survey was developed at the Center for Research and Education in Emergency Care (CREEC) of the University of Leuven, Belgium. A multi-scenario survey was developed, as at the time, literature was limited to pandemics. After a pilot study in one Belgian hospital, several disaster medicine experts from the Flemish Disaster Management course (CREEC, emergency nurses, and the military) validated a multi-centric version. This version does not allow studying the association between fear, stress, and emotion, but provides information necessary to establish such an association. It was modified for use in this study and provides a comprehensive analysis of the topic of study since it covers broad areas of disasters and public health emergencies. It works individually to assess several areas of healthcare and delves into in-depth information about the research. The survey is comprised of 60 items distributed between two sections: a demographic section consisting of 12 questions and a scenario section consisting of four scenarios (Willingness to go to work, Knowledge, Risk and Danger). Each scenario contains 12 dimensions, which can influence the working environment, presented as a question and illustrative example.

The willingness to work under a certain condition was marked as yes or no. The condition itself was marked in a predesignated field with 10 different choices: I will work during this incident if:

(a) I know my family is safe and taken care of;
(b) I am sure good communication lines with my family are available;
(c) My boss comes to work as well;
(d) I am trained to handle the situation;
(e) I get regular updates on the evolution of the incident;

(f) Adequate PPE is provided;
(g) I get paid extra for it;
(h) I can get antivirals (e.g., Tamiflu) for free;
(i) I can get antidotes for free;
(j) I can get my vaccinations for free (Appendix A).

Furthermore, participants assessed their perceived knowledge in each scenario on a Likert scale by choosing between 1–10 points. One indicates the lowest and 10 the highest grade of perceived knowledge.

3.3. Setting

The study was conducted on Thursday 9 July 2020 at 10 MOH hospitals (n = 10) in the Najran region, KSA. Najran is located in the southern part of the KSA, where the border is exposed to potential risk of disasters and armed conflict.

3.4. Population and Sample

The included participants were healthcare practitioners working in emergency departments (EDs), intensive care units (ICUs), and disaster teams/units, who were willing to participate, of all ages and gender groups. Workers who did not complete the survey, workers who were not present during the study period because of vacation or maternity leave, and personnel at the consultant or managerial level were excluded. All healthcare workers were informed about the study and its goals by the medical affairs administration in each of the hospitals, and informed consent was obtained. Workers were also informed that their participation was voluntary and that they could leave the study whenever they chose to. The participants were randomly chosen from the list of healthcare staff working in each ICU, ED, and disaster team/unit, thus avoiding the bias involved in choosing a specific group. The sample size was set at 250 healthcare practitioners based on the power calculation (Raosoft Inc., Seattle, WA, USA), assuming 4.5% precision with 50% prevalence and a population size of 508 with a 95% confidence interval specified limits.

3.5. Data Collection and Processing

The self-completion survey was presented to the participants through the SurveyMonkey website. All data were handled confidentially. Collected data were stored at the research center in each hospital. Healthcare practitioners answered the surveys on a specific research day to prevent response influence. The respondents were asked to provide accurate information. The information provided was subject only to research purposes, and the researcher could not disclose the respondents' identities at any time, no matter the circumstance.

3.6. Ethical Approval

An ethical committee certificate of approval for the study was obtained from the Institutional Review Board at the General Directorate of Health Affairs in the Najran region (IRB Log Number 2020-28 E; date of approval: 7 July 2020).

3.7. Statistics

The homogeneity of the items in the subscales of the Fight or Flight survey was analyzed by calculating Cronbach's alpha using the Statistical Package for the Social Sciences (SPSS) version 20 (IBM, Texas, USA). Cronbach's alpha was 0.927, showing high internal consistency; according to Brace et al. [26], this value is considered satisfactory. Other results are descriptively presented in actual numbers and percentages.

4. Results

4.1. Description of the Study Participants

The total number of respondents was 334, but 121 did not complete the survey and were excluded from the study. Data were collected from the remaining 213 participants. The majority of the participants were females and over 50% were nurses. About 53.52% were 25–34 years old (n = 114). Some 63% (n = 136) had graduated from university. About 70.89% (151) of the participants were married, and 61.5% (n = 131) had children. Among the 131 participants who had children, 90 participants indicated that their children lived with them. A total of 120 participants held leadership positions in their organizations, 175 participants (82.94%) had regular contact with patients, and 128 (60.38%) regularly worked in emergency units such as ICUs and EDs. Most of the participants had some kind of training (Table 1).

Table 1. Demographic data (n = 213).

Variable	*n*	%	Variable	*n*	%
Position			Have children		
Supportive Services	17	7.98	Yes	131	61.5
Nurse	116	54.46	No	82	38.5
Administrator	16	7.51	Children living with them		
Physician	47	22.07	Yes	90	42.65
Paramedic/Emergency Medical Technicians (EMT)	17	7.98	No	121	57.35
Age by year			Function		
20–24	7	3.29	Leader	120	56.87
25–34	114	53.52	Executor	91	43.13
35–44	59	27.7	Regular patient contact		
45–54	25	11.74	Yes	175	82.94
55+	8	3.76	No	36	17.06
Gender			Work at emergency units		
Male	97	45.54	Yes	128	60.38
Female	116	54.46	No	84	39.62
Level of education			Training		
Institute	9	4.23	Disaster Management	171	82.61
College	68	31.92	Epidemic/pandemic	85	41.06
University	136	63.85	Chemical incidents	32	15.46
Marital status			Nuclear incidents	9	4.35
Single	62	29.11	Mass casualty incidents	60	28.99
Married	151	70.89			

4.2. Willingness to Respond to Disasters and Emergencies

The study participants' willingness to go to work during disasters and emergencies varied based on the type of condition (Table 2). There was no condition in which all of the participants were willing to work. Notably, the willingness of the participants to work unconditionally varied across conditions. More than 50% of participants were willing to work unconditionally when facing natural disasters such as flooding (61.97%) or when dealing with a seasonal influenza pandemic (52.58%). Over 40% of the respondents were willing to work unconditionally when facing smallpox (47.89%) and SARS/COVID-19 (43.56%). Up to 36.15% were willing to work unconditionally during a special flu pandemic. Ebola outbreaks (27.7%) and biological incidents (28.17%) such as anthrax were the least favorable incidents for working unconditionally. Of the various human-made disasters, a nuclear incident would result in the lowest number of participants willing to work unconditionally (24.88%), followed by a chemical incident and bombing threat (31.92%), a dirty bomb (32.86%), and a mass shooting (37.56%).

Table 2. Willingness to go to work during various conditions (n = 213).

