

# COVID-19 outbreak in healthcare workers in hospitals in Trieste, North-east Italy

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Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), first reported in Wuhan, China, in December 2019, has rapidly become an increasing health concern worldwide [1]. During a pandemic, healthcare workers (HCWs) are at the frontline [2]; they are at high risk of infection providing care for patients [3]; and they are subjected to long working hours, psychological distress and fatigue. In Trieste, a north-eastern Italian province with 234,493 inhabitants, 903 of 4216 HCWs in public hospitals reported contact with patients with COVID-19 between 1<sup>st</sup> March and 6<sup>th</sup> April 2020, and were followed-up to verify symptom onset. Their characteristics are reported in Table 1. Contacts were interviewed daily to verify their health status, had to monitor and report their body temperature twice daily, and were tested using reverse transcriptase polymerase chain reaction (RT-PCR) virus detection in nasopharyngeal and oropharyngeal swabs every 3 days after close contact and after 13 days for causal contact. In the case of symptom onset, HCWs were tested immediately, stopped working, and remained at home with active daily monitoring by telephone.

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Nasopharyngeal and oropharyngeal swabs were tested by real-time RT-PCR targeting the E, N and RdRp genes of SARS-CoV-2 according to the US Centers for Disease Control and Prevention and Charité laboratory protocols [4]. The cycle threshold values of real-time RT-PCR were used as qualitative indicators of the viral load of SARS-CoV-2 RNA in specimens, with lower cycle threshold values corresponding to higher viral copy numbers. A cycle threshold value below 40 was interpreted as positive for SARS-CoV-2 RNA. Data analysis was performed using STATA Version 14.0 (Stata Corp., LP, College Station, TX, USA).  $P < 0.05$  was considered to indicate significance.

The vast majority of HCWs infected with COVID-19 were employed in medical wards, with a significantly higher prevalence in Geriatric and Infectious Diseases (42.6%) [odds ratio (OR) 67.9, 95% confidence interval (CI) 34.7–133] and Internal Medicine I and II (29.6%) (OR 9.6, 95% CI 5.6–16.5). Regarding exposure history, most affected subjects had had contact with an infected patient (51.3%), 27 reported that they had only been exposed to colleagues (23.5%), and 29 reported that they had been exposed to both patients and colleagues (25.2%), with the latter case showing a significant difference compared with negative contacts (OR 7.0, 95% CI 3.7–13.3). Most cases reported using personal protective equipment (PPE) during working hours (71.3%). However, following checks, it was found that the use of PPE was not appropriate during HCW meetings, thus contributing to the spread of COVID-19 among colleagues.

The spread of COVID-19 in different wards and the time trend analysis of contact and case onset showed four major cluster outbreaks. The first cluster of contacts occurred on 6<sup>th</sup> March 2020 in Geriatrics where an index patient without respiratory symptoms (one of the first cases documented in Trieste) was admitted: 72% of HCWs in the division were infected. Another two clusters of exposure occurred on 10<sup>th</sup> and 11<sup>th</sup> March 2020 in Internal Medicine I and II due to the hospitalization of two patients not initially suspected to be

