Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.
Short Report

SARS-CoV-2 infection: advocacy for training and social distancing in healthcare settings

A. Gagneux-Bruno, C. Pelissier, J. Gagnaire, S. Pillet, B. Pozzetto, E. Botelho-Nevers, P. Berthelot

ARTICLE INFO

Article history:
Received 18 June 2020
Accepted 3 August 2020
Available online 8 August 2020

Keywords:
COVID-19
Healthcare worker
Social distance
Prevention
Training

SUMMARY

This article reports the observed rate of infection with severe acute respiratory syndrome coronavirus-2 in healthcare workers (HCWs) who worked on wards dedicated to care of patients with coronavirus disease 2019 (COVID-19) compared with HCWs who worked on non-COVID-19 wards. The infection rate was significantly higher among HCWs who worked on non-COVID-19 wards (odds ratio 2.3, \( P = 0.005 \)), illustrating the need to strengthen social distancing measures and training.

© 2020 The Healthcare Infection Society. Published by Elsevier Ltd. All rights reserved.

Healthcare workers (HCWs) are on the front line during the current coronavirus disease 2019 (COVID-19) pandemic, and account for a great number of infected people. In France, up to 9th June 2020, there were 154,188 confirmed cases of severe acute respiratory virus coronavirus-2 (SARS-CoV-2) infection, including 30,258 HCWs (28% were nurses) [1]. Recently, in the UK, Hunter et al. observed no difference in the rate of SARS-CoV-2 infection in HCWs facing COVID-19 patients directly compared with non-patient-facing HCWs and non-clinical staff [2], suggesting that patients are not the primary source of infection in HCWs. The authors’ experience at the University Hospital of Saint-Etienne, France supports this finding.

At the study hospital, from 24th March 2020, the systematic wearing of surgical masks was recommended to HCWs in all wards, and N95 respirators were also recommended systematically for all patient care in wards treating patients with COVID-19. The hospital was re-organized with the delineation of three types of ward: COVID-19 wards (type 1) harbouring
dedicated HCWs; mixed wards with COVID-19 sectors (type 2) 
harbouring, according to ward, dedicated or shared HCWs; and 
COVID-19-free sectors (type 3). A 1-h on-site training session 
was offered to 2200 HCWs regarding proper wear, removal 
and disposal of personal protective equipment (PPE). Screening 
for SARS-CoV-2 infection was strongly recommended for all HCWs 
exhibiting symptoms of COVID-19, even if mild. 

Between 25th March 2020 and 28th April 2020, 514 HCWs 
were screened, and 64 (13%) had a positive result on SARS-CoV-
2 reverse transcriptase polymerase chain reaction (RT-PCR) 
from a nasopharyngeal swab. Of these 64 HCWs, 55 were in 
direct contact with patients and nine were not in direct contact 
with patients. Among the 1000 HCWs caring for patients during 
this period, 5.5% (95% confidence interval 4.0–6.9) became 
infected with SARS-CoV-2. The results regarding comparison 
between the three types of wards are shown in Table I. Using 
Chi-squared test for trend, the observed rate of infected HCWs 
was significantly higher among HCWs who worked on type 3 
wards compared with HCWs who worked on type 1 or type 2 
wards. The density incidence for 1000 HCW-days was 1.1, 1.0 
and 2.5 in type 1, 2 and 3 wards, respectively. To rule out an 
impact of work load on the incidence of SARS-CoV-2 infection, a 
density incidence reported to 1000 patient-days was calculated; this incidence was 2.1 for type 1 wards and 2.5 for type 3 
wards. It was not possible to calculate the density incidence for 
type 2 wards as data were not available from the emergency 
department, which included a ward for short-term 
hospitalizations. 

The observed rate of infected HCWs at the study hospital 
was lower than that observed in other hospitals with broad 
recommendations for SARS-CoV-2 testing of HCWs. Keeley 
et al. reported a proportion of symptomatic HCWs with a posi-
tive SARS-CoV-2 RT-PCR of 18% [3]. Although the study hospital 
was located in one of the regions in France that was most 
heavily impacted by COVID-19 during the study period, the 
number of infected HCWs remained low. The systematic 
wearing of surgical masks on all wards, and the use of N95 
respirators for all care of patients with COVID-19 may have 
contributed to significantly reduce the incidence of SARS-CoV-2 
infection in HCWs at the study institution. 