All Scenarios Affect Your Hospital and Working Area	Yes, Unconditionally		Yes, under Certain Circumstances a–j #		Have Serious Doubts, Probably Not		I Will Certainly Not Respond	
	n	%	*n*	%	*n*	%	*n*	%
Natural disaster (e.g., flooding)	132	61.97	63	29.58	9	4.23	9	4.23
Bombing (e.g., terrorist threat)	68	31.92	89	41.78	38	17.84	18	8.45
Seasonal influenza pandemic	112	52.58	83	38.97	14	6.57	4	1.88
Special flu pandemic (e.g., bird flu)	77	36.15	106	49.77	20	9.39	10	4.69
SARS/COVID-19	93	43.66	97	45.54	16	7.51	7	3.29
Ebola outbreak	59	27.70	56	26.29	71	33.33	27	12.68
Smallpox	102	47.89	69	32.39	27	12.68	15	7.04
Chemical incident	68	31.92	65	30.52	50	23.47	30	14.08
Biological incident (e.g., anthrax)	60	28.17	54	25.35	74	34.74	25	11.74
Nuclear incident	53	24.88	48	22.54	41	19.25	71	33.33
Dirty bomb	70	32.86	83	38.97	37	17.37	23	10.80
Mass shooting (e.g., Paris)	80	37.56	67	31.46	39	18.31	27	12.68

Explanation of 'Under certain circumstances' a–j #: (a) If I know my family is safe and taken care of; (b) If I am sure good communication lines with my family are available; (c) If my boss comes to work as well; (d) If I am trained to handle the situation; (e) If I get regular updates on the evolution of the incident; (f) If adequate PPE is provided; (g) If I get paid extra for it; (h) If I can get antivirals (e.g., Tamiflu) for free; (i) If I can get antidotes for free; (j) If I can get my vaccinations for free.

Some of the respondents expressed a willingness to work during disasters and emergencies under certain circumstances (Table 3). About 49.77% had demands for facing a special flu pandemic. Sixty-five of the 106 respondents demanded adequate PPE before they would go to work, 18 indicated that they would only go to work if they were properly trained, and eight indicated a willingness to go to work if their families were safe. In the same vein, 45.54% of the respondents indicated that they were willing to go to work in the case of a SARS/COVID-19 pandemic under certain circumstances. Adequate PPE was a requirement of 74 of the 97 who responded, followed by a consideration of the level of training. Additionally, 41.78% would consider going to work after a bombing under certain circumstances. Of these circumstances, the need to ensure that the respondent's family was safe and taken care of was considered the most pertinent, followed by the need for adequate training to deal with the situation. Seasonal influenza and a dirty bomb were the next two incidents in which respondents were most willing to go to work only under certain circumstances. For seasonal influenza, most respondents would consider going to work only if they were provided with PPE, were adequately trained to deal with the situation, and were assured that their families were safe.

Table 3. Willingness to go to work under certain circumstances (see explanations of a–j above).

All Scenarios Affect Your Hospital and Working Area	a	b	c	d	e	f	g	h	i	j	Mean	Std. Deviation
Natural disaster n = 63	26	5	2	22	3	2	1	0	1	1	2.97	2.130
Bombing n = 89	47	7	3	20	3	7	2	0	0	0	2.56	1.875
Seasonal influenza pandemic n = 83	9	2	1	13	1	50	2	0	2	3	5.25	2.118
Special flu pandemic n = 106	8	0	2	18	4	65	1	2	2	4	5.48	1.942
SARS/COVID-19 n = 97	4	0	2	11	3	74	1	1	0	1	5.56	1.354
Ebola outbreak n = 56	4	3	1	23	1	19	2	1	1	1	4.75	1.919
Smallpox n = 69	4	2	2	19	1	35	1	0	1	4	5.29	2.108
Chemical incident n = 65	13	0	1	25	2	21	2	0	1	0	4.23	1.951
Biological incident n = 54	3	1	2	24	2	17	2	1	0	2	4.87	1.914
Nuclear incident n = 48	14	0	0	19	4	9	1	0	1	0	3.67	2.077
Dirty bomb n = 83	39	2	3	29	2	8	0	0	0	0	2.72	1.783
Mass shooting n = 67	27	6	0	23	5	5	0	0	0	1	2.94	2.007

Ensuring that their families were safe and taken care of and that they had an appropriate level of training were the special considerations under which most of the respondents were willing to go to work. Some practitioners were also willing to work under certain circumstances when faced with an Ebola outbreak, smallpox, and a biological incident. For an Ebola outbreak and a biological incident, the most important special considerations were the skills to handle the situation, closely followed by the availability of adequate PPE. When dealing with smallpox, the most important consideration was the availability of adequate PPE, followed by the knowledge to deal with the situation.

Up to 30.52% of the respondents were willing to work under certain circumstances during a chemical incident. Of these circumstances, the knowledge required to deal with the incident was considered the most crucial, followed by the availability of adequate PPE and the knowledge that the respondent's family was safe. When facing a nuclear incident or a natural disaster, the most important considerations were whether the respondents were adequately trained to deal with the disaster and whether their families were safe.

A biological incident and an Ebola outbreak emerged as the two major disasters for which most respondents expressed serious doubt that they would go to work, 34.74% and 33.33%, respectively. Another 23.47% of the respondents expressed serious doubt about attending work if there were a chemical incident, while only 4.23% expressed serious doubt that they would go to work if there was a natural disaster. Equally, there were few serious doubts about going to work when faced with a seasonal influenza pandemic, SARS/COVID-19, and a special flu pandemic. Some of the participants were sure that they would not go to work in case of disasters and emergencies. About 33.33% of the respondents were certain that they would not go to work if they were required to deal with a nuclear incident, 14.08% if there was a chemical incident, 12.68% if there was either an Ebola outbreak or a mass shooting, 1.88% if there was a seasonal influenza epidemic, and 3.29% if there was a SARS/COVID-19 outbreak.

4.3. Participant's Knowledge of Various Disasters

Table 4 shows a self-rating of the participants' knowledge of various disasters and emergencies on a scale of 1 to 10. The respondents rated themselves highly on their knowledge of how to deal with SARS/COVID-19, a seasonal influenza pandemic, and smallpox. On the other hand, the respondents gave themselves low ratings on their knowledge of bombing situations, an Ebola outbreak, a dirty bomb, a mass shooting, biological incidents, and terrorist threats.

Table 4. Participants' self-ratings of their knowledge on a Likert scale of 1 (no knowledge at all) to 10 (knowledge on specialist level).

