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Investigating SARS-CoV-2 transmission among co-workers in a University of Northern Italy during COVID-19 pandemic: an observational study

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Abstract

Background: *This study aimed to investigate SARS-CoV-2 transmission among co-workers at the University of Genoa, Italy, during the second COVID-19 pandemic wave.* **Methods:** *A cross-sectional study was carried out in October 2020 – March 2021: RT-PCR confirmed cases of COVID-19 notified to the Occupational Health Service were included in the analysis.* **Results:** *Among the n = 201 notified cases, contact tracing of n = 53 individuals identified n = 346 close contacts. The household setting (IRR = 36.8; 95% CI: 4.9-276.8; p < 0.001) and sharing eating areas (IRR = 19.5; 95% CI: 2.5-153.9; p = 0.005) showed the highest Secondary Attack Rates (SARs) compared to the office setting. Fatigue (IRR= 17.1; 95% CI: 5.2-55.8; p < 0.001), gastrointestinal symptoms (IRR= 6.6; 95% CI: 2.9-15.2; p< 0.001) and cough (IRR= 8.2; 95% CI: 3.7-18.2; p= p< 0.001) were associated with transmission of infection. Polysymptomatic cases (IRR= 23.1; 95% CI: 3.1-169.2; p = 0.02) were more likely to transmit the infection. Among COVID-19 index cases aged >60 years (OR = 7.7; 95% CI: 1.9-31.9; p = 0.0046) SARs were higher than in other age groups. Wearing respiratory protections by both the case and the close contact resulted an effective measure compared with no use (IRR = 0.08; 95% CI: 0.03-0.2; p = < 0.0001). Conclusions: Accurate infection monitoring and contact tracing was useful to identify the main situations* **Conclusions:** *Accurate infection monitoring and contact tracing was useful to identify the main situations of SARS-CoV-2 transmission in the workplace, and hence for risk assessment and prevention programs.*

Introduction

The COVID-19 pandemic is one of the biggest challenges that societies and businesses have faced (1).

COVID-19 spreads primarily through respiratory droplets or contact with contaminated surfaces. Inter-human transmission can lead to epidemic clusters both at the community and occupational levels. Regarding the occupational settings, exposure in the workplace or commuting may favour virus transmission (e.g., work-related travel to an area with local community transmission; crowded public transportation).

The COVID-19 pandemic has caused more than 200 million cases and nearly 5 million deaths world-

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wide. Workplaces have a role in spreading and mitigating the COVID-19 pandemic throughout the world. If the progressive increase in the number of cases has led many countries to adopt "stay at home" policies for workers, it has also imposed a challenge to guarantee safe workplaces for essential workers (e.g., healthcare workers, food retails, transport, services, etc.) (2). Authorities provided specific guidance on the protection and preventive measures to maintain essential services and control workplace infections. Even so, several clusters of COVID-19 have been recognized in different occupational settings.

During the pandemic, the European Centre for Disease Prevention and Control (ECDC) has activated a collection data survey to assess COVID-19 cases in the workplaces across the EU/EEA. A report based on the collected data showed several clusters and outbreaks of COVID-19 in different occupational settings. Most occupational cases were reported from the health and social care setting, followed by food packaging and processing, factory/manufacturing, office, and educational facility. A total of 1266 clusters were reported in the period March-July 2020 (3). Occupational sectors with reported COVID-19 clusters and outbreaks were similar also in Italy, ranging from 0.7% in the education setting to 65.2% in the healthcare setting. From January 2020 to August 2021, 179,992 cases were notified in Italy (4). Jobs, work settings, socio-economic and demographic conditions may favour COVID-19 infection, and therefore influence workers' health and safety. Healthcare workers are known to be at greater risk of occupational exposure to biological agents, particularly infectious pathogens such as *Mycobacterium Tuberculosis*, influenza virus, SARS-CoV, measles virus etc. Close and direct contact with contagious cases, insufficient or incorrect use of personal protective equipment (PPE), work in confined indoor spaces contribute to the diffusion of infection (5, 6). Outside of healthcare facilities, several factors have been identified as determinants of COVID-19 transmission among co-workers, in particular: (i) person-to-person contact; (ii) inadequate ventilation; (iii) common eating areas; (iv) shared work accommodation and shared travel to and from work. Factors outside the workplace may also lead to an increased risk of SARS-CoV-2 transmission in the workplace (e.g., shared accommodation, commuting and social gathering of co-workers) (7).

