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Health-promoting strategies and anxiety about long COVID in medical professionals: A cross-sectional survey during the pandemic

Strategie prozdrowotne i lęk przed *long COVID* wśród personelu medycznego: badanie przekrojowe w okresie pandemii

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ABSTRACT

INTRODUCTION: The coronavirus disease 2019 (COVID-19) pandemic has caused global lifestyle changes. Social isolation measures and rising SARS-CoV-2 complications have significantly affected healthcare workers who face increased occupational demands and growing concerns about infection risks and long-term consequences. This study examined the association between medical profession type and both COVID-19 health behaviors and long-term complication concerns.

MATERIAL AND METHODS: A retrospective study was conducted on a group of 133 healthcare workers and medical students between October 2023 and February 2024. A questionnaire designed by the author was used, which collected demographic and anthropometric data, as well as information on health-promoting behaviors related to the COVID-19 pandemic. Descriptive statistics were used, with significance set at $p < 0.05$. Comparisons between variables were performed using the Fisher exact test.

RESULTS: During the COVID-19 pandemic 40.6% of healthcare workers engaged in physical activity, 33.8% modified diets, and 18.8% adopted other preventive behaviors, with no significant profession-dependent differences ($p > 0.05$). Nearly half (48.9%) expressed long-term complication concerns, most frequently among "other healthcare professionals" (77.3%), showing significant group variation ($p = 0.01$). Doctors/medical students disproportionately reported ≥ 4 specific concerns ($p < 0.05$). The study reveals profession-linked disparities in risk perception but not preventive behaviors.

CONCLUSIONS: The study found no profession-dependent differences in COVID-19 preventive behaviors ($p > 0.05$), but significant variation in long-term complication concerns ($p < 0.05$). While health measures were uniform across roles, risk perception differed by type of medical profession.

KEYWORDS

health-promoting behaviors, medical personnel, long COVID, fear

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STRESZCZENIE

WSTĘP: Pandemia COVID-19 (*coronavirus disease 2019*) spowodowała globalne zmiany w stylu życia. Środki izolacji społecznej i powikłania związane z SARS-CoV-2 dotknęły szczególnie pracowników służby zdrowia, którzy muszą stawiać czoła zwiększonym wymaganiom zawodowym i rosnącym obawom o ryzyko infekcji i jej długoterminowe skutki. Celem pracy była analiza związku między zawodem medycznym a zachowaniami zdrowotnymi i obawami dotyczącymi długoterminowych powikłań po COVID-19.

MATERIAŁ I METODY: Przeprowadzono badanie retrospektywne w grupie 133 pracowników ochrony zdrowia oraz studentów kierunków medycznych w okresie od października 2023 r. do lutego 2024 r. Zastosowano autorski kwestionariusz, który obejmował dane demograficzne i antropometryczne, a także informacje dotyczące zachowań prozdrowotnych związanych z pandemią COVID-19. W analizie wykorzystano statystykę opisową, przyjmując poziom istotności $p < 0,05$. Porównania między zmiennymi przeprowadzono z użyciem testu dokładnego Fishera.

WYNIKI: Podczas pandemii COVID-19 40,6% pracowników ochrony zdrowia podejmowało aktywność fizyczną, 33,8% modyfikowało dietę, a 18,8% wdrażało inne zachowania profilaktyczne; nie stwierdzono istotnych różnic zależnych od wykonywanego zawodu ($p > 0,05$). Niemal połowa badanych (48,9%) wyrażała obawy dotyczące długoterminowych powikłań, najczęściej w grupie „innych pracowników ochrony zdrowia" (77,3%), co wskazywało na istotne zróżnicowanie między grupami ($p = 0,01$). Lekarze i studenci kierunków medycznych nieproporcjonalnie częściej zgłaszali ≥ 4 konkretne obawy ($p < 0,05$). Badanie ujawnia różnice w postrzeganiu ryzyka związane z wykonywanym zawodem, lecz nie w zakresie zachowań profilaktycznych.