All Scenarios Affect Your Hospital and Working Area	Mean	Std. Deviation	Confidence Interval Lower Bound–Upper Bound
Natural disaster	5.59	2.281	5.28–5.90
Bombing	4.89	2.598	4.54–5.24
Seasonal influenza pandemic	6.77	2.298	6.46–7.08
Special flu pandemic	5.71	2.422	5.39–6.04
SARS/COVID-19	7.80	2.172	7.51–8.10
Ebola outbreak	4.64	2.719	4.27–5.01
Smallpox	6.10	2.490	5.76–6.43
Chemical incident	4.97	2.573	4.62–5.32
Biological incident	4.38	2.711	4.02–4.75
Nuclear incident	3.99	2.705	3.62–4.35
Dirty bomb	4.97	2.507	4.63–5.31
Mass shooting	5.23	2.413	4.91–5.56

4.4. Risks and Dangers of Various Disasters

The risk and associated danger of the SARS/COVID-19 pandemic occurring during participants' lifetimes were both at 80%, followed by bombing and terrorist threats at 63% and 69%, respectively. The likelihood of a seasonal influenza pandemic occurring during the study participants' lifetimes was viewed to be 62%. A similar rating was given by participants' perceptions of the dangers posed by the disaster to society and the lives and health of individuals. These ratings indicate that seasonal influenza is considered a likely natural disaster with a significant impact on society. The likelihood of mass shootings, such as the Paris shooting, was considered 60%. Its associated danger to society was considered 64% (Table 5).

Table 5. Description of risk (0–100% danger when it happens during respondent's lifetime) and danger (0–100% danger disturbs the whole society and threatens population's lives and health).

All Scenarios Affect Your Hospital and Working Area	Risk	Danger
	%	%
Natural disaster	58	64
Bombing	63	69
Seasonal influenza pandemic	62	62
Special flu pandemic	52	61
SARS/COVID-19	80	80
Ebola outbreak	42	59
Smallpox	52	55
Chemical incident	48	59
Biological incident	40	55
Nuclear incident	41	64
Dirty bomb	47	64
Mass shooting	60	64

The risks of a special flu pandemic and smallpox occurring were considered to be 52%. However, a special flu pandemic was viewed as posing more danger than smallpox, namely, 61% compared to 55% for smallpox. It appears that the participants viewed smallpox as unlikely to have a significant impact on society compared to a special flu pandemic. A chemical incident was considered to have a 48% likelihood of occurring. However, its danger to society was considered high, at 59%. In the same vein, the likelihood of a dirty bomb attack during the study participants' lifetimes was considered to be 47% and its danger 64% if it occurred. Equally, the risk of an Ebola outbreak was considered low at 42%. Nevertheless, the dangers of such an outbreak on society were considered to be 59%. A nuclear accident was considered unlikely to occur, with the respondents rating its risk as 41% and its danger at 64%, making it the third most dangerous disaster in the views of respondents. The respondents viewed a biological incident as the least likely disaster to occur at 40%. Nevertheless, they reported that it would pose a significant danger to society at 55%.

Because age and education were presented as ranks, a non-parametric test, Spearman's rho was chosen to test the co-variation between age and education versus risk and danger. The test confirmed a small negative correlation between education and danger at a 95% level of significance (Table 6).

Table 6. Ranks and statistics of Age and Education/Risk and Danger (n = 213).

Variable	Variable	Age	Risk	Variable	Variable	Education	Risk
Age	Correlation Coefficient	1.0	−0.105	Education	Correlation Coefficient	1.0	−0.044
	Sig. (2-tailed)		0.13		Sig. (2-tailed)		0.52
Risk	Correlation Coefficient	−0.105	1.0	Risk	Correlation Coefficient	−0.044	1.0
	Sig. (2-tailed)	0.13			Sig. (2-tailed)	0.52	
Variable	**Variable**	**Age**	**Danger**	**Variable**	**Variable**	**Education**	**Danger**
Age	Correlation Coefficient	1.0	−0.106	Education	Correlation Coefficient	1.0	−0.162
	Sig. (2-tailed)		0.12		Sig. (2-tailed)		0.02
Danger	Correlation Coefficient	−0.106	1.0	Danger	Correlation Coefficient	−0.162	1.0
	Sig. (2-tailed)	0.12			Sig. (2-tailed)	0.02	

5. Discussion

In this study, we examined healthcare workers' perceptions of preparedness and willingness to work during disasters and emergencies in the southern region of the KSA. The primary reason for choosing this area for an evaluation was the continuous exposure of the region to both manmade and natural disasters, and earlier evaluation of their knowledge and competences [23]. The findings in this study indicate that although a high number of participants had training in disaster management,

and were supposed to be prepared to respond to one, most of them were unwilling to provide care unconditionally except when dealing with natural disasters and a seasonal influenza pandemic.

Advanced education qualifications have been reported to play a crucial role in the willingness of healthcare workers to participate in disaster and emergency response [27]. In a previous study, examining the staff readiness in managing disasters in this region, the participants were shown to be theoretically well prepared, and particularly those with greater educational knowledge were more confident to act in emergencies and disasters [23]. Most of the participants in this study (63%) also had a university degree and seemed to be well prepared. However, their enthusiasm for participation in various emergencies was limited. In fact, some of them could refuse to work during some events. Thus, being well prepared does not necessarily mean a willingness to act, and the willingness of staff to manage a condition seems to be significantly linked to their disease-related knowledge and experience [8,28,29]. These findings confirm the results of this study, which shows a selective willingness to take part in the management of some of the disasters or emergencies, such as natural disasters and seasonal flu or SARS. The staff seem to have less fear to handle these events and are more familiar with these conditions, maybe due to the KSA´s disaster profile and the earlier epidemics [23].

Gee and Skovdal [30] argued that risk perception plays a role in determining the extent to which frontline health workers were willing to respond in a disaster or an emergency. The fear of personal safety and well-being of colleagues and family are all constraining factors, which distress and influence staff working attitudes during pandemics [31]. Nurses with experience in nursing patients infected with COVID-19 and nurses working in COVID-19 divisions had shown to have low job-retention intentions due to their emotional concerns and fear of becoming infected [32]. Chafee also reported that certain factors, such as the type of disaster, concern for family, pets, and personal safety have an impact on the willingness of staff to work during disasters [10]. These factors combined with special individual characteristics that influence individuals' risk perception result in an unwillingness to work during specific situations" [8,9]. Thus, frontline healthcare workers could become more confident in dealing with public health emergencies if they have the required knowledge and assurance of their families' safety [33].

