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Research article

## ASSESSMENT OF RELATIVE RISK OF DISCOMFORT AND ITS SUBJECTIVE PERCEPTION ASSOCIATED WITH PERSONAL PROTECTIVE EQUIPMENT: ADAPTATION DIFFERENCES AMONG STAFF IN INFECTIOUS DISEASE AND MULTIDISCIPLINARY HOSPITALS DURING THE COVID-19 PANDEMIC

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*The object of the study was represented by healthcare workers from infectious disease and multidisciplinary hospitals repurposed to treat COVID-19 patients.*

*The aim of the study was to assess subjective perception of discomfort associated with prolonged use of personal protective equipment (PPE) and to identify differences in adaptation to such working conditions between healthcare staff in infectious disease and multidisciplinary hospitals during the COVID-19 pandemic.*

*A survey was conducted among healthcare workers, including questions on daily duration of PPE use (medical masks/respirators, protective goggles, coveralls) and the presence of symptoms indicating adverse effects of prolonged PPE using.*

*Changes in working conditions during the COVID-19 pandemic led to a significant increase in the proportion of healthcare workers regularly using PPE as well as a substantial rise in duration of its use. Prolonged PPE use during the pandemic resulted in an increased frequency of complaints related to PPE in both hospital types. Higher prevalence of complaints associated with PPE use was observed in the multidisciplinary hospital, both during routine and repurposing periods, as well as a greater change in the frequency of systemic physiological disorders while wearing respiratory PPE (difficulty breathing, sensation of shortness of breath, dizziness) during the pandemic in the multidisciplinary hospital compared to the infectious disease hospital. The identified inter-hospital differences likely reflect greater adaptability among staff in infectious disease hospitals to prolonged PPE use attributed to stringent infection control protocols and the availability of well-tested algorithms for working in routine daily practice.*

*These disparities in preparedness and adaptation of healthcare workers to PPE use in repurposed hospitals highlight the need for expanded implementation of occupational health risk management measures, emphasize the importance of optimizing PPE design, improving selection and usage protocols, introducing training programs on rational PPE use, and conducting regular health screenings for PPE-related adverse effects among healthcare workers.*

***Keywords:*** *COVID-19, pandemic, healthcare workers, occupational health risks, subjective complaints, personal protective equipment (PPE), medical masks, protective goggles, protective coveralls.*

Biological threats of a scale reaching an epidemic or even a pandemic pose a serious challenge for public healthcare due to the necessity to develop immediate and effective health protection measures. The necessity to repurpose in-patient hospitals to treat patients with communicable diseases requires implementing numerous administrative, manage-



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ment, engineering-technical, and organizational activities and infection control measures as well as employing additional resources such as healthcare workers and personal protective equipment (PPE). The spread of SARS-CoV-2 in 2019 and the following COVID-19 pandemic have demonstrated how important it is to prepare healthcare organizations to deal with such threats [1–3].

Occupational activities involving health protection and recovery are inherently associated with serious health risks for those who perform them [4–7]. Work with patients infected with highly contagious respiratory pathogens involves additional health risks for healthcare workers; these risks are associated not only with possibility to get infected but also growing physical, intellectual, sensory, and emotional loads, the necessity to use PPE for a long time, and contacts with disinfectants and antiseptics [8]. The necessity to use PPE for long periods of time can involve damage to the skin in places where a medical mask / respirator and goggles contact it, developing symptoms of heat stress when using coveralls, as well as lower work capacity and headaches [9–13]. Physical discomfort caused by PPE use often leads to failure to comply with standards for its use: healthcare workers can consciously reduce time of its use or refuse from using it completely, especially under heavy workloads. Such breaches of infection control protocols raise risks of occupational infection considerably eliminating any protective PPE effects and creating health threats for both healthcare workers themselves and their patients [14]. In this respect, occupational risk management, including minimization of discomfort caused by PPE use, provision of PPE ergonomics and availability, as well as teaching healthcare workers how to use PPE rationally, becomes an integral part of infection prevention and control. These measures promote compliance with safety protocols thereby reducing probability of violations and creating a sustainable system of anti-epidemic measures aimed at preventing in-hospital spread of infections [15–18][1].