WNIOSKI: Badanie nie wykazało różnic w zachowaniach profilaktycznych związanych z COVID-19 zależnych od wykonywanego zawodu ($p > 0,05$), jednak zauważono istotne różnice w poziomie obaw o powikłania długoterminowe ($p < 0,05$). Pomimo stosowania podobnych środków ochrony percepcja ryzyka zakażenia różniła się w zależności od wykonywanego zawodu.

SŁOWA KLUCZOWE

zachowania prozdrowotne, personel medyczny, *long COVID*, lęk

INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic has precipitated profound societal transformations, significantly altering global lifestyles and healthcare delivery [1,2]. Among healthcare workers, these changes have been particularly acute, manifesting in heightened professional demands and growing apprehensions about long-term complications of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection [3,4]. Emerging evidence suggests these concerns extend beyond acute infection, encompassing potential chronic sequelae [5,6]. Recent studies document widespread behavioral adaptations, including shifts to remote work [7]. The healthcare sector has borne unique burdens, with isolation measures and post-acute COVID-19 syndromes substantially disrupting clinical practice [8]. Frontline providers face compounded stressors, including increased patient loads [9], while confronting anxieties about long-term cardiopulmonary consequences [10].
This study examines whether health-promoting behaviors and COVID-19 complication concerns vary across healthcare professions.

MATERIAL AND METHODS

A survey study was conducted among 133 healthcare professionals and medical students. An author--developed questionnaire, which included demographic and anthropometric data as well as information on health-promoting behaviors related to the COVID-19 pandemic, was employed. Due to the subject of the work, the so-called survey technique was used to conduct the research, which was of a survey nature. An original questionnaire was prepared, aimed at defining pro-health strategies and assessing the fear of "long COVID" among medical personnel through the appropriate construction of questions. The form consisted of 26 closed, single-choice questions. The initial questions were of a general nature, so that it was possible to characterize the group of patients, including the type of medical profession performed and self--assessment regarding the level of fear of complications after COVID-19.

Study questionnaire

The author's questionnaire was based on information on health-promoting behaviors related to the COVID--19 pandemic and demographic and anthropometric data in the study group. The analysis of demographic data included educational background, with study participants stratified into professional subgroups: physicians, nursing staff, medical students, and allied healthcare personnel (including paramedics and patient care technicians). The questionnaire included closed questions regarding the time and type of physical activity, diet and changes in diet, and in the case of other activities, attention was paid to hygiene, monitoring vital signs, and limiting stimulants. In turn, in the case of concerns about the long-term effects of

COVID-19, a decrease in physical capacity, neurological disorders (brain fog, concentration problems), respiratory problems and sleep disorders were indicated.

Statistical analysis

Statistical analysis was performed using Statistica 12.0 software (Krakow, Poland). Results were presented as mean standard deviation or percentages for nominal and ordinal scale data. Results were considered statistically significant with a *p* value less than 0.05 [11]. Comparisons of variables were performed using Fisher's exact test [12].

RESULTS

In the study, a total of 40.6% of the medical personnel surveyed engaged in regular physical activity, 33.8% implemented dietary interventions, and 18.8% adopted other preventive measures; no significant differences were observed between professional groups ($p > 0.05$). However, 48.9% expressed concerns about long-term complications, with a significant association between professional affiliation and these concerns ($p = 0.01$), and the majority of those who reported four or more specific concerns were doctors and medical students ($p < 0.05$). The leading concerns were post-COVID complications from the respiratory, neurological, and cardiovascular systems, respectively.

In our study cohort, regular physical activity was implemented as a preventive measure, with particular emphasis on outdoor aerobic exercises (running, walking, and cycling) to enhance cardiopulmonary fitness. Dietary modifications focused on maintaining nutritionally balanced meals incorporating easily digestible, vitamin- and mineral-rich fruits and vegetables. Additionally, 18.8% of participants (n = 25) adopted stress-reduction strategies to mitigate occupational burdens, including psychological support interventions, spiritual counseling, and mindfulness meditation practices (Figure 1).