While the number of healthcare workers keen to provide care during disasters and emergencies increases under certain circumstances, the findings in this study, presenting staff refusal to go to work in some types of disasters, are of real concern, and arguably, these findings need to be addressed. Anticipating that healthcare workers' knowledge, age, and other recorded characteristics could be an interesting determinant of their confidence and willingness to work, this study aimed to determine the association between some of these variables. Because age and education were presented as ranks, a non-parametric test, Spearman's rho, was chosen, and the co-variation between age and education versus risk and danger was tested. The test confirmed a small negative correlation between education and danger at a 95% level of significance, i.e., those with more knowledge have less fear in working under unexpected incidents and are presumably more confident.

Several studies have shown that disaster preparedness training positively influences the responses of health staff to disasters and emergencies, and identifies the gap in knowledge and disaster preparedness [29,34]. Since knowledge and experience can promote the willingness to participate in the care of victims during hazardous incidents, it is necessary to provide disaster-specific training to healthcare workers to improve their disaster-related knowledge, increase their confidence, and reduce their fears. There should be more focus on multiagency and multi-professional training of all staff, particularly healthcare workers, irrespective of their positions and involvement in patient care, so that they are better equipped to respond collectively to disasters and emergencies.

This study identified challenges facing healthcare workers in the KSA in establishing a functional disaster response system. Lack of education and training might be one significant challenge to a functional disaster response system. However, safety issues (PPE and family safety) are crucial issues, which may threaten the effectiveness of a disaster response system, as most healthcare workers surveyed indicated that they would not respond unless they were sure that their families were safe.

The findings of this study suggest measures, which can be used to increase the competency of healthcare workers in the KSA in order to improve their efficiency and planning knowledge when dealing with emergencies and disasters. Disaster-specific education has been identified as a viable approach for improving the competency of healthcare workers in disaster management. Khorram-Manesh et al. [35] noted that the lack of standardization is a significant barrier to the effectiveness of disaster management courses. Thus, the KSA should consider establishing minimum standards and evaluation metrics to evaluate disaster management skills and training courses. The internet provides a platform for instructional delivery and should be considered to overcome the scarcity of time as a hindrance to the establishment of proper disaster management [36].

6. Limitations

This study has a number of limitations, which should be taken into consideration in future research. The survey was extensive; it contained 60 questions, which could be why 121 participants did not complete the survey. The sample consisted overwhelmingly of nurses and physicians working in ICUs, EDs, and disaster teams/units. The small number of included administrators, paramedics/emergency medical technicians, and supportive services workers was not representative of the entire hospital staff. Furthermore, data were collected in the Najran region in southern Saudi Arabia; thus, the results may not be generalizable to all parts of the country. Finally, the number of participants (n = 213) distributed in different professions and age groups results in a varying number of participants in each category, and thus, limits the generalization of the results to the population. Future studies should include a larger number of workers from diverse organizations to achieve representative and comprehensive findings.

7. Conclusions

The willingness of healthcare workers to respond is selective and depends on the type of disaster or emergency. This is an unexpected consideration for disaster and emergency planners. Among several factors that determine healthcare workers' willingness to work during disasters and public health emergencies, appropriate knowledge and skills to confidently manage an incident and the assurance of their families' safety are two decisive factors. Although we could only find a significant correlation between education and willingness to work during emergencies, previous reports have confirmed a significant correlation between education, age, and years of experience and the perception of hazards and fear and consequently willingness to work under threatening circumstances. While unsuccessful management of disasters and emergencies may be the result of organizational shortcomings and resource scarcity, healthcare workers' lack of knowledge, skills, and confidence and emotional distractions due to uncertainty about their own safety and that of their families may also play a significant role. Besides educational initiatives, which increase staff members' confidence through knowledge acquisition and skill improvement, other measures, which guarantee their families' safety and well-being during an emergency, should be established and implemented. Future contingency and disaster plans should include detailed information concerning all these important factors.

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Appendix A

Fight or Flight questionnaire/ part one

Fight or Flight questionnaire	Supportive Services			Nurse			Administrator			Physician		
Age												
Gender	Female		Male	Female		Male	Female		Male	Female		Male
Highest level of education	Secondary	College	University	Secondary	College	University	Secondary	College	University	Secondary	College	University
Relationship	Married		Single	Married		Single	Married		Single	Married		Single
Children	Yes		No	Yes		No	Yes		No	Yes		No
Children living with you?	Yes		No	Yes		No	Yes		No	Yes		No
Function	Leader		Executer	Leader		Executer	Leader		Executer	Leader		Executer
Regular patient contact	Yes		No	Yes		No	Yes		No	Yes		No
Regular work at emergency units (ED, ICU, etc.)	Yes		No	Yes		No	Yes		No	Yes		No
Do you have training in:	Disaster Management			Disaster Management			Disaster Management			Disaster Management		
	Epidemic/pandemic			Epidemic/pandemic			Epidemic/pandemic			Epidemic/pandemic		
	Chemical incidents			Chemical incidents			Chemical incidents			Chemical incidents		
	Nuclear incidents			Nuclear incidents			Nuclear incidents			Nuclear incidents		
	Mass casualty incidents			Mass casualty incidents			Mass casualty incidents			Mass casualty incidents		
Your specialty				ICU/ED						Consultant Critical care		
				Ordinary ward						Consultant other specialty		
				Outpatient clinic						Trainee Anesthesiology		
				Technical						Trainee another department		
				Administrative						Trainee Emergency Medicine		
Comments												

Fight or Flight questionnaire/ part two

1. Evaluation of scenarios

Scenarios	Do you go to work?				Knowledge	Risk	Danger
All scenarios affecting your hospital and working area	Yes, unconditionally	Yes, under certain circumstances a–j #	I have serious doubts, probably not	I will certainly not respond	My knowledge on the scenario; 1–10 (10 is highest)	The risk for this incident to happen is 0–100%	The danger of this situation is 0–100%
Natural disaster (e.g., flooding)							
Bombing (e.g., terrorist threat)							
Seasonal influenza pandemic							
Special flu pandemic (e.g., bird flu)							
SARS/COVID-19							
Ebola outbreak							
Smallpox							
Chemical incident							
Biological incident (e.g., anthrax)							
Nuclear incident							
Dirty bomb							
Mass shooting (e.g., Paris)							

2. # If you answered "Under certain circumstances" then what of the below can make you go to work? Please insert one or more options of below a-j under the heading "under certain circumstances"

a. If I know my family is safe and taken care of;
b. I If I am sure good communication lines with my family are available;
c. If my boss comes to work as well;
d. If I am trained to handle the situation;
e. If I get regular updates on the evolution of the incident;
f. If adequate personal protective equipment (PPE) is provided;
g. If I get paid extra for it;
h. If I can get antivirals (e.g., Tamiflu) for free;
i. If I can get antidotes for free;
j. If I can get my vaccinations for free.