A necessary activity aimed at managing occupational health risks for healthcare workers involves developing and implementing specific measures on preventing negative outcomes of occupational exposures associated with considerable changes in working conditions when in-patient hospitals are repurposed in an unfavorable epidemic situation [19, 20]. In this context, we can assume that healthcare workers employed at infectious disease hospitals possess specific knowledge and skills of treating communicable diseases; therefore, they are better trained to treat patients during a pandemic than their colleagues from multidisciplinary repurposed hospitals. Healthcare workers employed at infectious disease hospitals have a better insight into specificity of infectious processes, infection control protocols and safety precautions, which can be crucially important in time of epidemics and pandemics.

Therefore, analysis of differences in preparedness and ability to adapt among healthcare workers from infectious disease and somatic hospitals during a pandemic is an important research trend, which can help develop more effective strategies aimed at responding to future biological threats. A complex approach to raising preparedness of all healthcare organizations, providing relevant training and equipment for healthcare workers can considerably increase effectiveness of the whole healthcare system when it faces new epidemic challenges.

**The aim of this study** was to assess subjective perception of discomfort associated with prolonged use of personal protective equipment (PPE) and to identify differences in adaptation to such working conditions between healthcare workers in infectious disease and multidisciplinary hospitals during the COVID-19 pandemic.

**Materials and methods.** The research was accomplished in an infectious disease hospital and multidisciplinary hospital in

[1] Keep health workers safe to keep patients safe: WHO. *World Health Organization*. Available at: https://www.who.int/news/item/17-09-2020-keep-health-workers-safe-to-keep-patients-safe-who (March 29, 2025).

Minsk (Republic of Belarus) repurposed for treating patients infected with COVID-19. We conducted a survey among healthcare workers to investigate subjective perception of discomfort. The survey included questions on frequency and duration of PPE use in routine work (medical masks / respirators, protective goggles, and coveralls) as well as having symptoms indicating presence of some negative health effects produced by prolonged PPE use. The respondents could choose several options when answering questions about subjective symptoms associated with PPE use.

One hundred and three respondents from the infectious disease hospital and 95 respondents from the multidisciplinary hospital took part in the survey. Two samples did not differ significantly per sex ($p$ = 0.052), age ($p$ = 0.29), or work records ($p$ = 0.21). All participants gave their consents to personal data analysis provided that confidentiality and anonymity were secured.

This subjective assessment method has a limitation, namely, the fact that the survey data depended on accuracy of the respondents' self-reports. This may lead to information bias due to cognitive mistakes, social advisability or differences in individual interpretation of the results. This should be considered when survey results are interpreted. However, within this study context, the survey turned out to have significant advantages: the method allowed operative data collection in an epidemic emergency when it was too difficult to apply more resource-consuming approaches; subjective assessment of discomfort is an important source of information about individual perception, which determines how ready healthcare workers are to comply with infection control protocols. Use of a standardized inventory with binary and ordinal answer options minimized variability in interpreting the questions and anonymity helped reduce social advisability when answering them.

The survey data were statically analyzed using statistical software packages Excel and Statistica 13. The data analysis involved calculating absolute and relative frequencies. The confidence interval was calculated for intensive indicators per the Wilson method. Qualitative ordinal indicators in dependent groups were compared with the Wilcoxon matched pairs test. Significance of differences in data describing qualitative indicators in independent groups was established based on the $\chi^2$test value. Frequencies of binary indicators in dependent groups were compared using the McNemar's mid-$p$-value binomial test; the effect size was estimated by calculating Odds Ratio (OR) and its confidence interval. OR values in two samples were compared by using Conditional Relative Odds Ratio (CROR) and its confidence interval [21]. The research results were considered authentic and differences between indicators significant at the probability value being not less than 95.5 % ($p < 0.05$).