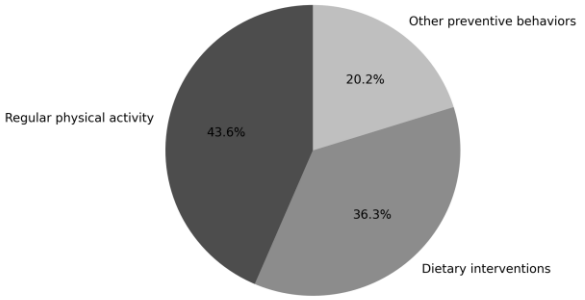

Fig. 1. Distribution of COVID-19 preventive health behaviors among healthcare professionals: physical activity, dietary modifications, and other strategies (psychological support/spiritual practices)

When stratified by professional group, 40.2% of doctors and medical students, 31.0% of nurses, and 54.0% of other healthcare professionals reported regular physical activity; dietary interventions were reported by 37.1%, 31.0%, and 45.5% of these groups, respectively; and other preventive behaviors (psychological support/spiritual practices) by 22.0%, 3.5%, and 27.3%, respectively (Table I, Figure 2).

Table I presents the percentages of three types of health-promoting behaviors among three professional groups: physicians and medical students, nurses, and other healthcare professionals. It also includes descriptive statistics: standard deviation (SD), mean and range (min-max) for each behavior type.

Table I. Health-promoting behaviors among healthcare professional groups with descriptive statistics

Health behavior	Physicians and medical students (%)	Nurses (%)	Other healthcare professionals (%)	Mean (%)	SD (%)	Range (%)
Regular physical activity	40.2	31.0	54.0	41.7	11.8	31.0–54.0
Dietary interventions	37.1	31.0	45.5	37.87	7.5	31.0–45.5
Other preventive behaviors	22.0	3.5	27.3	17.6	10.4	3.5–27.3

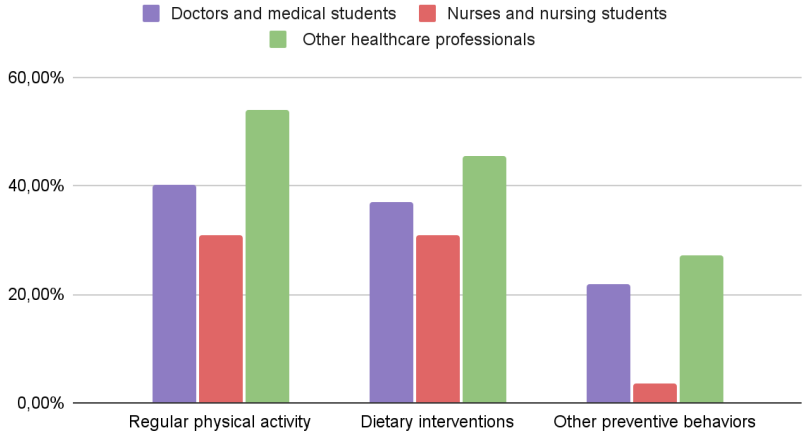

Fig. 2. Health-promoting behaviors related to COVID-19 among three groups of medical professionals [Percentage of respondents (%)]

Other healthcare professionals reported the highest engagement in all categories of health behaviors. The greatest variability (SD = 11.8%) was observed in physical activity, indicating substantial differences between groups. The smallest variability (SD = 7.5%) was found in dietary interventions, suggesting a relatively similar approach to diet across all groups. Nurses consistently showed the lowest engagement, particularly in additional protective measures. Preventive behaviors were both low overall (17.6%) and highly variable (3.5%–27.3%), particularly among nurses. Other healthcare workers were significantly more likely to engage in physical activity (OR = 2.60, 95% CI: 1.55–4.35) and practice stress reduction techniques (OR = 10.29, 95% CI: 2.85–37.12) than nurses. Physicians/medical students were 3.2 times more likely to have ≥ 4 specific concerns about long COVID (95% CI: 1.85–5.53).

There was no statistically significant association between the type of preventive measure and group affiliation ($p > 0.05$). In addition, 48.9% of the study group had concerns about long-term complications of SARS-CoV-2 infection, with such concerns reported by 43.9% of physicians and medical students, 41.4% of nurses and nursing students, and 77.3% of other healthcare workers (Figure 3).