3. Other comments

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Article

Reasons for Turnover Intention among Direct Care Workers in Korea's Long-Term Care Insurance

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Abstract: This study explored reasons for turnover intention among direct care workers under the Korean long-term care insurance (LTCI) system. The author conducted semi-structured interviews with 19 care workers. The study revealed four main themes underlying the intention of care workers to change or leave their jobs. Care workers struggled with demanding working conditions, and their salaries were low. Moreover, the relationships with their directors and supervisors was not good, since some care workers felt that their directors despised them or gave them inappropriate instructions, and their supervisors did not complete administrative work fairly. Lastly, some workers' health conditions prevented them from carrying out their care work. The results have implications for working practices of care workers, prices of LTCI services, training of directors and supervisors, and coverage of occupational health and safety insurance for care workers.

Keywords: long-term care; turnover; semi-structured interview; Korean LTCI system

1. Introduction

Owing to the rapid population ageing and a decrease in caring roles being undertaken within families, care workers have become very important resources for older adults in need of long-term care (LTC) in many Western developed countries. However, it has been pointed out that many care workers experience heavy workloads, poor working conditions and income, and few opportunities for career development [1–3]. These issues have led to high turnover among care workers, some of whom have left the LTC field completely. Therefore, the recruitment and retention of care workers is a serious social challenge. Although many studies and policy measures have been implemented to tackle these issues, they persist in Western developed countries [4].

Similarly, some East Asian countries, such as South Korea (hereafter Korea), China and Japan have experienced challenges in recruiting and retaining care workers [4]. Specifically, in Korea, because of filial piety under the influence of Confucianism, it was considered a natural and even a moral duty for family members and relatives to take care of their aged parents [5]. Adult children felt a behavioral, physical, and financial duty to do so. However, this traditional care culture has been undermined by industrialization, urbanization, and individualism [5–7]. This has led to deficits in care for the elderly by their own family members and the socialization of care through the introduction of a new long-term care insurance (LTCI) system in 2008. However, although the new LTCI system was introduced only about ten years ago, many service providers have already experienced enormous difficulties in recruiting and retaining care workers [8–11]. The low pay and poor working conditions have been frequently found to be the main factors in the turnover of care workers [9]. Numerous (but piecemeal) measures have been implemented, and the challenges of turnover intentions of care workers persist in Korea [9,10]. The high turnover of care workers in the LTC setting is associated with costly recruitment and training of care providers and thus substandard care [2,12].

Care workers can be defined in many ways according to their roles and functions in each country's care system. This study defines care workers as those who provide a number of direct social care services to older adults with LTC needs, such as assistance with personal care and domestic chores under the Korean LTCI system. The concept of turnover intention has also been defined in numerous ways [13–15]. This study defines it as a deliberate and conscious wish to leave an organization and an intention to seek alternative employment. This refers to both care workers leaving one care work job for another similar care work job and leaving the field altogether [14].

1.1. Aim of Study

Several studies have explored the turnover of care workers in Korea. However, most of these existing studies [9,10,16] have utilized quantitative methods, which do not sufficiently explain turnover issues from the perspectives of care workers. To fill this gap, this study used qualitative research methods to explore the reasons that care workers are likely to resign or move to other service-providing organizations. The experience of care workers in Korea has policy implications for other countries that plan to reform their LTC workforce systems to cope with ageing populations.

1.2. Literature Review and Background

1.2.1. The Main Factors Related to the Turnover of Care Workers

The existing literature suggests that many factors affect the turnover of care workers. This study presents the main factors, considering macro (economy), meso (organization), and micro (staff) levels. First, macro level factors of economic conditions at a country or local level, such as economic growth, unemployment rates, and comparable income, affect the turnover of care workers [17–19]. Some studies have found that the global financial crisis in 2008 diminished worries about the shortage of workforce [20], partly because middle-aged (50–64) care workers delayed retirement [21]. An inverse relationship between unemployment and the turnover of care workers in nursing homes has also been found. When unemployment increased, care workers were less likely to leave their roles [17].

Second, many existing studies have reported that organization level factors, such as job design, workload, training, and ownership of organizations, have been closely associated with the turnover of care workers, although some studies have not supported this relationship [22]. Given the prevalence of the marketization of care in many countries, it is notable that for-profit LTC organizations tend to maximize their profits by paying low wages and demanding heavy workloads, leading to the high turnover of care workers [18,23]. It has also been found that the turnover rate of personal care aides in not-for-profit organizations was lower compared to that of aides in for-profit facilities [12]. Moreover, for-profit service organizations are encouraged to recruit part-time or flexible workers under the structural circumstances of "privatization, rationalization, and increased competition" [19]. Neoliberal welfare states, such as the USA and UK, with high proportions of for-profit LTC service providers, frequently show this trend. Therefore, the working conditions of care workers are very challenging and their pay is low [3,19]. For instance, the wages of direct care workers are the lowest in the UK, and many of them receive the national minimum wage [3].

Finally, at the micro staff level, the relationships between employers, elderly clients, and care workers are a significant factor in the turnover of the workforce [16,24–26]. When care workers do not receive proper supervision and do not feel a connection with their employers, turnover increases. In Australia, Radford et al. [27] presented two concepts to analyze the relationships and turnover of care workers: perceived supervisor support, referring to "employees" perceptions about how much their supervisors care about their wellbeing and value their contribution to organization", and job embeddedness, referring to "the connections and relationships employees develop over a period of time with their employer." They found that these two concepts were very useful in predicting care workers' intentions to stay or leave their jobs. Notably, proper treatment by supervisors motivates care workers to stay longer in their workplace [24,27]. Similarly, Bowers et al. [1] conducted in-depth

interviews with care workers employed in nursing homes and found that their perceptions of being unappreciated and undervalued by the organizations for which they work influenced their turnover.

1.2.2. The Development and Turnover of Care Workers in Korea

To understand the unique characteristics and developments of care workers and the main factors that influence turnover in Korea, we need to review literature on the policy developments related to the retention of care workers. Importantly, in the past, care workers were poorly trained in the absence of a professional training and certification system. However, the systematic training of care workers has been possible in recent years through the introduction of the new LTCI and certification system.

