Predictors of post-traumatic stress disorder among healthcare workers during the COVID-19 pandemic in Poland

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Abstract

The COVID-19 pandemic has significantly impacted the mental health of healthcare workers globally. Given the critical role these professionals play, understanding the prevalence and predictors of post-traumatic stress disorder (PTSD) among healthcare workers is crucial for developing targeted interventions. Comprehensive data on the predictors of PTSD symptoms within this population remain limited. This cross-sectional study surveyed 852 healthcare workers across 4 Polish regions between 2021 and 2022. Data were collected using the Post-traumatic Stress Disorder Checklist–Civilian Version (PCL-C), which was culturally adapted and validated for Polish respondents. To identify key predictors of PTSD symptoms, researchers employed various statistical methods: Descriptive Statistics summarized key variables (e.g. age, job tenure) to provide an overview of data distribution and sample characteristics. Pearson Correlations examined linear relationships among variables like age, work experience, and PTSD severity, ensuring no multicollinearity through variance inflation factor checks. t-Tests and Mann–Whitney U tests compared PTSD symptom severity across demographic and professional subgroups, accounting for normality using the Kolmogorov–Smirnov test. And Hierarchical Regression Analysis identified significant predictors, incorporating demographic factors first and work-related variables (e.g. fear for personal health) in a second step. A total of 88.1% of participants were female, and 82.6% were nurses. The overall prevalence of PTSD symptoms was high, with a mean total PTSD score of 37.87. Gender differences were significant, with women reporting higher scores across the PTSD subscales, including avoidance and hyperarousal. Nurses had significantly higher intrusion symptoms compared to other professionals. Fear for personal health was the strongest predictor of PTSD symptoms ($\beta = 0.15$, $P < .001$), explaining 11% of the variance in the final regression model ($R^2 = 0.11$, $P < .001$). The findings underscore the urgent need for targeted mental health interventions, particularly for women and nurses, who are disproportionately affected by PTSD during the pandemic. Predictive models should guide the development of support programs to mitigate the long-term psychological impact of COVID-19 and ensure better preparedness for future pandemics. The significant influence of fear for personal health on PTSD outcomes highlights the importance of protective measures and psychological support for frontline healthcare workers.

Abbreviations: COVID-19 = coronavirus disease 2019, DSM-IV = diagnostic and statistical manual of mental disorders, fourth edition, ED = emergency department, GAD = generalized anxiety disorder, PCL-C = Posttraumatic Stress Disorder Checklist–Civilian Version, PTSD = post-traumatic stress disorder, VIF = Variance Inflation Factor, WHO = World Health Organization.

Keywords: COVID-19, fear of infection, frontline workers, gender differences, healthcare workers, mental health, nurses, post-traumatic stress disorder, psychological support

1. Introduction

The coronavirus disease 2019 (COVID-19) pandemic continues to evolve, with new variants of the virus emerging and periodic spikes in infection rates, although severity in patients is having a lower incidence.[1] This ongoing crisis has had, and continues to have, a profound impact on the mental well-being of healthcare workers.[1–3] Studies on the psychological consequences of epidemics reveal consistent patterns, often described as the "psychological portrait" of healthcare professionals.[4,5] These findings not only highlight the increased workload during the pandemic but also underline the fears of healthcare workers, fears of infecting themselves and their families, particularly vulnerable groups like children and the elderly.[5,6]

Healthcare workers have faced the immense challenge of caring for critically ill patients who often deteriorate rapidly and die in isolation, without the comfort of loved ones.[5] In some cases, they have also witnessed the illness and death of their own colleagues.[7] The strain of these experiences has pushed personal resources to their limits, forcing workers to make difficult decisions about who is eligible for life-saving treatments, such as ventilators, and who is not.[7] This has left many with moral injuries, a deep psychological trauma born of the impossible ethical dilemmas they have faced.[7,8]