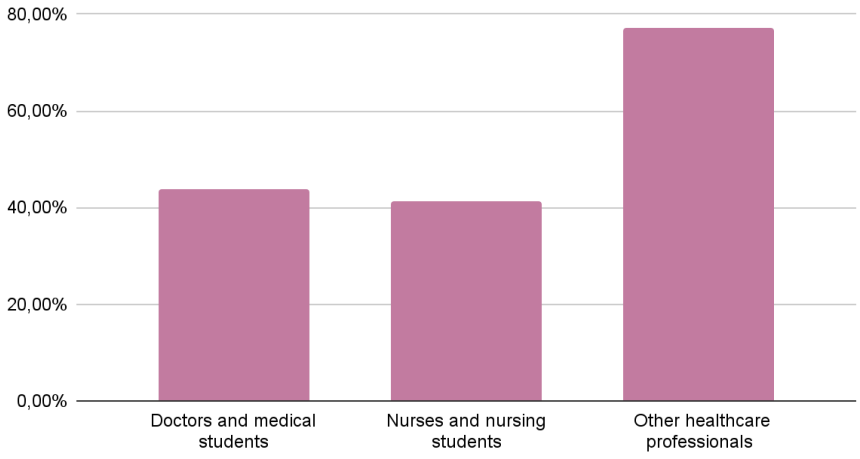

Fig. 3. Health-promoting behaviors related to COVID-19 among groups of medical professionals [Percentage of respondents (%)]

A significant relationship was observed between group affiliation and the presence of these concerns ($p = 0.01$), and notably, the majority of individuals reporting four or more specific concerns were doctors and medical students ($p < 0.05$). These results indicate that although the type of medical profession does not significantly affect the adoption of health-promoting behaviors during the pandemic, it is associated with variability in perceived long-term health risks.

Our data showed clear differences between the discussed professional groups in preventive health behaviors. The greatest deficits in these procedures

were observed in the group of nurses, which indirectly indicates the need for targeted educational and systemic interventions. Improving health behaviors in this group is necessary not only for maintaining their own health, but also in the case of this professional group, improving the effectiveness of nursing care for patients and increasing the level of competence in clinical practice.

DISCUSSION

This cross-sectional study assessed healthcare practices and concerns about COVID-19 related outcomes among healthcare personnel. Results showed a uniform adherence to preventive measures across all professional categories ($p > 0.05$), while revealing significant differences across professions among healthcare personnel in concerns about long-term complications ($p < 0.05$), with a particularly pronounced concern among non-physician healthcare workers (77.3%). Our own observations are partially consistent with the results of Stefanatou et al. [13] who, in their analysis assessing the behaviour of healthcare workers, reported consistent agreement in the use of personal protective equipment, but divergence in risk perception across medical specialties. The uniformity in health-promoting behaviors observed in our cohort (40.6% physical activity adoption, 33.8% dietary modifications) contrasts with profession-specific patterns reported by Mulhem et al. [14], our analysis found that other healthcare workers showed significantly greater engagement in physical activity (OR = 2.60) and stress reduction (OR = 10.29) compared with nurses, while physicians/medical students were 3.2 times more likely to report multiple concerns about long COVID (all $p < 0.05$). These results underscore distinct patterns of behavior and health across healthcare professions during the pandemic.

Our study found that physicians were 53% more likely to report better sleep habits than nurses (OR 1.53, 95% CI 1.21–1.93). This difference between professional groups might reflect changing workplace conditions during our study period (October 2023–February 2024), when standardized safety protocols may have reduced earlier variations in health behaviors – a pattern previously noted by Greenberg et al. [15] in their research on pandemic-related behavior changes among healthcare workers. In our analysis, 48.9% of the study group expressed concerns about long COVID-19 (77.3%), which is relatively higher than those reported in comparable studies. Pappa et al. [16] documented a prevalence of significant concerns about long COVID-19, with nurses showing the highest concern. This may likely be due to geographical differences in experiences with the pandemic or, in our case, the inclusion of medical students who showed a disproportionately high reporting of ≥ 4 specific concerns ($p < 0.05$). The stronger anxiety of students is confirmed in the work of Torales et al. [17], where medical interns showed 2.3 times greater health anxiety related to COVID-19 compared to practicing physicians (95% CI 1.8–2.9). The neurobiological basis of our participants occupational anxiety patterns is supported by recent neuroimaging studies. Riedel et al. [18] reported that healthcare workers with a high level of knowledge about the long-term complications of COVID-19 reported more specific concerns despite lower general anxiety. This is consistent with our observation that physicians/medical students were more focused on specific systemic complications than generalized concerns.