As it is well recognized, during the second pandemic wave caused by SARS-CoV-2, additional preventive measures were implemented at national and local government levels to mitigate the transmission of the novel coronavirus. One of these special arrangements placed non-healthcare workers at high risk of infection and disease severity on smart working. These measures were taken to avoid the overcrowding of employees, teachers, educators, researchers, and students naturally immersed in potentially higher-risk occupational settings. Indeed, only a tiny proportion of non-healthcare employees continued to work in person. Nonetheless, scientific research concerning which and how the implemented preventive measures contribute to lowering the risk of transmission in different workplaces and which occupational factors increase the possibility of spreading the infection to colleagues is limited.

Thus, this study investigates the determinants and factors of COVID-19 transmission in the specific occupational setting by evaluating the most critical aspects of secondary contagion and the most effective prevention measures adopted.

Methods

The present study has been drafted according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines (8).

Study design and population

An observational study was performed among workers employed at the University of Genoa during the "second wave" of the SARS-CoV-2 pandemic, from 1st October 2020 to 31st March 2021, involving the entire workforce of the University of Genoa, including the personnel employed as healthcare workers at the IRCCS-Ospedale Policlinico San Martino of Genoa. During the COVID-19 pandemic, the Occupational Health Service (OHS) activated a surveillance system based on self-reporting. It aimed to identify, manage and follow-up suspect and confirmed cases and perform contact tracing among close contacts. Confirmed cases included a positive RT-PCR nasopharyngeal (NP) swab test processed by Authorized Laboratories in the Liguria Region. Close contact was defined according to the Italian Ministry of Health's case definition (9) as a person who had exposure or lived with a probable or confirmed case or had direct and face-to-face contact exposure with the index case in the period between two days before the positive PCR test or two days preceding the onset of COVID-19 symptoms and end of isolation after infection resolution.

Data Collection

Data collection involved extrapolating available information from *ad hoc* datasets created by the OHS during COVID-19 surveillance activities. Moreover, all cases of COVID-19 reported to OHS were interviewed by telephone to collect additional information. All subjects with COVID-19 diagnosis underwent home isolation. Data of interest have been retrospectively extracted from the datasets and gathered as follows: (i) demographic, (ii) tasks, (iii) history of exposure to COVID-19 cases, (iv) close contact with suspected or confirmed COVID-19 cases among co-workers, (v) setting of exposure, (vi) symptoms of infection, (vii) use of PPE.

The clinical spectrum and severity of SARS-CoV-2 infection were defined following the National Institutes of Health (NIH) guidelines (10).

All workers employed in-person activities who notified themselves as confirmed cases of COVID-19 and close contacts have been included. The primary outcome investigated was the secondary attack rate of SARS-CoV-2 infection. We analyzed exposures at the workplace and in a household setting, provided that exposures occurred among co-workers. All the activities were performed in compliance with the Declaration of Helsinki and current healthcare standards, following the recommendations of the Italian Ministry of Health. Data were anonymized before the analysis.

Statistical analysis

Continuous numerical variables were summarized as means and standard deviations (SDs). Nominal and ordinal categorical variables were summarized and described as frequency and percentages. The Poisson regression test was used for univariate analysis regarding variables that were representative of different potential ways of SARSCoV-2 transmission.

A 2-tailed $p < 0.05$ was considered statistically significant. Multivariate analyses were performed for variables with probability (p) values of <0.20 reporting only the ones with statistical significance. SAR was calculated as the proportion of secondary cases among close contacts (11). All analyses were performed using SPSS statisti-cal software v. 20.0 (IBM Corp.).

Results

The population of this study consisted of 201 COVID-19 cases, of which 167 were index cases. Among them, 44 HCWs reported being exposed to COVID-19 patients during medical care activities. Seventy workers and students did not report occupational close contact exposure and were therefore excluded from our analysis. Furthermore, the contact investigation of 53 COVID-19 cases with available exposure information showed that they caused 346 close contact exposures in co-workers, 34 of whom acquired the infection as secondary cases, with an overall SAR of 9.8%.