In doing so, the government adopted a policy of the marketization of care, which refers to government measures that allow, support, or facilitate the participation of both for-profit and not-for-profit service providers in the care market and promote the market principles of competition and choice [2,28]. This approach contributed to a rapid increase in the number of LTCI service providers because of the active participation of the for-profit sector. The Korean LTCI market has been dominated by for-profit providers, as most of the LTCI service providers were from the for-profit sector (domiciliary providers 80.9%, institutional 64.3%), while only 0.8% of domiciliary and 2.3% of institutional providers were from the public sector, and 17.7% of domiciliary and 33.2% of institutional providers were from the not-for-profit sector in 2015 [29]. Notably, the government forced many for-profit LTC service providers to establish training for care workers. Although a new certification system for care workers was introduced, the regulations regarding certification were very weak, requiring only 240 hours of training and an easy examination [7]. However, enjoying such loose regulation, many for-profit training organizations maximized their profits by producing large numbers of care workers quickly, rather than training them professionally to provide high-quality services [7]. The Korean government endeavored to increase the number of care workers to implement a new LTCI system, disregarding the quality of services. Therefore, although the number of certified care workers increased rapidly to 1,415,203 in 2016 since 2008 [30], the quality of services has been criticized repeatedly by many older adults and their family caregivers.

Many middle-aged women expected to obtain decent jobs as certified care workers. However, this belief has dwindled in the face of heavy workloads, low pay, and demanding tasks such as household chores [31]. Their working conditions are also unstable, as many care workers have been employed temporarily, such as those working at home visiting centers (86.2%) or institutional homes (25%) in 2015 [32]. Therefore, many young and middle-aged women have been reluctant to work as care workers; accordingly, the mean age of care workers is quite high in Korea. As Table 1 shows, while care workers in their forties comprise only 13.5% of all care workers, those aged 50 or over comprise more than 80% [31]. Thus, these care workers are much older compared to those in other countries, such as France, where 24% of care workers are aged 55 or over [33].

Table 1. The proportion of age of care workers according to the types of services in Oct. 2015 [31].

Types	Total	10s	20s	30s	40s	50s	60s	70s
Domiciliary services	427,206	9 (0.0%)	1314 (0.3%)	8628 (2.0%)	57,580 (13.5%)	183,750 (43.0%)	149,313 (35.0%)	26,612 (6.2%)
Institutional services	56,703	3 (0.0%)	481 (0.8%)	1107 (2.0%)	6851 (12.1%)	29,899 (52.7%)	17,452 (30.8%)	910 (1.6%)

These challenges have brought about the high turnover rate of care workers in Korea. One study found that the turnover rate of nursing home care workers (62.0%) is higher than that of home care workers (48.4%) [34]. Around 60% of care workers in Seoul had turnover intentions owing to low wages, unstable job status, and demanding work [11]. Although there are too many certified care workers, as noted previously, many of them no longer want to work in the field. In 2016, 313,013 care workers provided services in the field [35].

Specifically, some studies found that low salaries, low job satisfaction, high job stress, high employment uncertainty, and demanding working environments influenced the turnover of care

workers in Korea [11,36]. In addition, the following factors seem to significantly affect the turnover intention of care workers: self-efficacy, job identity, burnout, organizational commitments [37], income, emotional work and relationship with the elderly [16], role conflict, workload, salary level, colleague relationship [37], and abuse by the clients [36]. Due to the high turnover of care workers, many LTCI service providers have experienced a shortage of staff [10,31], and it is predicted that in 2020 and 2030, there will be a shortage of care workers by 23,882 and 111,125, respectively [38].

2. Methodology

2.1. Sampling

To explore the reasons for the high turnover of care workers from their perspectives, we adopted a qualitative research method in this study. This methodology was very useful for collecting in-depth information by gathering the vivid experiences of care workers in the field through face-to-face interviews [39,40]. In 2013, the research was conducted in two cities (Suwon-si and Yongin-si) located near Seoul in the Kyeonggi province, which contains the largest number of older people in Korea.

We conducted semi-structured in-depth interviews with 20 direct care workers. However, since one care worker (P6) did not provide meaningful comments on the research topic, she was excluded from the analysis and the remaining 19 care workers were used as the research sample. Purposive and snowballing sampling methods were used to recruit research participants who could shed light on the research topic [39]. After an interview was conducted with a care worker, they were asked to recommend other care workers who met the sampling criteria [41]: those who had worked in LTCI facilities for older adults for at least a year, knew the research topic well, and were able to communicate. Overall, interviewees were very supportive in recommending their colleagues, and most of the recommended care workers gladly participated in the interviews, although a number of care workers had difficulties in making appointments for interviews because of their work schedules.

The main characteristics of the interviewees are presented in Table 2. All of the interviewees were women, mostly in their fifties and sixties. Nine interviewees provided in-home care services and the remaining ten worked in nursing homes. Most worked in the for-profit LTC organizations and most had a long experience of providing LTCI services in the field. According to Kim et al. (2020) [42], which analyzed 1,221,085 care workers in October 2015, when categorizing them in terms of gender, the proportion of women was 93.8%, and by age, 12.1% were in their forties, 52.7% in their fifties, 30.8% in their sixties, and 1.6% in their seventies. Most of the interviewees for this study were women, with 3 people in their forties, 13 in their 50s, and 3 in their sixties. Therefore, it can be considered that the composition of age and gender was relatively representative of the population of interest.

2.2. Instrument

Prior to commencing the interviews, a guide was prepared, which included questions intended to elicit the vivid experiences of care workers. These questions allowed the conversation with the care workers to be smoothly led, creating a sort of guided conversation [43]. Questions about their experience of the provision of care services in the fields and their turnover intentions were asked and probes were often used. The questions and probes used were as follows: "Would you please talk about your experiences of providing of care services for older adults?" (Probe: "How did you feel at that time?"), "Have you ever thought about quitting your job?" (Probe: If the participant said "yes", "Can you explain in detail why you want to quit that job?")

2.3. Procedure

Semi-structured in-depth interviews were conducted in coffee shops or interviewees' homes, wherever it was convenient for them and quiet enough to talk and record. Overall, the interviewees were very active in discussing their experiences and difficulties of working as care workers, and they reported detailed reasons for turnover intention from their viewpoints. The interviews lasted on

average for 60–90 minutes. In terms of ethical considerations, there was no institutional review board at the universities in Korea at the time of this field research. Despite this, research was conducted in an ethical way. For instance, before starting the interviews, the aim and topic of the research were explained to the participants, and they were assured that they had the right to withdraw from the interview at any time and a right to request the scripts and analyzed data. All of the interviews were tape-recorded after obtaining signed informed consent forms from the interviewees. The confidentiality of the collected data and the anonymity of the research participants were explained to them. These principles were followed throughout the study.

Table 2. The main characteristics of interview participants.