We are aware that the study requires a deeper and broader study group in the context of assessing concerns about the long-term effects of COVID-19, and the sample size ($n = 133$) limits the possibility of generalization, especially in the case of subgroup analyses. Our cross-sectional design aimed to investigate whether it is possible to assess the relationship between health-promoting behavior and anxiety. In the future, we plan to expand the questionnaire based on the Pandemic Anxiety Scale used in the study by Kızılkaya and Çağatay [19], being aware that the lack of a scale potentially limits direct comparability, as also noted by Gozpinar et al. [20].

Despite these limitations, our study provides preliminary evidence of an association between health-promoting behaviors and anxiety levels among healthcare workers in the post-pandemic period. Ultimately, these observations may help develop targeted interventions to support the mental health of healthcare workers, not only in the post-pandemic period but also due to occupational hazards.

CONCLUSIONS

1. Significant interprofessional differences ($p < 0.05$) were observed in the level of concern regarding potential long-term sequelae of SARS-CoV-2 infection, suggesting divergent risk appraisal based on specialization.
2. No statistically significant association was found between healthcare profession type and adherence to COVID-19 health-promoting behaviors ($p > 0.05$), indicating consistent compliance across medical specialties.
3. Although compliance with protective measures was comparable among different medical specialties, physicians, and especially medical

students, differed significantly in assessing the severity of potential complications after infection.

4. Studies indicate that although the level of implementation of pro-health behaviors was similar across all professional groups, there were significant differences in concerns about long-term complications following COVID-19 infection. This may suggest the need to consider the specificity of risk perception depending on the profession when planning educational activities or psychological support for healthcare workers.

Authors' contribution

Study design – B. Pietrzyk, T. Maciejczyk, S. Kulejewski
Data collection – T. Maciejczyk, S. Kulejewski, B. Pietrzyk
Data interpretation – T. Maciejczyk, B. Pietrzyk, S. Kulejewski
Statistical analysis – S. Kulejewski, B. Pietrzyk, T. Maciejczyk
Manuscript preparation – B. Pietrzyk, T. Maciejczyk
Literature research – B. Pietrzyk, S. Kulejewski, T. Maciejczyk