The prolonged stress, anxiety, and depressive symptoms healthcare workers have endured include persistent feelings of hopelessness, a loss of interest in almost all activities, and an overall reduction in their ability to experience pleasure.[7,8] Additionally, symptoms of generalized anxiety disorder have emerged, such as constant worry, fatigue, disturbed sleep, poor concentration, irritability, and a sense of being overwhelmed by the fear that something terrible may happen again.[7,8] For some, this has escalated into panic attacks and full-blown posttraumatic stress disorder (PTSD).[9,10] PTSD is a serious mental health condition characterized by intrusive memories, avoidance behaviors, negative changes in thinking and mood, and heightened arousal. It is often linked to exposure to traumatic events, such as those healthcare workers experience during pandemics, including prolonged contact with critically ill patients and exposure to high mortality rates.[10]

Numerous studies have identified key factors that predict PTSD in healthcare workers, including personal characteristics such as gender and age, professional variables such as job role and years of experience, and environmental factors like workplace support and availability of personal protective equipment.[2,5–7] Among these, fear for personal health has consistently emerged as a significant predictor of PTSD symptoms.[5] In the context of pandemics, additional stressors such as isolation from family, witnessing patient suffering, and moral injury from ethical dilemmas further amplify the risk of developing PTSD.[6] Understanding these predictors is essential for identifying vulnerable groups and developing targeted interventions.[2,5–7]

Understanding the psychological state of healthcare workers in the aftermath of the pandemic, as well as during the so-called "new normal" of ongoing pandemic conditions, is crucial for improving their quality of life and, by extension, the quality of care they provide. Identifying and addressing the psychological factors affecting this population can help optimize intervention strategies and mitigate the long-term negative consequences of the pandemic on healthcare professionals.[11,12] Current research indicates that there is a significant demand for psychological and psychiatric care among healthcare workers and emphasizes the importance of closely monitoring their mental well-being.[13,14]

Since the start of the pandemic, numerous reports have emerged on the mental health status of healthcare personnel, providing a framework for early intervention. These reports serve as the first step toward establishing a comprehensive mental health support system for healthcare workers. However, many of these studies have been limited to monitoring and descriptive data, with few engaging in statistical modeling to predict future mental health outcomes. This gap highlights the need for predictive models that integrate sociodemographic factors, professional variables, and pandemic-specific stressors to forecast PTSD risk and inform intervention strategies. The next step involves conducting more robust scientific analyses, such as meta-analyses of studies across different countries using diverse research tools.[15–17] While these studies shed light on broader trends, such as the impact of cultural differences on mental health, there is a growing need for predictive models that can inform the development of targeted mental health support programs for healthcare workers.[18]

The aim of this study is to assess the level of PTSD among healthcare workers who cared for patients during the COVID-19 pandemic. Additionally, the study seeks to predict overall PTSD symptoms through statistical modeling, with a particular focus on the influence of sociodemographic factors and work-related variables in healthcare settings.

2. Materials and methods

2.1. Location of the study

This study was conducted across multiple waves of the COVID-19 pandemic in Poland between 2021 and 2022. Given the ongoing pandemic, all data collection took place online. The survey's web link was distributed to medical facilities across 4 key regions: Mazovia, Łódź, Świętokrzyskie, and Lublin. These regions were selected to ensure a geographically diverse sample of healthcare workers. Established partnerships and prior collaboration with healthcare communities in these regions facilitated the efficient distribution of the survey, allowing us to gather a representative sample of healthcare professionals. Participants came from a broad spectrum of healthcare entities, including primary care, specialized outpatient care, emergency departments (ED), long-term care facilities, social welfare homes, and various hospital wards. These wards treated different patient groups- some focused on non-COVID-19 cases, while others were dedicated to suspected or confirmed COVID-19 patients. The study also included emergency medical teams, whose assignments were categorized based on whether they were responding to COVID-19-related or non-COVID-19-related incidents.

2.2. Questionnaire

The Posttraumatic Stress Disorder Checklist–Civilian Version (PCL-C) is a widely recognized self-report tool designed to assess symptoms of PTSD.[19] It comprises 17 items that align with the core PTSD symptoms as outlined in the DSM-IV criteria. This instrument has been validated and culturally adapted for Polish respondents, including healthcare professionals, ensuring its relevance and accuracy in the study context.[20,21] Participants were asked to rate their symptoms on a 5-point Likert scale, ranging from 1 ("Not at all") to 5 ("Extremely"), with higher scores indicating greater severity of symptoms.