**Results and discussion.** Respiratory PPE provides necessary protection against respiratory pathogens. Our study revealed a considerably higher frequency of using respiratory PPE by healthcare workers during the COVID-19 pandemic, which is consistent with global guidelines on infection prevention and control. The share of healthcare workers who used face masks or respirators in their routine work grew significantly in both in-patient hospitals, namely, from 71.0 (62.5–79.6) to 100 % (96.4–100) ($p < 0.001$) in the infectious disease hospital and from 91.6 (84.3–95.7) to 100 % (96.1–100) ($p$ = 0.004) in the multidisciplinary hospital. This highlights the universality of taken safety precautions. Together with a growing number of healthcare workers who used PPE, there was a growth in time of PPE use during a work shift. The trend was significantly more prominent in the infectious disease hospital ($p < 0.001$): 87.4 % (79.6–92.5) of the respondents from the infectious disease hospital ($p < 0.001$) and 47.4 % (37.6–57.3) of the respondents from the multidisciplinary hospital ($p < 0.001$) mentioned longer time of using this PPE. The growth in the number of healthcare workers using face masks was also accompanied with more frequent complaints associated with their long use (Table 1).

Table 1

The results obtained by comparative analysis of frequency of complaints associated with wearing a face mask / respirator

| Complaints | The share of the respondents with complaints in routine working conditions, % | The share of the respondents with complaints during the COVID-19 pandemic, % | McNemar's mid-*p*-value | OR (95 % CI) | CROR (95 % CI) |
|---|---|---|---|---|---|
| Itch in the nose or throat | 19.4 / 21.1 | 35.0 / 23.2 | 0.002 / 0.581 | 4.2 (1.58–11.14) / 1.4 (0.44–4.41) | 3.0 (0.67–13.53) |
| Labored breathing | 20.4 / 24.2 | 39.8 / 42.1 | < 0.001 / < 0.001 | 3.86 (1.68–8.86) / 18.0 (2.40–134.84) | 4.66 (0.53–41.19) |
| Shortness of breath | 15.5 / 42.1* | 22.3 / 49.5* | 0.115 / 0.096 | 2.17 (0.82–5.70) / 2.4 (0.85–6.81) | 1.11 (0.27–4.59) |
| Dizziness | 2.9 / 8.4 | 3.9 / 15.8* | 0.688 / 0.022 | 1.5 (0.25–8.98) / 8.0 (1.0–63.97) | 5.33 (0.34–82.83) |
| Discomfort on the face and / or behind the ears | 41.8 / 56.8* | 68.0 / 69.5 | < 0.001 / 0.019 | 3.46 (1.77–6.76) / 2.71 (1.14–6.46) | 1.28 (0.43–3.82) |
| Redness and / or maceration on the face, behind the ears | 9.7 / 40.0* | 5.8 / 50.5* | 0.180 / 0.019 | 3.0 (0.61–14.86) / 3.5 (1.15–10.63) | 1.17 (0.17–8.19) |

Note: the data in the columns 2–4 are given in the following format: 'infectious disease hospital / multidisciplinary hospital'; * means significant differences in frequency of complaints in the analyzed hospitals under the same work scenario at $p < 0.05$.

Comparative analysis of frequency of complaints associated with long use of medical face masks / respirators established the following. In the infectious disease hospital, an authentic growth in frequency of complaints during the pandemic against routine work was found for the following symptoms: itch in the nose or throat, from 19.4 (12.9–28.1) to 35.0 % (26.4–44.6) ($p = 0.002$, $OR = 4.2$); labored breathing, from 20.4 (13.7–29.2) to 39.8 % (30.9–49.5) ($p < 0.001$, $OR = 3.86$); discomfort on the face and / or behind the ears, from 41.8 (32.7–51.4) to 68.0 % (58.4–76.2) ($p < 0.001$, $OR = 3.46$). In the multidisciplinary hospital, the most prominent growth was established for the following symptoms: labored breathing, from 24.2 (16.7–33.7) to 42.1 % (32.7–52.2) ($p < 0.001$, $OR = 18.0$); dizziness, from 8.4 (4.3–15.8) to 15.8 % (9.8–24.4) ($p = 0.022$, $OR = 8.0$); discomfort on the face and / or behind the ears, from 56.8 (46.8–66.3) to 69.5 % (59.6–77.8) ($p = 0.019$, $OR = 2.71$); redness and / or maceration on the face, behind the ears, from 40.0 (30.7–50.0) to 50.5 % (40.7–60.4) ($p = 0.019$, $OR = 3.5$).

