

PROGNOSTIC ASSESSMENT OF STRESS-RELATED FACTORS IN HEALTHCARE WORKERS DURING THE COVID-19 PANDEMIC

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SUMMARY

Introduction: The COVID-19 pandemic is an extraordinary challenge for all countries and affects the psychological wellbeing of healthcare professionals working with people suffering from COVID-19 and puts them at a high risk of mental health problems. The aim of the study was to identify stress-related factors that affect the mental health of healthcare workers during the COVID-19 pandemic in Ukraine.

Subjects and methods: A total of 1098 Ukrainian healthcare workers were surveyed using an online questionnaire consisting of questions relating to a) socio-demographic characteristics; b) perceptions of the COVID-19 related situation; and c) stress and protective factors. Respondents were divided into two groups, depending on whether they provided care to the patients with COVID-19 or not.

Results: Of the 1087 healthcare workers, 863 (79.4%) were found to have anxiety / fear caused by the COVID-19. No significant difference was detected between professionals who did and did not provide personal assistance to patients with COVID-19 concerning anxiety / fear related to COVID-19 ($p=0.0776$). Based on logistic regression model ($\chi^2(6)=263.70$, $p=0.000$) the most significant predictive factors for anxiety / fear caused by the COVID-19 were factors related to safety and risk perception (the risk of getting infected, dying, infecting loved ones, perception of the threat of the epidemic spread), information factors (constant news about COVID-19), as well as factors related to the organisation of care (lack of staff in health care facilities).

Conclusions: Negative risk perception, high consumption of COVID-19 news, and shortage of staff in health care facilities were significant predictors of anxiety / fear caused by the COVID-19.

Key words: COVID-19 - mental health - healthcare workers - anxiety - stress

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INTRODUCTION

The COVID-19 pandemic has become an immense challenge for healthcare workers worldwide (Mehta et al. 2021, Baud et al. 2020). The new virus has had a profound effect on the psychological wellbeing of healthcare employees working on the front-line, placing them at a high risk of mental health problems (Cabarkapa et al. 2020). Disastrous outcomes such as burnout, insomnia, distress, posttraumatic stress disorder, anxiety, and depressive symptoms have been reported among healthcare workers treating patients with COVID-19 (Lai et al. 2020, Pappa et al. 2020, Carmassi et al. 2020, Giusti et al. 2020, Azoulay et al. 2020, Pinchuk et al. 2021). According to previous pandemic experience, mental health disorders have been reported even after the end of an outbreak, suggesting long-term implications (Mak 2009, Lancee 2008).

There is a growing number of reports indicating increased stress among health workers in the context of the COVID-19 pandemic (Sanghera et al. 2020, Chen et al. 2020, Chung & Yeung 2020). Thus, stress symptoms are observed not only among healthcare

staff directly dealing with COVID-19 patients, but also among those who are not on the frontline (Vizheh et al. 2020). It is worth mentioning that lockdown along with strict biosecurity measures during the COVID-19 pandemic turned out to be powerful stress factors for healthcare workers, including increased workloads, decreased access to social support, lack of information about COVID-19, fear of infecting friends and family (Koh 2020).

Risk factors increasing the vicarious traumatization in healthcare workers include young age, female gender, as well as absence of social support, isolation, stigmatisation, large amounts of work, nursing, lower level of specialised training, and lack of work experience (Li et al. 2020). Furthermore, the following factors reduce the negative impact of an epidemic on the mental health of medical personnel: a warm and friendly atmosphere at work, improving the health status of infected colleagues; stopping the spread of infection among medical staff; organisation of coordinated and flexible work of all departments in the institution; previous professional experience; high level of commitment to professional ethics and integrity (Duan & Zhu 2020).

The aim of this study was to identify stress-related socio-psychological factors that affect the mental health of healthcare workers during the COVID-19 pandemic in Ukraine.

SUBJECTS AND METHODS

Study Design

A cross-sectional descriptive study was conducted from 04.10.2020 until 05.11.2020. Data were gathered from an online questionnaire.

Study Sample

The survey of 1098 healthcare workers across Ukraine was conducted using a specially developed online questionnaire.

Data Collection Tool

For the study, a self-administered online questionnaire was developed. The questionnaire was created based on the experience and results of a survey conducted during the SARS epidemic in 2003 by I. Khalid and colleagues (Khalid et al. 2016). The questionnaire consisted of 4 sections. The first 10 questions focused on socio-demographic characteristics of the respondents, the remaining 37 questions were grouped into 3 blocks of factors associated with COVID-19 stress: 1) perceptions about COVID-19 related situations; 2) stress factors; 3) protective factors. However, not all respondents provided complete answers to all groups of questions, thus the absolute values for individual categories of questions ranged from 1039 to 1087.