The questionnaire assesses PTSD symptoms across 3 key symptom clusters. The first cluster, intrusion/re-experiencing, includes items 1 to 5 and captures symptoms such as recurring thoughts or distressing memories of traumatic events. A symptom in this cluster is confirmed if at least one item is rated between 3 and 5. The second cluster, avoidance/numbing, consists of items 6 to 12 and examines behaviors such as avoiding reminders of the trauma and feelings of emotional detachment. At least 3 items must be rated between 3 and 5 to confirm a symptom in this cluster. The third cluster, hyperarousal, spans items 13 to 17 and reflects symptoms such as heightened irritability, difficulty sleeping, or an exaggerated startle response. A symptom in this cluster is confirmed if at least 2 items are rated between 3 and 5.

The PCL-C also includes an optional scale that measures perceived social support, although this was not utilized for formal PTSD diagnosis in the present study. The tool demonstrated high reliability within this sample, with an overall Cronbach α of 0.94 and subscale reliability scores ranging from 0.88 to 0.94, highlighting its internal consistency and suitability for assessing PTSD symptoms in healthcare workers.

2.3. Data collection tools and procedure

Data were collected using the PCL-C, which was administered through an online platform to healthcare professionals. The survey link was distributed to healthcare institutions in the 4 Polish regions (Mazovia, Łódź, Świętokrzyskie, and Lublin). Established networks in these regions helped ensure a high response rate, and the online nature of the survey allowed for widespread participation from healthcare professionals.

The questionnaire was distributed to a variety of healthcare providers, including those in primary care units, specialized outpatient clinics, ED, long-term care facilities, social welfare homes, and hospital wards. These wards treated different types of patients – some focused on non-COVID-19 patients, while others catered specifically to patients with suspected or confirmed COVID-19. Emergency medical teams were also included, and their roles were categorized based on whether they were responding to COVID-19-related or non-COVID-19-related cases. This flexible and comprehensive approach allowed for the assessment of PTSD symptoms in healthcare workers exposed to diverse stressors during the COVID-19 pandemic.

2.4. Study population

A total of 1022 healthcare workers initially completed the online survey, with the final sample comprising 852 participants after applying inclusion and exclusion criteria. The inclusion criteria required participants to be employed in healthcare facilities in the 4 previously described Polish regions during the study period and to have been directly involved in patient care during the pandemic. Exclusion criteria included incomplete survey responses and lack of direct involvement in patient care during the pandemic.

The majority of the sample (88.1%) were female, with men making up 11.9% of the respondents. Participants ranged in age from 20 to 59 years, with a mean age of 39 years (SD = 10.02). The average length of service in healthcare was 12 years (SD = 11.44), with participants reporting between 1 month and 41 years of professional experience.

Professionally, most respondents were nurses (82.6%), followed by paramedics (8.9%), medical caregivers (1.6%), and doctors (0.9%). Additionally, 6% of respondents reported other medical occupations, such as medical orderlies or receptionists. In terms of workplace settings, 40.3% of respondents worked in hospital wards treating non-COVID-19 patients, while 21.9% were assigned to COVID-19 wards. Around 14% worked in primary healthcare, and 14.4% were employed in other healthcare institutions.

2.5. Statistical analysis

To address the research questions and test the hypotheses, statistical analyses were conducted using IBM Statistical Package for the Social Sciences Statistics version 26. This analysis aimed to identify predictors of PTSD symptoms among healthcare workers and compare PTSD symptom severity across demographic and professional groups. Descriptive statistics were calculated to summarize the key variables, including means, standard deviations, frequencies, and percentages.

Pearson correlation analysis was performed to explore the relationships between continuous variables, such as age, years

of work, and PTSD symptoms. To ensure there was no multicollinearity between age and years of work, variance inflation factors were assessed, and all values were below the threshold of concern (VIF < 5). This confirmed that multicollinearity did not affect the regression model.