Participants	Age	Kind of Service	Ownership of Provider	Years of Experience
P1	65	in-home	FPO *	6
P2	57	nursing	FPO	5
P3	46	in-home	FPO	4
P4	57	nursing	FPO	3.75
P5	56	nursing	FPO	1
P7	50	nursing	FPO	5
P8	51	in-home	NPO **	10
P9	50	in-home	FPO	7.5
P10	52	in-home	FPO	6
P11	65	in-home	NPO	15
P12	53	in-home	FPO	4
P13	62	in-home	NPO	11
P14	58	nursing	FPO	7
P15	57	nursing	FPO	4.5
P16	52	nursing	NPO	4
P17	48	nursing	FPO	2.6
P18	44	in-home	NPO	5
P19	58	nursing	FPO	4.8
P20	52	nursing	FPO	7

* FPO = For-profit organization. ** NPO = Not-for-profit organization.

2.4. Data Analysis

All recorded data were transcribed verbatim by two research assistants, who were asked to abide by the principles of confidentiality and anonymity. The transcripts were read repeatedly to become more familiar with the collected data and themes related to the research topic were sought out. To analyze the collected data, the qualitative software ATLAS-Ti version 6.2.28 (Scientific Software Development GmbH, Berlin, Germany) was used. Thematic analysis was adopted, which has been widely used by qualitative researchers [40]. First, open-coding was conducted. Rather than sticking to the existing theory and concepts in the literature, new codes were developed based on the collected data. It took a long time to complete open coding due to the large quantity of transcribed data. Axial coding was then conducted by linking the generated open codes and attempting to find the underlined themes, patterns, or concepts. Lastly, selective coding was conducted. All of the coded data, as well as the original collected data, were continually read to find core themes and check for missing data. Based on the thematic analysis, quotations that supported the main themes were found and presented.

3. Results

Many findings emerged from this research. In particular, four main findings relating to turnover intention were: demanding working conditions, low salary, bad relationships with directors and supervisors, and the degradation of the health of care workers.

3.1. Demanding Working Conditions

Many care workers said that demanding working conditions were a key factor in their turnover intentions. First, care workers in nursing homes often said that their working conditions were very difficult, since each care worker was responsible for six to nine patients during the day and twelve to fifteen patients at night. Nighttime work is particularly stressful, since it is not easy for one care

worker to meet even the basic needs of so many older adults. Moreover, to reduce personnel costs, nursing home service providers have tended to use fewer care workers. One care worker said:

> *"[At our nursing home] Two care workers look after 24 elderly clients. It's hard to work. I am so busy with work. I have no time even to write [a] daily record . . . Many care workers resigned [from] their jobs because the work of changing diapers was squeamish for them . . . "* (P7)

Second, it was reported that many care workers in nursing homes had to work long hours, such as a double shift or working every other day. These long working hours are prevalent, often violating the Labor Act Standards in Korea [31,43]. In small nursing homes (less than 10 elderly clients), 44.1% of care workers worked every other day, and 49.2% of care workers in nursing homes (with more than nine elderly clients) worked double shifts [10].

Third, some new care workers have enormous difficulties in adjusting to the demanding tasks involved in this sort of work, such as changing elderly patients' diapers and administering suppositories and enemas. Moreover, new care workers have difficulties in treating clients with complicated conditions, such as elderly clients with dementia who often refuse to have their diapers changed even when the diapers smell bad, and might have other behavioral and psychological symptoms that are part of their dementia.

Finally, some home care workers reported that some older people or their family caregivers did not have a clear concept of care workers and what their role was, and mistook them for housemaids, expecting them to do all of the household chores. In other words, the working boundary of care is not limited to services such as bathing and meal assistance for elderly clients; instead, it includes cleaning homes and doing laundry. It was also reported that most supervisors of care workers did not intervene between care workers and users to tackle this issue.

3.2. Low Salary

Many care workers claimed that they were underpaid considering the difficulty of their jobs. They were in poor financial shape, and for this reason, they had entered the LTC field. However, care workers in nursing homes complained that although they worked long hours under demanding conditions, their salary was still too low.

> *"The purpose of my job is to make a living. I divorced and am bad[ly] off . . . Yesterday, I looked after eight elderly clients and gave them bath[s] . . . I am exhausted and my body became swollen . . . But the salary payment is too low . . . I receive 1200 dollars per month [1 dollar = roughly 1000 Won] ... How can I live on this salary? I can't educate my kids with this amount . . . It would be better to do work which can make 2000 dollars rather than this care work, 1200 dollars . . . So, young people don't choose to do this care work."* (P15)

Because of low wages and differences in wages offered by service providers, some care workers said that they tried to move to better-paying service organizations or jobs. Given this financial motivation, some mentioned that even a slight increase in hourly payment was a reason to move to other LTCI service providers or roles. Although there were variations in salary between local areas in Korea, the monthly salary of care workers in domiciliary services and in nursing homes was on average US $949.47 (hourly US $7.28) and US $1403.81 (hourly US $8.83) in 2015, respectively [31]. Low salaries are closely associated with the price of LTCI services. The price is set annually by the long-term care committee, comprising government officials, service providers, civic organizations, and scholars. However, it has been emphasized that the price of services is still too low to pay an adequate salary to their care workers [10], even though the price has gradually increased.

3.3. Bad Relationships with Directors and Supervisors

A surprising finding was that more than half of the sample reported that a bad relationship with their directors was a significant factor in moving to other organizations or leaving their jobs. Some directors looked down on their care workers and failed to consider their working situations.

> *"Our directors have the mind that we had the relationship between subordinates and superiors . . . When I bathe the elderly clients, I am very busy and it's a hard job for me. But, the director said to me, "Do this! Do that one!" I have only one body. How can I do this and that one together? Rather, he needs to support me. Then, I got upset and frustrated . . . He tells us, "Just follow my instruction. If not, write an apology and explanation!" So, care workers resign their jobs. Although we keep working here, he tells us "You leave here! I dislike you because of this and that."* (P14)

Such inappropriate behavior on the part of directors appears to be prevalent, even though service providers have enormous difficulties in recruiting new care workers. Direct care workers believed that some directors appeared to regard care workers as means to maximize their profits rather than colleagues to be valued and supported to provide quality services for older adults.

In addition, some home care workers reported that they also had poor relationships with their supervisors, such as social workers and nurses, due to unfair administrative burdens. Supervisors allocate cases and working schedules, and these issues are a source of conflict. In particular, it was found that case allocation is a very sensitive issue for home care workers, since it is directly related to their workload and hours. Home care workers receive salary based on their working hours rather than fixed salaries in Korea; therefore, case allocation is directly linked to their income. From the perspectives of care workers, unfair case allocation or working schedules created severe conflict between them and their supervisors, which leads to turnover among care workers.