Data Analysis

Descriptive statistics were used to illustrate socio-demographic indicators. Pearson's criterion χ^2 was applied to compare group differences in categorical variables (socio-demographic characteristics). The non-parametric Mann-Whitney U-test was used to compare the severity of each stress factor in the groups of respondents. A $p < 0.05$ value was considered statistically significant. Logistic regression analysis was utilized for the classification and prediction of anxiety and fear related to COVID-19 in healthcare workers based on stress factors obtained in the testing groups of respondents. Odds ratio and 95% CI, and p-values of the Wald test for each independent variable were reported. According to the logistic model, an operating characteristic curve (ROC) was created, an area under the ROC curve (AUC), and the corresponding cut points were displayed. The diagnostic value of stress factors for anxiety was evaluated. The results of the study were processed using the statistical package of the licensed program TIBCO Statistica 13.4 (Lavrakas et al. 2019).

Ethics Approval and Consent to Participate

All procedures were in accordance with the ethical standards of the institutional and the national research committees as well as with The Declaration of Helsinki (1964) and its amendments or comparable ethical standards. As the participation in the study was voluntary and the study was conducted without any intervention, meaning that it involved no more than minimal risk, the Research Ethics Committee approved that informed consent was provided immediately preceding the respondents completing the questionnaire.

RESULTS

Among the 1087 respondents, the majority were female healthcare workers 870 (80.1%). The most represented age categories of healthcare workers were from 41 to 50 years - 280 (25.8%), 31-40 years - 262 (24.1%), and over 60 years 250 (23%). Fewer respondents were aged under 30 - 178 (16.4%) and from 51 to 60 - 117 (10.8%).

Most of the participants in the online survey were employees of primary healthcare centres - 198 (18.2%) and family medicine clinics - 143 (13.2%). A large number of subjects represented inpatient medical institutions (37.3%): central district hospitals - 137 (12.6%), city multidisciplinary hospitals - 135 (12.4%) and regional hospitals - 134 (12.3%). The rest of the physicians - 340 (31.3%) were from other healthcare institutions.

The majority of the healthcare workers were from outpatient clinics - 202 (18.6%), psychiatry 137 (12.6%), and therapeutic departments - 129 (11.9%). The representation of medical staff from other medical departments (pediatrics, intensive care unit, surgical, infectious, other) ranged from 1.9% to 5.2%.

More than half of respondents were doctors - 630 (58.0%). Chiefs of departments - 157 (14.4%) and nurses - 143 (13.2%) also participated in the study, followed by 31 clinic chiefs (2.9%) and 126 (11.6%) professionals in other occupation positions.

Approximately every fifth surveyed healthcare professional was a family doctor ($n=229$ /21.0%). The number of psychiatrists and therapists was also relatively high, 172 (15.8%) and 113 (10.4%), respectively. At the same time, the participation of representatives of other medical specialties (pediatrics, intensive care medicine, cardiology, surgery, infectious diseases, obstetrics and gynecology, addiction, e.t.c.) ranged from 1.0% to 6.4%.

Regarding the marital status of the medical staff, at the time of the survey, more than two-thirds of them were married - 736 (67.7%), 186 (17.1%) - unmarried, 126 (11.6%) were divorced, another 39 (3.2%) were widows or widowers. More than half of the respondents had children - 670 (61.6%). The majority of the surveyed healthcare workers were living with a husband / wife - 698 (64.2%), 101 (8.5%) - with their parents, the remaining 213 (19.6%) - alone.

All respondents' answers were divided into two groups, depending on whether they provided care to patients with COVID-19 directly (group A, n=639) or were indirectly involved in the treatment process (group B, n=448). Thus, direct medical care for patients with COVID-19 was provided by 58.8% of the specialists who participated in the survey.

We relate the personal involvement in dealing with COVID-19 patients by healthcare workers with a range of socio-demographic indicators.

The results of the study suggest that the age of healthcare workers may affect the delivery of personal care to patients with COVID-19 ($p=0.0027$). In the age groups up to 30 years, from 31 to 40 and from 41 to 50 years, there were significantly more specialists who provided personal assistance to patients with COVID-19, compared to those who did not. Among specialists over the age after 50, the number of respondents who did and did not provide personal assistance was relatively equal.