Independent samples t-tests, Mann–Whitney U tests, and Kruskal–Wallis tests were used to compare PTSD symptom severity across demographic and professional subgroups. The Kolmogorov–Smirnov test was applied to assess the normality of the data distribution.

To identify significant predictors of PTSD symptoms, linear regression analysis was performed in a hierarchical manner. Sociodemographic variables, such as gender, age, profession, and years of work, were entered in the first step of the regression model. In the second step, work-related variables, such as fear for personal health and life, were added to the model. A significance level of α = 0.05 was adopted for all statistical tests.

2.6. Ethical considerations

The study did not involve medical experimentation and therefore did not require approval from the Bioethics Committee. Participants were fully informed about the study, including its purpose, the voluntary nature of their participation, and the confidentiality of their responses. Data were stored securely, and the study adhered to ethical principles as outlined by Polish law, exempting it from formal ethics approval.

3. Results

The analysis of the study sample provides insights into the demographic and professional characteristics of healthcare workers who participated in the study. These descriptive statistics establish the context for understanding the relationships between participant characteristics and PTSD symptoms. The following section outlines the demographic breakdown of the sample, including gender, age, professional roles, and work environments.

3.1. Participant demographic overview

The study included 852 healthcare workers, the majority of whom were women (88.1%), with a mean age of 39 years (SD = 10.02). Participants had an average of 12.9 years of healthcare experience, ranging from less than a year to 41 years. Nurses constituted the largest professional group (82.6%), followed by paramedics (8.9%), with smaller proportions of physicians, medical caregivers, and other healthcare roles.

Regarding work settings, 40.3% of participants worked in non-COVID-19 hospital wards, and 21.9% were assigned to COVID-19 wards. Other settings included primary healthcare (14.0%), ED (8.2%), and various specialized facilities such as long-term care institutions and social welfare homes. Full demographic and professional details are provided in Table 1.

3.2. Statistical analysis of quantitative variables

In the first step of the analysis, we examined the distributions of the quantitative variables. Basic descriptive statistics were calculated, alongside the Kolmogorov–Smirnov test to assess normality of the data distribution. Outliers were removed from comparative analyses. The results of the descriptive analysis are presented in Table 2.

The results of the Kolmogorov–Smirnov tests indicated significant deviations from normality across all variables, suggesting non-Gaussian distributions. However, skewness and kurtosis values remained within acceptable limits (absolute value < 2), allowing for parametric tests under the assumption that other test assumptions were met.

3.3. Gender differences in PTSD symptoms

To determine whether gender differences in PTSD symptom severity exist, independent t-tests and Mann–Whitney U tests were conducted. The parametric test results are presented in Table 3, comparing the means of PTSD symptom scores between males and females.

The results indicated significant gender differences in PTSD symptom severity. Women exhibited higher levels of PTSD symptoms compared to men. The effect sizes were small to moderate, with the largest difference observed in the intrusion subscale. The nonparametric Mann–Whitney U test confirmed these findings.

3.4. Correlations between sociodemographic variables and PTSD symptoms

Next, Pearson correlation analyses were conducted to examine the relationships between age, work experience, and PTSD symptom severity. The results are summarized in Table 4.

The analysis revealed no significant correlations between age and PTSD symptoms. However, work experience was weakly but positively correlated with both intrusion and avoidance symptoms. This suggests that participants with longer work experience exhibited slightly higher levels of intrusion and avoidance.

3.5. Professional role and PTSD symptom differences

Differences in PTSD symptoms were tested based on professional roles. Independent t-tests and Mann–Whitney U tests were conducted to confirm parametric results, which are presented in Table 5.

There was a statistically significant difference in intrusion symptoms between nurses and other professions, with nurses reporting higher levels of intrusion. However, no significant differences were found for other PTSD subscales.

3.6. Employment during the pandemic and PTSD symptoms

To examine the differences in PTSD symptom severity between participants who were employed in healthcare settings during the pandemic and those who were not, independent *t*-tests and Mann–Whitney U tests were conducted. The results of the parametric tests are presented in Table 6.

Table 1

Demographic and professional characteristics of the study population.