The investigation of demographic characteristics, professional tasks, and contact records regarding known exposures to COVID-19 cases are reported in Table 1.

The most represented job task among COVID-19 cases was working as residents (38.8%), followed by professors (17.9%) and administrative staff (14.9%). Regarding the exposure modality, the most frequent was household/community (33.8%) and close contact with patients (21.9%), followed by contact with co-workers (16.9%). About a quarter (26.4%) of COVID-19 cases were not aware of known exposures with other index cases.

Regarding the close contact exposures identified among co-workers, the SARs are reported for each exposure setting in Table 2: the highest SARs were observed to occur in household settings and sharing eating areas, respectively with Incidence Rate Ratio (IRR) equal to 36.8 (95% CI: 4.9-276.8) and to 19.5 (95% CI: 2.5-153.9) Compared to the of-

Table 1. Demographic characteristics, tasks and exposure history to COVID-19 cases between 1st October 2020 – 31st March 2021 notified to the Occupational Health Service of the University of Genoa (N=201)

Variable	Confirmed COVID-19 cases n (%)
Female	91 (45.3)
Male	110 (54.7)
age [years], Mean (SD)	35.2 (12.3)
Task	
Residents	78 (38.8)
Professors	36 (17.9)
Administrative staff	30 (14.9)
Students	28 (13.9)
PhD students	18 (9.0)
Postdoctoral Researchers	11 (5.5)
Exposure Setting	
Household/community close contact	68 (33.8)
Unknown exposure	53 (26.4)
Close contact with patients	44 (21.9)
Workplace close contact	34 (16.9)
Classroom	2 (1.0)

fice setting, no significant difference was found with classrooms (IRR= 5.2; 95% CI: 0.5-57.3; p = 0.18) and with laboratories (IRR= 2.6; 95% CI: 0.2-41.6; p = 0.50); moreover, close contact exposures between co-workers in the health-care setting did not show increased odds of transmission (IRR = 2.9; 95% CI: 0.3-25.8; p = 0.34).

Concerning the clinical characteristics of the index cases as potential determinants of transmission of SARS-CoV-2 infection (Table 2), fatigue (IRR= 17.1; 95% CI: 5.2-55.8; p< 0.001), gastrointestinal symptoms (IRR= 6.6; 95% CI: 2.9-15.2; p< 0.001) and cough (IRR= 8.2; 95% CI: 3.7-18.2; p= p< 0.001) were found to be significantly associated with transmission of infection. Conversely, no secondary cases of COVID-19 were observed following exposure to asymptomatic or presymptomatic index cases in the 48 hours before illness onset by the index case (Supplementary Table 1).

Further considering the clinical presentation of COVID-19 index cases, all presented with mild SARS-CoV-2 infection, and it was found that the patients who had a clinical presentation with three or more symptoms were more likely to transmit the infection than those with a single one (IRR= 23.1; 95% CI: 3.1-169.2; p = 0.02) as shown in Table 2. Moreover, the correlation between age of the index cases and transmission of SARS-CoV-2 to close contacts were investigated: SARs were higher in COVID-19 index cases aged >60 years (OR =7.7; 95% CI: 1.9-31.9; p = 0.0046) than in other age groups. On the other hand, no association was found with the age of close contacts (Supplementary Table 1). The use of respiratory protection (defined as the wearing of a respiratory PPE such as a surgical mask or filtering facepieces of higher efficiency) was an effective measure in pre-venting secondary cases compared to no PPE use by both the case and the exposed (IRR = 0.08; 95% CI: 0.03-0.2; p = < 0.0001) as shown in Table 2. However, the use of PPE only by close contact (but not by the index case) was not different compared to no-masking in reducing the odds of new cases of infection (IRR = 0.2; 95% CI 0.03-1.7; p = 0.15).

Considering the HCWs employed at IRCCS Ospedale Policlinico San Martino, contact tracing activities found that the most represented route of exposure was direct assistance to contagious patients, followed by exposures that occurred in the community and contacts with infected colleagues (45.4%, 15.5%, and 4.1% respectively) (Supplementary Table 2). More than one-third of HCWs (34/97 COVID-19 cases) reported an unknown route and source of exposure, demonstrating an important gap in the information required for contact tracing to disrupt the transmission chain of SARS-CoV-2. The overall infection prevalence among HCWs was observed to be 11.3%. No differences were found between HCWs employed in COVID-19 and non-COVID-19 wards, with infection prevalence of 13.0% and 10.5%, respectively (Supplementary Table 2). However, resident doctors working in a COVID-19 designated ward showed an increase in SAR, although with borderline statistical significance (OR = 1.15; 95% CI: 1.0 -2.3; p = 0.0514), compared to residents employed in non-COVID-19 wards.