An increased risk of infection was noted in HCWs from non-
COVID-19 wards. This observation confirmed that patient-to-
HCW transmission is not the primary cause of SARS-CoV-2 
infected in HCWs, as reported by Hunter et al. [2]. In 
another study, Wee et al. investigated 14 cases of SARS-CoV-2 
infection in HCWs; they excluded patient-to-HCW trans-
mision and identified the community as the primary source of 
HCW infection [4]. A third study showed that HCWs working on 
high-risk wards were more likely to be infected with SARS-CoV-
2 than HCWs working on general wards; however, contact with 
diagnosed or suspected patients was not associated with 
increased risk, and contact with an infected family member 
was highly associated with HCW infection [5]. In addition, 
Maltezou et al. observed that administrative personnel were 
more likely to get infected in hospital than front-line workers, 
suggesting that administrative staff were less trained in the use 
of PPE [6]. Lockdown commenced in France on 17th March 2020. 
As community transmission was decreasing during the study 
period in France, it is hypothesized that HCW-to-HCW trans-
mision may explain, at least in part, HCW infection at the 
study institution. It is thought that HCWs working on a ward 
COVID-19 wards self-perceived that they were at higher risk for 
SARS-CoV-2 infection, so more attention was paid to social 
distancing from colleagues on these wards compared with the 
non-COVID-19 wards. During the study period, quotas of PPE 
were allocated to each HCW, which resulted in no shortage of 
masks. The hospital chose to systematize the use of N95 respir-
ators in units where HCWs cared for patients with COVID-19, 
despite the fact that the recommended complementary 
hygienic precautions are still subject to debate: contact and 
droplet precautions (World Health Organization guidelines 
[7] and French guidelines [8]), or contact and airborne precautions 
(U.S. Centers for Disease Prevention and Control guidelines) [9]. 
However, this particular measure is not considered to 
completely explain the observed differences in COVID-19 rates in 
HCWs. It can also be hypothesized that HCW training in infec-
tion control measures was more intensive in units caring for 
patients infected with SARS-CoV-2 compared with other wards. 
Of note, in the study hospital, use of hydro-alcoholic handrub 
products increased from 8395 L between 1st January 2019 and 
31st May 2019 to 16,164 L between 1st January 2020 and 31st May 
2020. 

These observations suggest that training and implementa-
tion of proper precautions for infection control reduce the risk 
of nosocomial transmission on COVID-19 wards, and that social 
distancing between HCWs is crucial to reduce the spread of 
SARS-CoV-2 infection in healthcare settings. This study suffers 
from some limitations. First, no personal data were collected, 
and the populations of HCWs may have differed between 
COVID-19 wards and non-COVID-19 wards. Second, due to the 
high proportion of asymptomatic carriers, the rate of infected 
HCWs may be underestimated [10]. Third, with the exception 
of suspected nosocomial outbreaks (three patients or HCWs 
infectected in 1 week in the same unit), HCWs were not system-
atically tested if they were in contact with an infected col-
league; such a strategy may be useful to identify clusters due to 
HCW-to-HCW transmission. Fourth, the possibility that HCWs 
on non-COVID-19 wards may have been in contact with patients 
with undiagnosed COVID-19 cannot be excluded. However, 
during the pandemic phase, at the study institution, a large 
proportion of patients were sampled and patients were 
admilted to COVID-19 wards or mixed wards while awaiting the 
results of RT-PCR tests and/or thoracic computed tomography 
scans. 