The results obtained by comparing prominence of differences between the in-patient hospitals show an authentic difference in prevalence of several symptoms both in the routine work scenario and after repurposing during the pandemic. Thus, healthcare workers from the multidisciplinary hospital more often made the following complaints associated with respiratory PPE use: in the routine work scenario, shortness of breath ($p < 0.001$), discomfort on the face and / or behind the ears ($p = 0.034$), redness and / or maceration on the face, behind the ears ($p < 0.001$); when working during the pandemic, shortness of breath ($p < 0.001$), dizziness ($p = 0.005$), redness and / or maceration on the face, behind the ears ($p < 0.001$). Assessment of effects produced by a work scenario on frequency of complaints did not establish significant differences between the hospitals; however, we can still speak about certain trends associated with more prominent influence of the pandemic on frequency of complaints about itch in the nose or throat (CROR = 3.0 (0.67–13.53)) in the infectious disease hospital, labored breathing (CROR = 4.66 (0.53–41.19)) and dizziness (CROR = 5.33 (0.34–82.83)) in the multidisciplinary hospital. It is worth noting that wide

CROR confidence intervals, which include 1, indicate considerable uncertainty of these estimates, which can be partly due to the small size of the study sample.

The share of healthcare workers who used protective goggles, grew considerably both in the infectious disease hospital (from 25.2 to 91.3 %, $p < 0.001$) and in the multidisciplinary hospital (from 50.5 to 86.3 %, $p < 0.001$). The results obtained by analyzing frequency of complaints associated with wearing protective goggles (Table 2) revealed a prominent dynamic during the COVID-19 pandemic. In the infectious disease hospital, the share of healthcare workers who complained about discomfort in the area where the goggles contacted the head grew from 15.5 (9.8–23.8) to 73.8 % (64.6–81.3) ($p < 0.001$); in the multidisciplinary hospital, from 27.4 (19.4–37.1) to 56.8 % (46.8–66.3) ($p < 0.001$). High *OR* values in both hospitals (33 and 29) highlight a prominent correlation between a long time of wearing goggles during the pandemic and discomfort appearance. It is noteworthy that, despite an authentic increase in duration of using goggles in both hospitals, healthcare workers from the multidisciplinary hospital mentioned longer duration of using this PPE type more frequently (47.4 and 15.5 % of the respondents, $p < 0.001$). Comparison of dynamics between these two hospitals (CROR = 1.14, (0.07–18.84)) did not reveal any significant differences despite initially higher prevalence of such complaints in the multidisciplinary hospital under the routine work scenario (27.4 against 15.5 %; $p < 0.05$). Skin reactions such as itch, redness and maceration in the area where the goggles contact the skin also showed a pronounced growth: in the infectious disease hospital, from 1.0 (0.2–5.3) to 33.0 % (24.7–42.6) ($p < 0.001$); in the multidisciplinary hospital, from 5.3 (2.3–11.7) to 22.1 % (14.9–31.5) ($p < 0.001$, $OR = 17$). These changes can be caused by mechanical pressure, disrupted air exchange and moisture accumulation under personal protective equipment devices. Special attention should be paid to growing prevalence of headaches in the multidisciplinary hospital, from 12.6 (7.4–20.8) to 31.6 % (23.1–41.5) ($p < 0.001$, $OR = 19$), whereas similar dynamics was insignificant in the infectious disease hospital ($p = 0.25$).