Table 2. Relevant Incidence Rate Ratio (IRR) / Secondary Attack Rate (SARs) - univariate and multivariate analysis concerning variables investigated as potential determinants of SARS-CoV-2 transmission.

Variable	Index cases (n=53)	Close contact (n=346)	Secondary cases (n=34)	SARs	Mean n. cases for patient (SD)	*univariate analysis*		*multivariate analysis*	
						IRR (95% CI)	p	IRR (95% CI)	p
Clinical characteristics of COVID-19 index cases									
Cough									
no	38	191	8	4.2%	0.21 (0.70)	*ref.*	-	ref.	-
yes	15	155	26	16.8%	1.73 (3.36)	8.2 (3.7-18.2)	<0.001	6.94 (3.13-15.38)	<0.001
Fever									
no	30	177	11	6.2%	0.37 (1.33)	*ref.*	-		
yes	23	169	23	13.6%	1 (2.58)	2.7 (1.3-5.6)	0.006		
Fatigue									
no	33	158	3	1.9%	0.09 (0.29)	*ref.*	-		
yes	20	188	31	16.5%	1.55 (3.02)	17.1 (5.2-55.8)	<0.001		
Gastroenteric symptoms									
no	51	328	27	8.2%	0.52 (1.79)	*ref.*	-		
yes	2	18	7	38.9%	3.5 (4.9)	6.6 (2.9-15.2)	<0.001		
Concurrent symptom presentation among COVID-19 index case									
Single symptom at exposure	10	49	1	2%	0.1 (0.3)	*ref.*	-		
≥ 3 symptoms at exposure	13	125	30	24%	2.31 (3.54)	23.1 (3.1-169.2)	0.002		
Setting of exposure									
Office	13	53	1	1.9%	0.08 (0.28)	*ref.*	-		
Classroom	5	91	2	2.2%	0.4 (0.89)	5.2 (0.5-57.3)	0.18		
Laboratory	5	34	1	2.9%	0.2 (0.45)	2.6 (0.2-41.6)	0.50		
Healthcare setting	18	70	4	5.7%	0.22 (0.43)	2.9 (0.3-25.8)	0.34		
Sharing eating areas	6	47	9	19.1%	1.5 (2.8)	19.5 (2.5-153.9)	0.005		
Household	6	51	17	33.3%	2.8 (4.8)	36.8 (4.9-276.8)	<0.001		
Adoption of PPE									
No PPE adopted	12	98	26	27%	2.2 (3.8)	*ref.*	-	*ref.*	-
PPE by close contact, not by case	2	8	1	13%	0.5 (0.7)	0.2 (0.03-1.7)	0.15	0.17 (0.02-1.28)	0.086
PPE adopted by either close contact or case	39	240	7	3%	0.18 (0.45)	0.08 (0.03-0.2)	<0.001	0.098 (0.04-0.23)	<0.001

Discussion

To our knowledge, this is the first study conducted in occupational settings concerning the odds of transmission of SARS-CoV-2 and the potential predictors among co-workers. The results obtained may contribute to consolidating the evidence on this issue and providing helpful information to occupational health professionals to guide their decisions. COVID-19 pandemic has been challenging both for the public health and the occupational context (12). In particular, many work settings have undergone restrictions or forced to diversify the work processes overcrowding. Indeed, the results showed that the implementation of preventive measures in the University setting limited the spread of the disease, with no increased risk of transmission in workers attending COVID-19 patients and with most infective exposures occurring outside of the workplace or during lunch breaks. This highlights the importance of the adherence of all individuals to collective and institutional measures, not only at work but also at home, with evident contributions to the occupational setting in terms of risk reduction.

In this regard, occupational physicians played a crucial role in promptly identifying close contacts and mandating quarantine to prevent workplace clusters while ensuring that essential workers who were required to work on-site continued to perform their tasks.