Table I 

| Type of Ward          | Infected no./total no. of HCWs (%) | 95% CI   | Odds ratio for SARS-CoV-2 infection (95% CI) | P-value |
|-----------------------|-----------------------------------|---------|------------------------------------------|---------|
| COVID-19 wards (type 1) | 11/315 (3.5)                    | 1.4–5.4 | 1                                        | 0.005   |
| Mixed COVID-19 wards (type 2) | 7/209 (3.3)                  | 0.9–5.7 | 1 (0.4–2.5)                              |         |
| Non-COVID-19 wards (type 3)  | 37/476 (7.8)                   | 5.4–10.2| 2.3 (1.2–4.6)                           |         |

COVID-19, coronavirus disease 2019; CI, confidence interval.
In conclusion, this study showed that care of patients with COVID-19 was not a risk factor for SARS-CoV-2 infection in HCWs. PPE protects HCWs effectively from SARS-CoV-2 infection. HCWs who are not directly taking care of patients with COVID-19 should also be considered, and should self-consider themselves to be at risk for SARS-CoV-2 infection. The strengthening of social distancing measures is crucial in healthcare settings, and training should not be restricted to HCWs involved in direct care of infected patients.

Acknowledgements

The authors wish to thank the head nurse and hospital management of the University Hospital of Saint-Etienne for the collection of administrative data. In addition, the authors wish to thank the infection control team for on-site training of HCWs caring for patients with COVID-19.

Conflict of interest statement
None declared.

Funding sources
None.

References

[1] Santé Publique France. Recensement national des cas de COVID-19 chez les professionnels en établissements de santé. Available at: https://www.santepubliquefrance.fr/etudes-et-enquetes/recensement-national-des-cas-de-covid-19-chez-les-professionnels-en-etablissements-de-sante [last accessed June 2020].

[2] Hunter E, Price DA, Murphy E, van der Loeff IS, Baker KF, Lendrem D, et al. First experience of COVID-19 screening of health-care workers in England. Lancet 2020;395:e77–8.

[3] Keeley AJ, Evans C, Colton H, Ankorn M, Cope A, State A, et al. Roll-out of SARS-CoV-2 testing for healthcare workers at a large NHS foundation trust in the United Kingdom, March 2020. Euro-surveillance 2020;25:2000433.

[4] Wee LE, Sim JXY, Conceicao EP, Aung MK, Goh JQ, Yeo DWT, et al. Containment of COVID-19 cases amongst healthcare workers: the role of surveillance, early detection and outbreak management. Infect Control Hosp Epidemiol 2020. https://doi.org/10.1017/ice.2020.219.

[5] Ran L, Chen X, Wang Y, Wu W, Zhang L, Tan X. Risk factors of healthcare workers with coronavirus disease 2019: a retrospective cohort study in a designated hospital of Wuhan in China. Clin Infect Dis Off Publ Infect Dis Soc Am 2020. https://doi.org/10.1093/cid/ciaa287.

[6] Maltezou HC, Dedoukou X, Tseroni M, Tsonou E, Raftopoulos V, Papadima K, et al. SARS-CoV-2 infection in healthcare personnel with high-risk occupational exposure: evaluation of seven-day exclusion from work policy. Clin Infect Dis Off Publ Infect Dis Soc Am 2020. https://doi.org/10.1093/cid/ciaa888.

[7] World Health Organization. Coronavirus disease (COVID-19) technical guidance: infection prevention and control. Geneva:WHO 2020. Available at: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/infection-prevention-and-control [last accessed June 2020].

[8] Lepelletier D, Grandbastien B, Romano-Bertrand S, Aho S, Chidiac C, Géhanna J-F, et al. What face mask for what use in the context of COVID-19 pandemic? The French guidelines. J Hosp Infect 2020. https://doi.org/10.1016/j.jhin.2020.04.036.

[9] Centers for Disease Control and Prevention. Infection control guidance for healthcare professionals about coronavirus (COVID-19). Cent Dis Control Prev 2020. Available at: https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control.html [last accessed June 2020].

[10] Mizumoto K, Kagaya K, Zarebski A, Chowell G. Estimating the asymptomatic proportion of coronavirus disease 2019 (COVID-19) cases on board the Diamond Princess cruise ship, Yokohama, Japan, 2020. Eurosurveillance 2020;25:2000180.