**Table I**  
Main characteristics of the study population (N=903)

	COVID-19 positive	COVID-19 negative	OR (95% CI)
N (%)	115 (12.7)	788 (87.3)	
Male, N (%)	42 (36.5)	222 (28.2)	1.5 (0.98–2.2)
Age, mean±SD, years	43.5±11.1	45.7±15.7	
Job title, N (%)			
Physician	32 (27.8)	220 (27.9)	1
Nurse	44 (38.3)	345 (43.8)	0.9 (0.5–1.4)
Nurse aid	19 (16.5)	90 (11.4)	1.4 (0.7–2.6)
Resident	10 (8.7)	62 (7.9)	1.3 (0.5–2.7)
Others	10 (8.7)	72 (9.1)	0.9 (0.4–2.0)
Departments, N (%)			
High risk:			
Geriatric and Infectious Diseases	49 (42.6)	16 (2.0)	<b>67.9 (34.7–133)</b>
Medium risk:			
Internal Medicine I and II	34 (29.6)	78 (9.9)	<b>9.6 (5.6–16.5)</b>
Low risk:			
First aid, dialysis unit, surgical wards, other medical departments, radiology, rehabilitation, others	32 (27.8)	694 (88.1)	1
Contact with patients, N (%)	59 (51.3)	287 (36.4)	1
Contact with colleagues, N (%)	27 (23.5)	144 (18.3)	0.9 (0.54–1.5)
Contact with both, N (%)	29 (25.2)	20 (2.5)	<b>7.0 (3.7–13.3)</b>
Contact of contact, N (%)	0	337 (42.8)	
Use of personal protective equipment, N (%)			
Surgical mask	82 (71.3)	99/144 (68.7) <sup>a</sup>	1.6 (0.9–2.9)
FFP2–3 mask	50 (61.0)	91 (91.9)	1
FFP2–3 mask	32 (39.0)	8 (8.1)	<b>7.1 (3.0–16.7)</b>
Patients wearing mask, N (%)	52 (45.2)	14/144 (9.7) <sup>a</sup>	<b>7.1 (3.6–13.9)</b>
Asymptomatic, N (%)	13 (11.3)	724 (91.9)	
Symptoms, N (%)			
Upper respiratory tract symptoms	102 (88.7)	64 (8.1)	0.43 (0.14–1.22)
Cough	89 (87.2)	60 (93.7)	0.43 (0.15–1.2)
Loss of smell and taste	40 (39.2)	35 (54.7)	0.53 (0.28–1.0)
Lower respiratory tract symptoms	39 (38.2)	6 (9.4)	<b>5.9 (2.3–15.0)</b>
Fever >37.5°C	13 (12.7)	1 (1.6)	7.9 (1.0–62.7)
Diarrhoea	49 (48.0)	19 (29.7)	<b>30.1 (16.7–54.2)</b>
Start of symptoms after contact, mean±SD, days	5.6±4.7	5.3±3.8	

COVID-19, coronavirus disease 2019; OR, odds ratio; CI, confidence interval; SD, standard deviation.

Factors associated with COVID-19 positivity were investigated using multi-variate logistic regression adjusted for sex and reported as OR and 95% CI. Significant values are shown in bold.

<sup>a</sup> Data are only available for 144 COVID-19 negative workers.

COVID-19 positive (26% and 39% of HCWs were infected). The fourth cluster was in Infectious Diseases and began with a HCW who had acquired the infection in the community and infected 87% of colleagues. In the remaining hospital departments, the spread of COVID-19 was much more contained, with some sporadic cases in other medical wards and no cases in surgical wards.

In the study period, infected HCWs accounted for 16.2% of all cases of COVID-19 in the province of Trieste [5]. This percentage is higher than that reported in China (3.8%) [6] and similar to that observed in the USA (4.4–20% of all reported cases) [7]. The infection spread mainly in the first 12 days of March 2020 from contact with index patients admitted without respiratory symptoms. Pre-symptomatic transmission as well as atypical presentation have been known to lead to insidious spread of COVID-19 [8]. Hence, lack of recognition of the infection in addition to lack of adequate risk awareness and protection among HCWs resulted in a significant number of

infected subjects in the early nosocomial COVID-19 outbreaks. In particular, based on investigations, the improper use of PPE during HCW meetings was crucial in the early stages for all four major in-hospital COVID-19 clusters. Therefore, despite occupational health and safety procedures implemented to limit nosocomial spread of the infection, an inaccurate risk perception played a leading role in amplification of the early COVID-19 outbreak among HCWs in Trieste.

A strong hospital surveillance system and constantly updated education of HCWs about how the infection spreads and how they can protect themselves are crucial to stopping the transmission chains of infection.

#### Conflict of interest statement

None declared.

#### Funding sources

None.

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