Regarding the gender of the staff, no difference was found between those who provided personal care to patients with COVID-19 and those who did not ($p=0.3163$).

Marital status of a specialist was found to affect the care delivered to patients with COVID-19 ($p=0.0321$). Widowers and divorced professionals dealt with COVID-19 patients in relatively equal numbers, while married professionals provided care in the majority of cases. The most pronounced difference in rates was observed in the group of single respondents, only 32% of whom did not deliver personal care to patients with COVID-19 (Table 1).

Table 1. Differences between groups A and B in socio-demographic indicators (Pearson's χ^2 test)

| Socio-demographic indicators | Significance of differences | | |
|------------------------------|-----------------------------|----|--------|
| | χ^2 | df | p |
| Marital status | 8,79766 | 3 | 0.0321 |
| Age of the specialist | 16,2444 | 4 | 0.0027 |
| Health care institution | 179,055 | 6 | 0.0001 |
| Health care department | 124,868 | 9 | 0.0001 |
| Occupation | 104,147 | 5 | 0.0001 |
| Specialty | 202,899 | 12 | 0.0001 |

Df - degrees of freedom

The results of the study showed that the profile orientation of the department influenced the provision of personal care to patients with COVID-19 by specialists. Thus, most professionals from intensive care units, outpatient, therapeutic department, and pediatrics gave personal care to patients with COVID-19. A relative majority of surgical specialists (54%) also provided personal assistance to those with COVID-19. To a lesser extent, personal care was delivered by specialists from the psychiatric department (35%), administrative (42%), and other departments (26%).

Almost all specialists in infectious disease departments provided personal assistance to patients with COVID-19 ($p<0.0001$).

Significant differences between groups A and B were found for a number of studied stress-associated factors (Table 2, Figure 1). Specialists who provided personal assistance perceived the risk of personal infection and the threat of pandemic spread to be more pronounced. They were more confident in the willingness of the health care institution to provide assistance to patients with COVID-19, as opposed to specialists who did not provide personal care ($p<0.01$). According to the types of response to the COVID-19 related situation, specialists who did not provide personal assistance to patients with COVID-19 were more likely to quit their jobs or get sick leave, to feel that others were avoiding them because of their possible contact with COVID-19 ($p<0.01$). Professionals who provided personal assistance were more distressed due to their increased workload compared to employees who did not work with COVID-19. Regarding the stress factors, healthcare professionals who did not provide personal assistance were experiencing more profound stress due to the possibility of transmitting COVID-19 to their relatives and felt a potential conflict between duty and personal safety ($p<0.01$). They, unlike those who provided care to people with COVID-19, were less likely to experience stress due to physical exhaustion or fatigue, difficulty to get to work, and absence / insufficiency of personal protective equipment. Regarding the protective factors, the absence of COVID-19 infection among the staff was more important for the specialists who provided personal care to patients with COVID-19 compared to those who did not ($p<0.01$). No significant difference between both groups of respondents was found concerning the other studied factors that might influence personal care delivery to patients with COVID-19 ($p>0.05$).

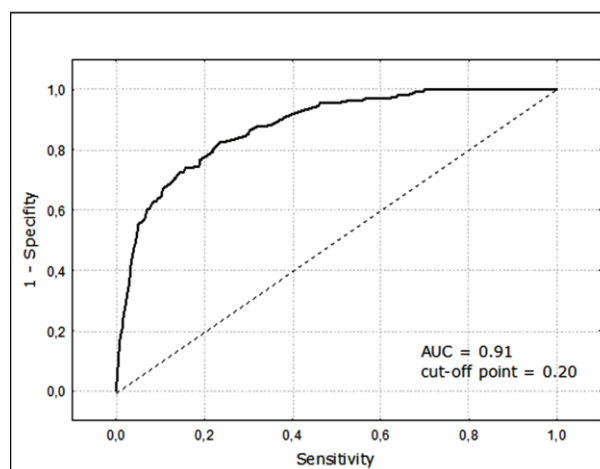


Figure 1. ROC constructed from the prediction model for feeling anxiety / fear of COVID-19 in health care workers