A considerable growth in the share of healthcare workers who wore protective coveralls during the pandemic was established both in the infectious disease hospital (from

Table 2

The results obtained by comparative analysis of frequency of complaints associated with wearing protective goggles

| Complaints | The share of the respondents with complaints in routine working conditions, % | The share of the respondents with complaints during the COVID-19 pandemic, % | McNemar's mid-*p*-value | OR (95 % CI) | CROR (95 % CI) |
|---|---|---|---|---|---|
| Discomfort in the area where the goggles contact the head | 15.5 / 27.4* | 73.8 / 56.8* | < 0.001 / < 0.001 | 33 (4.51–241.29) / 29 (3.95–212.90) | 1.14 (0.07–18.84) |
| Itch, redness and maceration in the area where the goggles contact the head | 1.0 / 5.3 | 33.0 / 22.1 | < 0.001 / < 0.001 | – / 17 (2.26–127.75) | – |
| Headache | 1.0 / 12.6* | 2.9 / 31.6* | 0.25 / < 0.001 | – / 19 (2.54–141.93) | – |

Note: the data in the columns 2–4 are given in the following format: 'infectious disease hospital / multidisciplinary hospital'; * means significant differences in frequency of complaints in the analyzed hospitals under the same work scenario at $p < 0.05$; blank spaces with dashes mean that the indicator was not calculated due to limitations intrinsic to the employed method.

31.1 to 98.1 %; $p < 0.001$) and in the multidisciplinary hospital (from 30.5 to 92.6 %; $p < 0.001$). This was accompanied with a significant growth in the number of complaints about physical discomfort and physiological impairments (Table 3), which is explained by a longer time of using coveralls in daily work in both analyzed hospitals. Longer use of coveralls during the pandemic was mentioned by 88.4 % (80.7–93.2) of the respondents from the infectious disease hospital ($p < 0.001$) and 69.5 % (59.6–77.8) of the respondents form the multidisciplinary hospital ($p < 0.001$).

Thus, in the infectious disease hospital, the share of the respondents who complained about elevated sweating grew from 24.3 (17.0–33.4) under the routine work scenario to 63.1 % (53.5–71.8) during the pandemic ($p < 0.001$) with the estimated odds ratio (*OR*) being equal to 41 (5.64–298.07). In the multidisciplinary hospital, it grew from 17.9 to 67.4 % ($p < 0.001$, $OR = 48$ (6.63–347.76)); the CROR value equaled 1.17 (0.07–19.31), which indicates absence of any significant differences in relative influence of changes in a work routine between these two hospitals. Similarly, complaints about feeling overheated became much more frequent in both hospitals: in the infectious disease hospital, their frequency grew from 5.8 (2.7–12.1) to 44.7 % (35.4–54.3) ($p < 0.001$); in the multidisciplinary hospital, from 12.6 (7.4–20.8) to 54.7 % (44.7–64.4) ($p < 0.001$). The *OR* estimates were not accomplished due to methodological limitations; however, statistical significance of these changes indicates pronounced effects produced by changes in working conditions on subjective perception of feeling overheated. Dynamics of complaints about dizziness showed that frequency of the symptom grew from 1.0 (0.2–5.3) to 7.8 % (4.0–14.6) ($p = 0.008$) in the infectious disease hospital and from 2.1 (0.6–7.4) to 15.8 % (9.8–24.4) ($p < 0.001$) in the multidisciplinary hospital. The *OR* values calculated for the multidisciplinary hospital equaled 14 (1.84–106.47), which emphasizes a considerable impact exerted by long time of wearing coveralls on appearance of dizziness. The number of the respondents who mentioned thirst also grew considerably: in the infectious diseases hospital, frequency of this compliant grew from 1.0 (0.2–5.3) to 16.5 % (10.6–24.9) ($p < 0.001$); in the multidisciplinary hospital, from 11.6 (6.6–19.6) to 49.5 %