Demographic feature	Count (N)	Percentage (%)
Gender		
Women	751	88.1
Men	101	11.9
Total participants	852	100
Age		
Average age ± SD		39.02 ± 10.02 yr
Range		20 to 59 yr
Work experience		
Work experience ± SD		12.90 ± 11.44 yr
Range		0.08 to 41 yr
Profession role		
Nurse	704	82.6
Paramedic	75	8.9
Physician	8	0.9
Medical caregiver	14	1.6
Other	51	6.0
Total participants	852	100
Work setting		
Primary healthcare (POZ)	119	14.0
Specialist ambulatory care (AOS)	34	4.0
Emergency department (SOR)	70	8.02
Admissions room	47	5.5
Care and treatment institution (ZOL)	39	4.6
Social welfare home (DPS)	36	4.2
Hospital (non-COVID-19 ward)	343	40.3
Hospital (COVID-19 ward)	187	21.9
Ambulance (non-COVID cases)	36	4.2
Ambulance (COVID cases)	48	5.6
Other	123	14.4

Table 2

Descriptive statistics and Kolmogorov–Smirnov test results.

Variable	M	Me	SD	Sk.	Kurt.	Min	Max	D	*P*
Age	39.02	41.00	10.02	−0.27	−1.12	20.00	59.00	0.10	<.001
Work experience (yr)	12.90	11.00	11.44	0.36	−1.30	0.08	41.00	0.16	<.001
Pandemic preparedness rating	3.19	3.00	0.97	−0.07	−0.20	1.00	5.00	0.23	<.001
PTSD - intrusion	10.11	10.00	3.91	1.12	01.39	5.00	25.00	0.17	<.001
PTSD - avoidance	15.04	14.00	5.67	0.83	0.34	7.00	35.00	0.12	<.001
PTSD - hyperarousal	12.73	12.00	4.61	0.64	−0.24	5.00	25.00	0.14	<.001
PTSD - total score	37.87	35.00	12.87	0.78	0.42	17.00	85.00	0.09	<.001

Note: Work experience data had 26 missing values, excluding participants without clear information on work tenure.
PTSD = post-traumatic stress disorder.

Table 3

Descriptive statistics and Kolmogorov–Smirnov test results.

Variable	Women (n = 751)	Men (n = 101)	*t*	*P*	95% CI	Cohen *d*
	M	SD	M	SD		
Intrusion	11.23	3.87	8.30	2.72	6.17	<0.001
Avoidance	15.19	5.66	13.66	5.21	2.56	0.011
Hyperarousal	12.87	4.63	11.50	4.15	2.82	0.005
PTSD - total score	38.30	12.82	32.73	9.90	5.00	<0.001

PTSD = post-traumatic stress disorder.

The results indicated significant differences in PTSD symptom severity between those employed during the pandemic and those who were not, with those employed in healthcare settings reporting higher levels of avoidance, hyperarousal, and overall PTSD symptoms. However, no significant differences were found for intrusion symptoms. The effect sizes were small, indicating that while the differences are statistically significant, the magnitude of these differences is relatively modest.

3.7. Predictors of PTSD symptoms

A hierarchical regression analysis was conducted to identify predictors of PTSD symptoms. In the first model, sociodemographic variables, including gender (reference: male), age, profession (reference: other professions), and work experience, were entered. This model explained 3% of the variance in PTSD symptoms ($R^2 = 0.03$, $P < .001$). Among these predictors, being female ($\beta = -0.14$, $P < .001$) and older age ($\beta = -0.18$, $P = .001$) were associated with lower PTSD symptom severity, while longer work experience ($\beta = 0.20$, $P < .001$) was associated with higher PTSD symptom severity. Profession

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Table 4

Correlations between sociodemographic variables and PTSD symptoms.

Variable	Age	Work experience
Intrusion	0.02	0.10*
Avoidance	0.00	0.07*
Hyperarousal	−0.06	0.00
PTSD - total score	−0.01	0.06

*$P < .05$.
PTSD = post-traumatic stress disorder.

Table 5

Differences in PTSD symptom severity by professional role.