Table 2. Differences between groups A and B in terms of factors associated with stress (Mann-Whitney U-test)

| Factor | Rank Sum | | U | p |
|--|----------|----------|----------|-------|
| | Group A | Group B | | |
| Perception of COVID-19 related situation | | | | |
| Thoughts about job quitting | 207062.5 | 330103.5 | 112667.5 | <0.01 |
| Thoughts about requesting sick leave | 229299.5 | 303728.5 | 124028.5 | <0.05 |
| The feeling that employees who did not work with COVID-19 were avoiding you | 206423.0 | 322483.0 | 112895.0 | <0.01 |
| The feeling that others were avoiding you because you might have had contact with COVID-19 | 202004.5 | 338275.5 | 107609.5 | <0.01 |
| Distress due to increased workload | 189335.5 | 349905.5 | 97957.5 | <0.01 |
| Stress factors | | | | |
| Threat of a disease spread | 194006.5 | 294559.5 | 108515.5 | <0.01 |
| Risk of being infected with COVID-19 | 183349.0 | 329229.0 | 95778.0 | <0.01 |
| Willingness of the health care institution to provide assistance to patients with COVID-19 | 201107.0 | 320624.0 | 109301.0 | <0.01 |
| The possibility to transmit COVID-19 to relatives | 205848.0 | 325117.0 | 115748.0 | <0.01 |
| Conflict between duty and personal safety | 209465.0 | 316360.0 | 118087.0 | <0.05 |
| Physical exhaustion or fatigue | 180435.0 | 338236.0 | 92864.0 | <0.01 |
| Absence / insufficiency of personal protective equipment | 219059.5 | 287461.5 | 110746.5 | <0.01 |
| Difficulties to get to work | 223357.5 | 291247.5 | 109141.5 | <0.01 |
| Protective factors | | | | |
| Absence of COVID-19 cases among staff | 204139.0 | 241901.0 | 94748.0 | <0.01 |

Table 3. Results of a logistic regression analysis of the level of anxiety / fear associated with COVID-19

| Factor | B | Standard error | Significance of differences | | | | |
|--|-------|----------------|-----------------------------|--------|-------|--------|--------|
| | | | Wald Chi-square | p | OR | 95% CI | |
| The threat of a COVID-19 pandemic spread | 2.080 | 0.697 | 8.891 | 0.003 | 8.002 | 2.035 | 31.466 |
| Risk of death from COVID-19 | 0.440 | 0.162 | 7.338 | 0.007 | 1.553 | 1.129 | 2.135 |
| The chance of getting COVID -19 | 1.473 | 0.242 | 36.892 | 0.0001 | 4.361 | 2.709 | 7.018 |
| Probability of transmitting COVID-19 to relatives or friends | 0.663 | 0.280 | 5.626 | 0.018 | 1.941 | 1.121 | 3.359 |
| Constant news of new cases of COVID-19 | 0.786 | 0.181 | 18.878 | 0.0001 | 2.195 | 1.539 | 3.131 |
| Lack of staff in healthcare facilities | 0.412 | 0.166 | 6.146 | 0.013 | 1.510 | 1.090 | 2.092 |

Note: B - regression coefficients; OR - Odds ratio; 95%CI - 95% Confidence interval

Psycho-affective response in the form of anxiety / fear caused by the COVID-19 pandemic was detected in 863 healthcare workers (79.4%), 224 (20.6%) declared absence of such manifestations. It is noteworthy that no significant difference was detected between professionals of both groups concerning anxiety / fear related to COVID-19 ($p=0.0776$). To identify the association between the 36 independent variables, which determined stress / protective factors and feelings of anxiety / fear related to COVID-19 in healthcare workers, logistic regression was used. Logistic regression allowed us to select significant predictive factors and build a final best predictive model (Table 3). As a result of an iterative process, the best logistic regression model based on 6 independent predictors was chosen ($\chi^2(6)=263.70$, $p=0.000$). The following 6 parameters were included in the logistic regression model:

- The threat of a COVID-19 pandemic spread.
- Risk of death from COVID-19.

- The risk of getting COVID-19.
- Probability of transmitting COVID-19 to relatives or friends.
- Constant news of new cases of COVID-19.
- Lack of staff in healthcare facilities.

It is noteworthy that the higher value of the Wald statistics determined the higher significance of the corresponding predictor for risk of anxiety. ROC analysis has been used to assess the sensitivity and specificity of predictors for the absence and presence of anxiety (Figure 1). Since $AUC > 0.8$, we could identify that the model had a high predictive power. According to the results of the model for classifying healthcare workers who experienced (yes) or not the feeling of anxiety / fear related to COVID-19, the model predicted correctly in 60.5% (not) cases and 94.1% (yes) cases, and incorrectly in 39.5% (not) cases 5.9% (yes) cases.