Table 3

The results obtained by comparative analysis of frequency of complaints associated with wearing protective coveralls

| Complaints | The share of the respondents with complaints in routine working conditions, % | The share of the respondents with complaints during the COVID-19 pandemic, % | McNemar's mid-*p*-value | OR (95 % CI) | CROR (95 % CI) |
|---|---|---|---|---|---|
| Elevated sweating | 24.3 / 17.9 | 63.1 / 67.4 | < 0.001 / < 0.001 | 41 (5.64–298.07) / 48 (6.63–347.76) | 1.17 (0.07–19.31) |
| Feeling overheated | 5.8 / 12.6 | 44.7 / 54.7 | < 0.001 / < 0.001 | – /– | – |
| Dizziness | 1.0 / 2.1 | 7.8 / 15.8 | 0.008 / < 0.001 | – / 14 (1.84–106.47) | – |
| Thirst | 1.0 / 11.6* | 16.5 / 49.5* | < 0.001 / < 0.001 | – / 37 (5.08–269.68) | – |
| Palpitations | 3.9 / 4.2 | 37.9 / 21.1 | < 0.001 / < 0.001 | – /– | – |

Note: the data in the columns 2–4 are given in the following format: 'infectious disease hospital / multidisciplinary hospital'; * means significant differences in frequency of complaints in the analyzed hospitals under the same work scenario at $p < 0.05$; blank spaces with dashes mean that the indicator was not calculated due to limitations intrinsic to the employed method.

(39.6–59.4) ($p < 0.001$). Finally, the dynamics of palpitations showed that the frequency of the symptom grew from 3.9 (1.5–9.6) to 37.9 % (29.1–47.5) ($p < 0.001$) in the infectious disease hospital and from 4.2 (1.7–10.3) to 21.1 % (14.1–30.3) ($p < 0.001$) in the multidisciplinary hospital. The comparative analysis established higher prevalence of thirst in the multidisciplinary hospital both under the routine work scenario (11.6 against 1.0 %; $p = 0.002$) and during the pandemic (49.5 against 16.5 %; $p < 0.001$).

**Conclusions.** The COVID-19 pandemic led to drastic changes in working conditions of healthcare workers and wide PPE implementation in healthcare organizations. This is confirmed by the fact that 100 % of the healthcare workers in the analyzed hospitals used face masks / respirators and a considerable growth in the share of those who used protective goggles and coveralls. Another universal feature of the pandemic was a longer time of using all PPE types accompanied with considerable growth of physical and physiological discomfort. Long use of respiratory PPE led to a considerable increase in the number of complaints made by healthcare workers from the infectious disease hospital about itch in the nose or throat ($p = 0.002$, $OR = 4.2$), labored breathing ($p < 0.001$, $OR = 3.86$), and discomfort on the face and /or behind the ears ($p < 0.001$, $OR = 3.46$). During the pandemic, healthcare workers from the multidisciplinary hospital had authentically more frequent complaints about such symptoms as labored breathing ($p < 0.001$, $OR = 18.0$), dizziness ($p = 0.022$, $OR = 8.0$), discomfort on the face and /or behind the ears ($p = 0.019$, $OR = 2.71$), and redness and / or maceration on the face and /or behind the ears ($p = 0.019$, $OR = 3.5$). Our comparison of frequency of complaints associated with respiratory PPE use under the same work scenario revealed that healthcare workers from the multidisciplinary hospital more often suffered from discomfort due to wearing a face mask / respiratory both in the routine work scenario and during the pandemic. Thus, in the routine work scenario, healthcare workers from the multidisciplinary hospital more often complained about shortness of breath ($p < 0.001$), discomfort on the face and /or behind the ears ($p = 0{,}034$), redness and / or maceration on the face and /or behind the ears ($p < 0{,}001$); during the pandemic, shortness of breath ($p < 0.001$), dizziness ($p = 0.005$), and redness and / or maceration on the face and /or behind the ears ($p < 0.001$). It is worth noting that changes in working conditions and respiratory PP use during the pandemic resulted in more considerable changes in frequency of systemic health disorders in the multidisciplinary hospital: labored breathing (CROR = 4.66 (0.53–41.19)), shortness of breath (CROR = 1.11 (0.27–4.59)), and dizziness (CROR = 5.33 (0.34–82.83)). In the infectious disease hospital, more prominent changes were observed for local reactions during the pandemic such as itch in the nose or throat (CROR = 3.0 (0.67–13.53)) and discomfort on the face and /or behind the ears (CROR = 1.28 (0.43–3.82)).