This aspect was particularly critical for the healthcare sector: balancing the necessities to provide workforce in clinical care with the risk of introducing workers into the wards who are potentially infectious requires accurate risk assessment in the face of the emergency context.

Based on our analyses, several key aspects should be taken into consideration when performing a risk assessment. One of the items to consider concerns the clinical picture of COVID-19 index cases. Symptoms such as cough and fatigue were more frequently linked to secondary infection. Polysymptomatic clinical patterns were observed to be an important risk factor for SARS-CoV-2 transmission (13).

In contrast with the evidence available from the literature (14), a finding pertains to the absence of secondary transmission of COVID-19 in our population, both among pre-symptomatic cases and asymptomatic contacts. This can be partly explained by the exposure in these events occurring in lower-risk settings (e.g., offices) and by the adoption of respiratory PPE by both cases and close contacts.

In our experience, the early identification of symptomatic individuals and their removal from workplaces represents another pillar of the administrative controls for COVID-19 IPC measures. If workers with symptoms quickly undergo testing and contact tracing, outbreaks can be contained effectively.

Another aspect that requires assessment is the source and point in which exposure occurs between index case and contact. Our data underline the high risk of infection for household contacts (15) and colleagues sharing a meal (16), thus suggesting that quarantine should be encouraged for this type of exposure, even for HCWs assigned to urgent and non-deferrable clinical care activities. On the other hand, specific settings are found to be at lower risk of transmission, even considering the feasibility of implementing IPC measures. Our study offices and classrooms (17, 18) showed low SARs, 1.9% and 2.2%, respectively, perhaps because of the possibility of maintaining social distancing, the mandatory use of surgical masks and other IPC measures in these settings (19).

Another relevant aspect (20) concerns the assessment of PPE adoption. In our study, the rigorous adherence to the use of PPE allowed us to observe very low SARs (3%) compared to the settings where the recommendation regarding their use was not applied (SARs = 27%) (21). However, this study is limited in some respects, mainly the possible introduction of non-response, recall, and self-report bias; moreover, a multivariate analysis was not performed due to the limited sample size and the possible inclusion of confounders. Further research is needed to overcome the generalizability of our results.

Conclusion

The correct management of index cases and avoiding secondary cases of SARS-CoV-2 infection among co-workers can help to reach the goal of maintaining open, safe and healthy workplaces and, in turn, protecting livelihoods, wellbeing and public health as claimed by WHO (22). In this scenario, the occupational physician acquired an important role as a key player during the pandemic. Investigating the determinants of secondary transmission allows improving risk assessment to adopt appropriate preventive measures to disrupt the chain of transmission. The present study's findings may be helpful as we approach a post-pandemic era in which the return to work must be guaranteed by applying tailored IPC in settings at greater risk of SARS-CoV-2 spreading.

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

References

1. European Agency for Safety and Health at Work (EU-OSHA), Healthy Workplaces Stop the Pandemic available at: https://osha.europa.eu/en/themes/covid-19-resources-workplace , (accessed on 02 October 2021).