DISCUSSION

The results of the study are in line with the results of other international publications on the effect of COVID-19 on the mental health state of healthcare workers (Pappa et al. 2020, Sanghera et al. 2020, Vizheh et al. 2020).

Thus, 79.4% of medical workers in Ukraine experience stress and anxiety associated with COVID-19, and this does not depend on whether they provide direct care to patients with COVID-19 or not. However, it should be noted that this study did not involve measuring the clinical level of symptoms of anxiety and stress, and it may turn out to be different for the abovementioned groups.

The stress of professionals who provide care for people with COVID-19 is influenced by increased workload, exhaustion and fatigue, difficulty getting to work, and lack of protective equipment. At the same time, professionals who do not directly provide care to patients with COVID-19 are more worried about the possibility of transmitting COVID-19 to the relatives and have potential conflict between duty and personal safety. They are also more likely to quit their jobs or get sick leave and are more worried about avoiding them in the community because of their possible contact with coronavirus. Thus, while healthcare professionals who provide care for COVID-19 patients are an obvious risk group that deserves special attention, healthcare workers who are not involved in care for people with COVID-19 also experience significant stress and need support. These findings correspond with previous research (Vizheh et al. 2020), highlighting the need in development of broad support systems for healthcare professionals.

The most significant protective factor in our study was the absence of COVID-19 infection among the staff, which was more important for the specialists who provided personal care to patients with COVID-19 compared to those who did not. According to other researchers (Monistrol-Mula et al. 2022, Theofilidis et al. 2021, Labrague & de los Santos 2020) protective factors also might include organisational support; social support; and personal factors, like values and beliefs, adaptability/ flexibility, experience, and self-esteem/self-efficacy. Therefore, support programs should address different levels of factors to enhance resilience in healthcare workers.

Predictive factors for stress and anxiety associated with COVID-19 are factors related to safety and risk perception (the risk of getting infected, dying, infecting loved ones, perception of the threat of the epidemic spread), information factors (constant news about COVID-19), as well as factors related to the organisation of care (lack of staff in health care facilities). Thus, ensuring the safety, proper informing of staff, and appropriate organisation of the facility work can affect the level of anxiety and stress of health care workers associated with COVID-19. This information can be used to design further programs to promote the mental health and well-being of healthcare professionals, such as selfcare programs (Nawaz et al. 2020) or recomme-

ndations for healthcare facilities on work policies and organisation (Hamouche 2021).

This study has a certain number of limitations. Firstly, it refers to the cross-sectional design of the study and the absence of follow-up. Secondly, the chain-referral sampling initiated in social networks among medical professionals may not be representative of the general population. Thirdly, the questionnaire was fulfilled only by medical workers who had access and competencies to fulfill online questionnaire.

CONCLUSION

This study proves that the mental health of healthcare workers in the context of overcoming the COVID-19 pandemic requires particular attention and further investigation not only concerning the stress-related risk factors, but also their long-term effect to ensure the wellbeing of health care professionals and efficacy of health care delivery.

According to our findings, fear and anxiety related to COVID-19 were regarded of significant importance for both healthcare professionals who did and did not provide care to patients with coronavirus infection. Among the factors that determined the risk of fear and anxiety associated with COVID-19 in all healthcare workers, the risk of getting infected by COVID-19 took the first place. Both factors that cause occupational stress and those that influence coping with it impact personal care delivery to patients with COVID-19 by healthcare professionals in an individual manner. The data obtained in this study provide a strong necessity for the development and implementation of preventive and rehabilitation measures, aimed at stabilization of the psycho-emotional state of healthcare professionals and improve the quality of medical assistance.

Contribution of individual authors:

Irina Pinchuk is responsible for the overall content as guarantor, concept and design of the article, literature search, writing manuscript, and approval of the final version.

Vitaliy Pishel & Marina Polyvianaia proposed the concept and design of the article, supervised the data analysis, and participated in the manuscript preparation.

Stanislav Chumak, Tetiana Ilynska, Nataliia Stepanova & Oksana Kopchak conducted a literature review and participated in data interpretation and manuscript preparation.

Yulia Yachnik & Oleksiy Kolodezhny: comments on the concept of the article, literature search, writing some parts of the manuscript.

Natalia Filimonova performed statistical analysis and participated in data interpretation and manuscript preparation.

Andrii Solonskyi participated in data interpretation and manuscript preparation.

All authors contributed to the article development and approved the final version of the manuscript.

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