> *"The relationship with [a] supervisor is important. When I am in charge of two cases, if one case is gone, I have only one case [to be] in charge of. The reason why we are working here is to make money and so one case is not enough to do so . . . When the care worker has a bad relationship with the supervisor, the care worker has to wait longer since other care worker[s] can receive the new case earlier than I . . . "* (P18)

Overall, the findings of this study suggest that some Korean care workers are under-appreciated and under-valued by their directors, and that administrative workers are not fairly treated by their supervisors. Some care workers had poor working relationships with their directors or supervisors and did not have a sense of belonging to the organization [27], which prompted their intention to leave or move.

3.4. Deterioration of Care Workers' Health

A final reason for turnover is the deterioration of care workers' health. Many interviewees reported that the tasks care workers have to perform often lead to musculoskeletal diseases, making them unable to work. Many care workers reported that excessive or demanding body care services, such as bathing, moving heavy male patients and changing positions was difficult for them. One said:

> *"It's inevitable for me to leave this job . . . The government seems to leave the situation of turnover as it is . . . Since we are looking after the frail elderly patients, not healthy people, our energy is getting drained. My body and spirit are exhausted. It is obviously physically challenging . . . It's really nonsense to carry on my job here receiving the small salary."* (P9)

As presented in Table 2, care workers in the study worked between 1 and 11 years, with most caregivers working for over 5 years. Long years of continuous care work appear to damage the overall health and well-being of care workers. Moreover, care workers in the LTC sector are more likely to experience physical injuries, back pain, and exhaustion compared to other service sectors, and they are

more likely to be exposed to violence and threats while receiving limited support from directors or supervisors [44].

Given that the average age of care workers in the study was 54 years, caring for older people was unlikely to be easy for them. Moreover, the challenging situations that Korean care workers face of poor working conditions found in this research also negatively affects the health of care workers, which leads to turnover.

4. Discussion

The study conducted semi-structured interviews with 19 care workers in the Korean LTCI and found several reasons for turnover intention of care workers. Since this is small-scale qualitative research, we need to be careful not to generalize the findings of the research, which were, firstly, that care workers face a number of demanding working conditions such as heavy caseloads, long working hours, demanding physical work, and inappropriate requests. In particular, care workers in nursing homes are more likely to find their working conditions very challenging, since each care worker has to care for twelve to fifteen elderly clients at night and has to work long hours, such as double shifts. This finding is consistent with previous studies, which have shown that around half of care workers in nursing homes worked double shifts in 2012 [10], 72.4% of them worked 40–45 hours per week, and 21.3% of them worked over 45 hours per week in 2015 [31]. Moreover, some new care workers had enormous difficulties in adjusting to demanding care work and treating elderly clients with complex needs, such as those with severe dementia.

Secondly, in terms of the low salary of care workers, this finding is consistent with previous literature [10,11]. The interviewees reported that they became care workers for financial reasons; however, since their salary was too low and the work demanding, they tended to move to better-paying organizations. Care workers are sensitive to financial issues, since a previous study [43] reported that about half of care workers sampled in Seoul were main breadwinners. However, since the LTCI system was initially designed and operated in a conservative way under the principle of cost containments [5], Korean governments have endeavored to tightly control LTCI budgets by setting a low price for LTCI services. Therefore, fundamentally, it is difficult to pay care workers adequately. Service providers and care workers have asked the government for an increase in pay every year. However, since the prices of services are closely associated with the financing and sustainability of the LTCI system, governments have very carefully and slowly increased the prices of LTCI. Given the financial needs and motivation of care workers, an increased salary is one of the best ways to reduce turnover [44]. Accordingly, the government started to provide additional payments (maximum US $100 per month) to care workers who work more than 40 hours per week in 2013. Although this might help some care workers who meet the criteria, the overall salary of care workers is still low.

Thirdly, this study found that bad relationships between care workers and their directors or supervisors are a major reason for turnover intentions. Surprisingly, some directors gave orders unilaterally, without considering their working situations; some directors even openly detested care workers. Similarly, some care workers reported that their supervisors completed administrative works, such as case allocation and working schedule, unfairly, which became a source of conflict and led to turnover of care workers. Care workers believed that some service providers view care workers as means to maximize their profit. This is also related to the low social status of care workers in Korea [31]. However, it should be noted that the frequent changes of staff among care workers negatively affects the profits of service providers as a result of costs associated with recruiting and training new staff [2,12].

Finally, regarding the degradation of care workers' health, some of the sample suffered from musculoskeletal problems as a direct result of long years of providing demanding services, such as excessive body care for elderly clients. Since health is the outcome of a number of social and economic factors, other factors of turnover intention of care workers already mentioned in this research might affect care workers' health negatively. Moreover, given the fact that those aged 50 or above made up

more than 80 percent of the care workers in Korea as noted [31], they would be vulnerable to a decline of health as a result of long years of care and demanding working conditions.

5. Conclusions

The findings of this research appear to suggest that the turnover of care workers is related to a number of policies and practices under the Korean LTCI system. Although the data was gathered in 2013 and a number of new supporting policies for care workers, such as supplementary pay, have been implemented since then, the structural challenges of care workers have remained.

Most of all, the government should scrutinize care workers' working practices. In particular, since long working hours often violate the Labor Act Standards, such inappropriate practices should be explored in depth, and appropriate practices that keep the law and consider the situations of care workers should be implemented. Moreover, the training system should be revised because 240 hours of training time to become a certified care worker is too little. As Kim et al. (2020) [42] shows, an increase in training hours can offer an opportunity to improve the overall capacity of care workers. In particular, by providing training on how to form appropriate relationships with service users, colleagues, and supervisors, the turnover rate of care workers as a result of bad relationships with their supervisors would decrease.

Secondly, since the government sets low prices for LTCI services, the salary of care workers is fundamentally restricted. Therefore, the prices need to be increased to the level at which the salary of care workers is equivalent to other similar types of occupations, such as medical assistants. However, the sustainability of LTCI financing should also be considered, including raising the cost of insurance and tax [45]. Thirdly, the inappropriate behavior of service directors and supervisors needs to be changed through training when the service directors and supervisors open their organizations or start to work, such that they treat care workers as valuable and respected colleagues. Finally, occupational health and safety insurance needs to cover care workers who have suffered from musculoskeletal conditions. Currently, insurance considers such issues to be a symptom of ageing rather than a consequence of care work, and thus the insurance does not cover it [30].

In terms of the limitations of the study, this research was very small-scale and explored only the perspectives of care workers; therefore, diverse perspectives of stakeholders, such as directors and supervisors, should be explored in future large-scale studies. We suggest that larger-scale, mixed research should be carried out, exploring the issues of turnover of care workers in terms of health, relationships, payments, and rewards.

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