2. World Health Organization (WHO) – Preventing and mitigating COVID-19 at work -19, May 2021 available at: https://apps.who.int/iris/rest/bitstreams/1347444/retrieve (accessed on 24 September 2021).
3. ECDC – COVID-19 clusters and outbreaks in occupational settings in the EU/EEA and the UK – 11th August 2020. Available at: https://www.ecdc.europa.eu/sites/default/files/documents/COVID-19-in-occupational-settings.pdf (accessed on 24 September 2021).
4. Istituto nazionale Assicurazione Infortuni sul Lavoro (INAIL). Scheda nazionale infortuni sul lavoro da COVID-19, dati delle denunce al 30 giugno 2021. NR. 18 – giugno. – 23 luglio 2021 Available at: https://www.inail.it/cs/internet/docs/alg-scheda-tecnica-contagi-covid-30-giugno-2021.pdf (accessed on 10 October 2021).
5. Bazant MZ, Bush JWM. A guideline to limit indoor airborne transmission of COVID-19. Proceedings of the National Academy of Sciences Apr 2021, 118 (17) e2018995118; DOI: 10.1073/pnas.2018995118.
6. World Health Organization (WHO) - Rational use of personal protective equipment (PPE) Interim guidance 19 March 2020. https://apps.who.int/iris/handle/10665/331498 (accessed on 10 October 2021).
7. World Health Organization (WHO) - An update on COVID-19 prevention at the workplace. The latest on the covid-19 global situation & how to prevent and mitigate covid-19 at work – 28 July 2021. https://www.who.int/publications/i/item/WHO-2019-nCoV-workplace-actions-policy-brief-2021-1 (accessed on 10 October 2021).
8. Von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. Lancet. 2007;370(9596):1453–7, https://doi.org/10.1016/S0140-6736(07) 61602-X.
9. Istituto Superiore di Sanità. COVID-19 integrated surveillance: key national data. Available at https://www.epicentro.iss.it/en/coronavirus/sars-cov-2-integrated-surveillance-data (accessed on 28 September 2021).
10. National Institutes of Health. COVID-19 Treatment Guidelines Panel. Coronavirus Disease 2019 (COVID-19) Treatment Guidelines. Available at https://www.covid19treatmentguidelines.nih.gov/ Accessed (accessed on 9 October 2021).
11. Last JM. A Dictionary of Epidemiology: Oxford; 2000.
12. Mutti A. Occupational Medicine in the time of COVID-19. Med Lav 2020;111(2):83-86.
13. Marcus JE, Frankel DN, Pawlak MT, et al. Risk Factors Associated With COVID-19 Transmission Among US Air Force Trainees in a Congregant Setting. JAMA Netw Open. 2021; 4(2):e210202. Published 2021 Feb 1. doi:10.1001/jamanetworkopen.2021.0202.
14. Qiu X, Nergiz AI, Maraolo AE, Bogoch II, Low N, Cevik M. The role of asymptomatic and pre-symptomatic infection in SARS-CoV-2 transmission-a living systematic review. Clin Microbiol Infect. 2021;27(4):511-519. doi:10.1016/j.cmi.2021.01.011.
15. Madewell ZJ, Yang Y, Longini I M Jr, Halloran M E, Dean N E. (2021). Factors Associated With Household Transmission of SARS-CoV-2: An Updated Systematic Review and Meta-analysis. JAMA network open, 4(8), e2122240. https://doi.org/10.1001/jamanetworkopen.2021.22240.
16. Ng OT, Marimuthu K, Koh V, et al. SARS-CoV-2 seroprevalence and transmission risk factors among high-risk close contacts: a retrospective cohort study. Lancet Infect Dis. 2021;21(3):333-343. doi:10.1016/S1473-3099(20)30833-1.
17. European Centre for Disease Prevention and Control. COVID-19 in children and the role of school settings in transmission - first update. Stockholm: ECDC; 2020. Available at: https://www.ecdc.europa.eu/en/publications-data/children-and-school-settings-covid-19-transmission (accessed on 13 September 2021).
18. WHO Regional Office for Europe. The fourth meeting of the Technical Advisory Group on Safe Schooling During the COVID-19 Pandemic. Copenhagen, Denmark 9th March 2021. Copenhagen: WHO Regional Office for Europe; 2021. Available at: https://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-covid-19/publications-and-technical-guidance/risk-communication-and-community-engagement/fourth-meeting-of-the-technical-advisory-group-on-safe-schooling-during-the-covid-19-pandemic-copenhagen,-denmark-9-march-2021-produced-by-whoeurope (accessed on 12 September 2021).
19. Sami S, Vuong N, Miller H, et al. (2021). SARS-CoV-2 Infection and Mitigation Efforts among Office Workers, Washington, DC, USA. Emerging Infectious Diseases. https://dx.doi.org/10.3201/eid2702.204529, Available at: https://wwwnc.cdc.gov/eid/article/27/2/20-4529_article (accessed on 6 September 2021).
20. Centers for Disease Control and Prevention media briefing, 13th May, 2021.
21. Boffetta, P, Violante, F, Durando, P, et al. Infection in Italian Healthcare Workers (2021). Determinants of SARS-CoV-2 infection in Italian healthcare workers: a multicenter study. Scientific reports, 11(1), 5788. https://doi.org/10.1038/s41598-021-85215-4.
22. World Health Organization (WHO) COVID-19 and work: Staying healthy and safe at work during the COVID-19 pandemic. Available at: https://openwho.org/courses/COVID-19-and-work?locale=ru (accessed on 20 September 2021).