REFERENCES

1. Kraut RE, Li H, Zhu H. Mental health during the COVID-19 pandemic: Impacts of disease, social isolation, and financial stressors. PLoS One. 2022;17(11):e0277562. doi: 10.1371/journal.pone.0277562.
2. Hadar-Shoval D, Alon-Tirosh M, Asraf K, Tannous-Haddad L, Tzischinsky O. Lifestyle Changes, Emotional Eating, Gender, and Stress during COVID-19 Lockdown. Nutrients. 2022;14(18):3868. doi: 10.3390/nu14183868.
3. Alon-Tirosh M, Hadar-Shoval D, Asraf K, Tannous-Haddad L, Tzischinsky O. The Association between Lifestyle Changes and Psychological Distress during COVID-19 Lockdown: The Moderating Role of COVID--Related Stressors. Int J Environ Res Public Health. 2021;18(18):9695. doi: 10.3390/ijerph18189695.
4. Khanji MY, Collett G, Godec T, Maniero C, Ng SM, Siddiqui I, et al. Improved lifestyle is associated with improved depression, anxiety and well--being over time in UK healthcare professionals during the COVID-19 pandemic: insights from the CoPE-HCP cohort study. Gen Psychiatr. 2023;36(1):e100908. doi: 10.1136/gpsych-2022-100908.
5. Siddiqui I, Gupta J, Collett G, McIntosh I, Komodromos C, Godec T, et al. Perceived workplace support and mental health, well-being and burnout among health care professionals during the COVID-19 pandemic: a cohort analysis. CMAJ Open. 2023;11(1):E191–E200. doi: 10.9778/cmajo.20220191.
6. Shenkman R, Diewald L, Murray MB, Oliver TL. Unveiling Lived Experiences: Exploring the Health and Lifestyle Effects of COVID-19 on Healthcare Workers. Nutrients. 2023;15(23):4857. doi: 10.3390/nu15234857.
7. Hannemann J, Abdalrahman A, Erim Y, Morawa E, Jerg-Bretzke L, Beschoner P, et al. The impact of the COVID-19 pandemic on the mental health of medical staff considering the interplay of pandemic burden and psychosocial resources-A rapid systematic review. PLoS One. 2022;17(2):e0264290. doi: 10.1371/journal.pone.0264290.
8. Fouad MM, Zawilla NH, Maged LA. Work performance among healthcare workers with post COVID-19 syndrome and its relation to antibody response. Infection. 2023;51(4):839–849. doi: 10.1007/s15010-022-01942-4.
9. Strahm C, Seneghini M, Güsewell S, Egger T, Leal-Neto O, Brucher A, et al. Symptoms Compatible With Long Coronavirus Disease (COVID) in Healthcare Workers With and Without Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Infection-Results of a Prospective Multicenter Cohort. Clin Infect Dis. 2022;75(1):e1011–e1019. doi: 10.1093/cid/ciac054.
10. GBD 2021 Demographics Collaborators. Global age-sex-specific mortality, life expectancy, and population estimates in 204 countries and territories and 811 subnational locations, 1950–2021, and the impact of the COVID-19 pandemic: a comprehensive demographic analysis for the Global Burden of Disease Study 2021. Lancet. 2024;403(10440):1989–2056. doi: 10.1016/S0140-6736(24)00476-8.
11. Andrade C. The *P* Value and Statistical Significance: Misunderstandings, Explanations, Challenges, and Alternatives. Indian J Psychol Med. 2019;41(3):210–215. doi: 10.4103/IJPSYM.IJPSYM_193_19.
12. Jung SH. Stratified Fisher's exact test and its sample size calculation. Biom J. 2014;56(1):129–140. doi: 10.1002/bimj.201300048.
13. Stefanatou P, Xenaki LA, Karagiorgas I, Ntigrintaki AA, Giannouli E, Malogiannis IA, et al. Fear of COVID-19 Impact on Professional Quality of Life among Mental Health Workers. Int J Environ Res Public Health. 2022;19(16):9949. doi: 10.3390/ijerph19169949.
14. Mulhem E, Zeman LL, Childers K, Roy S, Homayouni R. Association of health behaviors with healthcare workers' physical and psychological well--being: Learning from the COVID-19 pandemic. PLoS One. 2025;20(10):e0334752. doi: 10.1371/journal.pone.0334752.
15. Greenberg N, Weston D, Hall C, Caulfield T, Williamson V, Fong K. Mental health of staff working in intensive care during Covid-19. Occup Med (Lond). 2021;71(2):62–67. doi: 10.1093/occmed/kqaa220.
16. Pappa S, Ntella V, Giannakas T, Giannakoulis VG, Papoutsi E, Katsaounou P. Prevalence of depression, anxiety, and insomnia among healthcare workers during the COVID-19 pandemic: A systematic review and meta-analysis. Brain Behav Immun. 2020;88:901–907. doi: 10.1016/j.bbi.2020.05.026.
17. Torales J, O'Higgins M, Castaldelli-Maia JM, Ventriglio A. The outbreak of COVID-19 coronavirus and its impact on global mental health. Int J Soc Psychiatry. 2020;66(4):317–320. doi: 10.1177/0020764020915212.
18. Riedel B, Horen SR, Reynolds A, Hamidian Jahromi A. Mental Health Disorders in Nurses During the COVID-19 Pandemic: Implications and Coping Strategies. Front Public Health. 2021;9:707358. doi: 10.3389/fpubh.2021.707358.
19. Kızılkaya S, Çağatay A. Behind COVID-19 pandemic backstage: anxiety and healthcare workers. Cir Cir. 2023;91(2):247–252. doi: 10.24875/CIRU.22000418.
20. Gozpinar N, Cakiroglu S, Zorlu A, Yıldırım Budak B, Gormez V. Videoconference anxiety: Conceptualization, scale development, and preliminary validation. Bull Menninger Clin. 2022;86(3):223–248. doi: 10.1521/bumc.2022.86.3.223.