Variable	Nurse (n = 734)		Other profession (n = 115)		t	P	95% CI	Cohen's d
	M	SD	M	SD				
Intrusion	11.17	3.83	9.27	3.59	2.37	.018	0.33 to 3.50	0.52
Avoidance	15.00	5.58	14.76	5.45	0.44	.663	−0.78 to 1.22	0.04
Hyperarousal	12.67	04.55	13.06	5.00	−0.84	.400	−1.21 to 0.53	−0.08
PTSD − total score	37.85	12.65	36.77	12.26	0.85	0.396	−1.43 to 3.61	0.09

PTSD = post-traumatic stress disorder.

Table 6

Comparison of PTSD symptoms by employment during the pandemic.

Variable	Employed during pandemic (n = 782)		Not employed during pandemic (n = 70)		t	P	95% CI	Cohen d
	M	SD	M	SD				
Intrusion	11.17	3.90	9.37	3.97	2.64	.102	−0.15 to 3.77	0.46
Avoidance	15.16	3.66	13.61	5.56	2.19	.028	0.17 to 3.21	0.35
Hyperarousal	12.85	4.58	11.41	4.78	2.49	.013	0.32 to 2.57	0.30
PTSD - total score	38.18	12.78	34.40	13.48	2.36	0.019	0.64 to 7.04	0.29

PTSD = post-traumatic stress disorder.

Table 7

Differences in PTSD symptom severity by professional role.

Variable	B	SE	β	t	P
Model 1: F(4, 818) = 6.19; $P < .001$; $R^2 = 0.03$					
Constant	52.56	3.52		14.92	<.001
Gender (reference: male; 1 = female, 2 = male)	−5.46	1.54	−0.14	−3.54	<.001
Age	−0.24	0.07	−0.18	−3.22	.001
Profession (reference: other; 1 = nurse, 0 = other)	−2.45	1.48	−0.07	−1.65	.100
Work experience	0.23	0.06	0.20	3.59	<.001
Model 2: F(10, 812) = 9.78; $P < .001$; $R^2 = 0.11$; $\Delta R^2 = 0.08$					
Constant	59.52	4.45		13.38	<.001
Gender (reference: male; 1 = female, 2 = male)	−5.60	1.49	−0.14	−3.75	<.001
age	−0.24	0.07	−0.18	−3.30	.001
Profession (reference: other; 1 = nurse, 0 = other)	−3.30	0.44	−0.09	−2.30	.022
Work experience	0.17	0.06	0.15	1.75	.006
Fear for personal health and life	3.95	0.89	0.15	4.46	<.001
Fear for health and life of household members	2.34	0.90	0.05	1.49	.138
Fear for health and life of elderly people	1.70	0.87	0.07	1.95	.052

The reference categories used in this regression model are Male for Gender and Other professions for Profession. Negative B values indicate lower PTSD symptom severity compared to the reference category.
PTSD = post-traumatic stress disorder.

(nurse versus other professions) was not a significant predictor (P = .100).

The second model added work-related variables, including fear for personal health and life, fear for the health and life of household members, and fear for the health and life of elderly individuals. This model explained an additional 8% of the variance (ΔR^2 = 0.08), with the total variance explained increasing to 11% (R^2 = 0.11, P < .001). Fear for personal health and life emerged as the strongest predictor (β = 0.15, P < .001), indicating that individuals more concerned about their health during the pandemic reported higher PTSD symptom severity. Fear for household members and elderly individuals was not significant (P = .138 and P = .052, respectively). The results of the regression analysis are presented in Table 7.

4. Discussion

This study identified several key predictors of PTSD symptoms among healthcare workers during the COVID-19 pandemic. Women and nurses reported higher levels of PTSD symptoms, particularly in the domains of avoidance and hyperarousal. Professional experience was positively associated with intrusive PTSD symptoms, suggesting cumulative stress effects over time. Fear for personal health emerged as the strongest predictor of PTSD symptoms, while fears for household members and elderly individuals were less significant. These findings underscore the importance of targeted interventions to address the mental health challenges faced by healthcare workers, particularly those on the frontlines.