Longer use of protective goggles during the pandemic also led to more frequent complaints made by healthcare workers in both analyzed hospitals: in the infectious disease hospital, discomfort in the area where the goggles contact the head ($p < 0.001$, $OR = 33$), itch, redness and / or maceration in the area where the goggles contact the head ($p < 0.001$); in the multidisciplinary hospital, discomfort in the area where the goggles contact the head ($p < 0.001$, $OR = 29$), itch, redness and / or maceration in the area where the goggles contact the head ($p < 0.001$, $OR = 17$), and headaches ($p < 0.001$, $OR = 19$). We compared frequency of complaints associated with using protective goggles in both hospitals in the same work scenario; as a result, we established that, in general, healthcare workers from the multidisciplinary hospital, just as with wearing medical face masks, more often complained about physical discomfort under both work scenarios, which was manifested through such complaints as discomfort in the area where the goggles contact the head ($p = 0.042$) and headaches ($p < 0.001$) in the routine work scenario; headaches during the COVID-19 pandemic ($p = 0.023$).

Use of protective coveralls when treating COVID-19 patients was accompanied with

much more frequent complaints about all outlined symptoms both in the infectious diseases hospital and repurposed multidisciplinary hospital. However, healthcare workers from the multidisciplinary hospital more often complained about being thirsty when wearing coveralls both in the routine work scenario ($p = 0.002$) and during the pandemic ($p < 0.001$).

More frequent complaints associated with PPE use under both work scenarios as well as more frequent systemic physiological disorders caused by respiratory PPE use in the multidisciplinary hospital during the pandemic may indicate that healthcare workers from the infectious disease hospital are better adapted to longer PPE use due to stricter infection control protocols and well-tested work algorithms employed in their routine practice. Wide CROR confidence intervals, however, indicate the necessity to be very careful when interpreting the detected differences between the hospitals; this might be associated with an insufficient sample size as well as variability of compliance with the rules for PPE use among healthcare workers.

Our findings may indicate that some physiological compensatory mechanisms have been developed in healthcare workers who are employed at infectious diseases hospitals; these mechanisms are associated with regular use of respiratory PPE. Long work under moderate hypoxia is likely to stimulate adaptation (greater effectiveness of oxygen utilization in tissues, respiratory rhythm optimization, and enhanced capillary blood flow). These changes can also result from behavioral skills developed in routine practices (for example, controlled breathing aimed at minimizing discomfort).

Such differences in healthcare workers' preparedness and adaptation to PPE use in times when hospitals are repurposed give evidence of the necessity to more widely implement additional activities aimed at managing occupational health risks associated with PPE use in healthcare organizations responsible for treating patients during an epidemic rise in prevalence of respiratory infections.

To reach a comparable level of adaptation, it is advisable to implement step-by-step training programs, which simulate various work scenarios involving long PPE use. To manage occupational health risks more effectively, it is also necessary to conduct regular medical screening including estimation of external respiration. Its results can be employed to identify a risk group as regards hypoxia development; to train healthcare workers to self-diagnose early symptoms of oxygen starvation such as tachycardia, dizziness, or cognitive dysfunction; as well as to develop personalized recommendations on PPE use, which consider individual adaptation resources of healthcare workers.

Therefore, for multidisciplinary hospitals, it is important to transform measures taken during pandemics into a system for continuous training and preventive medical control. Implementation of such measures in periods between pandemics will help create sufficient preparedness to future epidemic challenges associated with the necessity to use personal protective equipment for a long time.

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