Gender has frequently been highlighted in literature as a significant factor affecting the mental health of healthcare workers during the COVID-19 pandemic. However, as some researchers point out, this variable has been insufficiently analyzed despite the pressing need for insights in this area.[22–24] According to the World Health Organization, up to 70% of all healthcare workers are women, with the figure being even higher in professions such as nursing.[25] This suggests that gender should be more frequently examined as a predictor of mental health outcomes.

Our findings align with this perspective, showing that women healthcare workers in our sample reported significantly higher levels of PTSD symptoms compared to men, particularly in the domains of avoidance and hyperarousal. These results are consistent with prior research suggesting that women often experience greater caregiving burdens, both at work and at home, which exacerbate their mental health challenges during crises such as the COVID-19 pandemic.[26,27]

Cultural norms surrounding emotional restraint may contribute to underreporting of psychological distress among men, which could partially explain the observed disparities.[28–32] This does not negate the presence of distress among male healthcare workers but highlights the limitations of self-report measures in capturing gendered differences in mental health. Furthermore, men are culturally expected in many societies to suppress emotions and avoid seeking help, which may skew data and provide a false impression that they experience fewer psychological challenges compared to women.[33–35]

In our study, age was not significantly correlated with PTSD symptoms. The lack of significant correlation between age and PTSD symptoms in our study could be due to the higher mean age of our sample, where older professionals may have had more developed coping mechanisms or access to resources that helped them mitigate the effects of trauma. This contrasts with studies that focused on younger, less experienced healthcare workers who may be more vulnerable to psychological distress due to fewer established support systems.[36–39]

Research suggests that younger healthcare workers may experience higher rates of aggression or workplace violence, as well as more severe sleep disturbances during crises like the COVID-19 pandemic, potentially exacerbating mental health challenges.[40–42] While age may not always be a direct predictor of PTSD, these broader factors highlight its relevance in mental health research.

Our study found that healthcare workers with longer professional experience were more likely to report intrusive PTSD symptoms, such as recurring images, dreams, and thoughts related to trauma. This may be attributed to cumulative stress stemming from prolonged exposure to high-stress environments and increased professional responsibilities. Previous studies have shown that experienced healthcare workers often face greater workloads, ethical dilemmas, and leadership responsibilities, all of which compound their psychological burden.[43–47] These findings emphasize the need for tailored mental health interventions for this group, including resilience training and stress-reduction strategies.

Nurses were significantly more likely to experience recurring images, dreams, and thoughts related to the trauma of the pandemic according to our data. This aligns with global studies, which consistently show that nurses, as primary caregivers, experience higher levels of stress compared to physicians and other healthcare professionals.[48,49] This could be due to their close and prolonged contact with severely ill patients, especially during peak waves of the COVID-19 pandemic. However, the relatively lower levels of stress reported by physicians and paramedics in our study suggest that these professionals may have had more access to coping resources or greater autonomy in their roles. These findings indicate that mental health interventions should be tailored to the specific stressors faced by different healthcare roles.

Nurses, as primary caregivers, often bear the emotional weight of providing end-of-life care, which can exacerbate their mental health challenges.[24,50] In contrast, physicians and other healthcare workers might have more control over their work environment or access to resources that help mitigate stress. Nonetheless, previous research has yielded mixed results regarding the mental health impact on physicians and paramedics, suggesting that the mental health landscape among healthcare roles is complex and requires further study.[51,52]

In the broader literature, demographic variables, such as gender and age, as well as work-related fears, have been identified as key predictors of mental health outcomes in healthcare workers.[53–56] Our study found that fear for personal health was the strongest predictor of PTSD symptoms. This aligns with previous research showing that the fear of contracting or spreading COVID-19 is a critical stressor for healthcare workers.[57,58] Interestingly, fears for household members and elderly individuals did not emerge as significant predictors, suggesting that healthcare workers may have been more focused on their immediate personal risk due to their occupational exposure.

Fear of infection has been linked to higher levels of depression, anxiety, and PTSD symptoms among healthcare workers in previous studies.[57,58] Many reported a wide range of issues, from general malaise to severe stress reactions, sleep disturbances, and even suicidal thoughts.[59] This highlights the need for interventions that address the psychological impact of working in high-risk environments, including improved access to protective equipment, mental health support programs, and debriefing sessions.

From a public health perspective, ensuring the mental well-being of healthcare workers is not only essential for their quality of life but also critical for maintaining the functionality of healthcare systems during public health emergencies. Burnout and mental health issues among healthcare workers have been linked to decreased quality of patient care, increased medical errors, and higher turnover rates, which can further strain already overburdened systems.[60] Proactive strategies, such as routine mental health screenings, organizational stress management programs, and fostering a culture of

psychological safety in healthcare institutions, are necessary to support this critical workforce. Additionally, addressing systemic issues such as staffing shortages and equitable distribution of resources during crises can help reduce the psychological burden on healthcare professionals and improve overall public health outcomes.[61]

The findings of this study highlight the need for targeted interventions that address the specific stressors faced by healthcare workers. Gender, professional experience, and health-related fears emerged as key predictors of PTSD symptoms, emphasizing the vulnerability of women and nurses during the pandemic. Future research should focus on developing predictive models and implementing policy changes at the organizational level to support healthcare workers more effectively.

5. Limitations

This study has several limitations that should be considered when interpreting the findings. First, the cross-sectional design limits our ability to establish causal relationships between the variables examined, particularly the association between gender, professional experience, and PTSD symptoms. Longitudinal studies would be necessary to assess the long-term psychological effects of the COVID-19 pandemic on healthcare workers and to better understand the evolution of PTSD symptoms over time.

Second, the data were collected through self-report questionnaires, which may introduce biases such as social desirability or recall bias. Participants may have underreported or over-reported their symptoms due to cultural factors or concerns about stigma, particularly in relation to mental health. This is especially relevant for male respondents, who may have downplayed their psychological distress due to societal expectations regarding emotional restraint. Male respondents, for example, may have underreported psychological distress due to societal expectations surrounding emotional restraint, potentially leading to underestimation of PTSD symptoms among this group.

Third, voluntary participation in the study may have introduced selection bias. Healthcare workers experiencing greater psychological distress may have been more motivated to participate, potentially overestimating the prevalence of PTSD symptoms in the broader population. Conversely, those experiencing severe burnout or time constraints may have been less likely to participate, leading to potential underestimation in certain subgroups.

Another limitation is the geographic scope of the study, which was conducted exclusively in Poland. While the findings provide valuable insights into the experiences of healthcare workers in this specific context, the results may not be fully generalizable to other countries with different healthcare systems, pandemic responses, and cultural attitudes toward mental health.

Furthermore, the study's sample was disproportionately composed of female healthcare workers, particularly nurses. While this reflects the gender composition of the healthcare workforce, it limits the ability to fully explore gender differences in other healthcare roles, such as physicians and paramedics, where the sample sizes were smaller.

Finally, although the study identified key predictors of PTSD symptoms, the models explained only a small portion of the variance in PTSD outcomes. This suggests that other unexamined factors, such as organizational support, personal coping mechanisms, or preexisting mental health conditions, may play a role in shaping healthcare workers' psychological responses to the pandemic.

Addressing these limitations in future research could provide a more comprehensive understanding of the mental health challenges faced by healthcare workers during and after the COVID-19 pandemic.

6. Conclusions

The COVID-19 pandemic has highlighted critical vulnerabilities in the mental health of healthcare workers, especially those on the frontlines. Our study confirms the significant prevalence of PTSD symptoms in this population, with gender, professional role, and fears about personal health being key predictors. Women, particularly nurses, are disproportionately affected, likely due to their dual caregiving roles both professionally and personally, as well as their close contact with COVID-19 patients. These findings emphasize the urgent need for targeted mental health interventions that account for the specific stressors faced by different healthcare roles.

Future research must focus on predictive models that help healthcare institutions implement tailored mental health programs. Given the likelihood of future pandemics, it is crucial to synthesize current knowledge through meta-analyses and develop long-term strategies for psychological support. This preparation will not only mitigate the long-term impacts of the COVID-19 pandemic but also ensure that healthcare workers are better equipped to handle similar crises in the future.

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