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Brief Report

Risk of SARS-CoV-2 transmission from universally masked healthcare workers to patients or residents: A prospective cohort study

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A B S T R A C T

In a multifacility prospective cohort study, we identified 116 acute care, 26 long-term care, and 67 rehabilitation patients who received direct care from a universally masked healthcare worker while communicable with COVID-19. Among 133(64%) patients with at least 14-day follow-up, 3 (2.3%, 95% CI, 0.77-6.4) became positive for SARS-CoV-2. Universal masking, embedded with other infection control practices, is associated with low risk of transmission of SARS-CoV-2 from healthcare workers to patients and residents.

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INTRODUCTION

SARS-CoV-2 transmission occurs mainly through close contact, and frequently in the absence or prior to the onset of symptoms.¹ Universal masking has been widely adopted across healthcare not only to provide protection but as a means of providing source control for those who may unknowingly be communicable to others.

While much attention has been paid to the safety of personal protective equipment for healthcare workers (HCWs), few studies have assessed the risk of SARS-CoV-2 transmission from HCWs to patients, in the presence of universal masking. One case report described SARS-CoV-2 transmission from a pre-symptomatic masked nurse to an unmasked patient but the frequency of this occurrence is unknown.² A prior systematic review assessed the impact of masking on SARS-CoV-2 transmission but did not specifically assess HCW to patient transmission in healthcare settings.³

We performed a prospective cohort study of patients and residents who received direct care from a HCW with laboratory-confirmed COVID-19, to determine the risk of transmission in the presence of universal masking.

METHODS

Our multi-facility academic health center includes an acute care hospital, long-term care home and rehabilitation and/or complex care hospitals. All HCWs are required to self-screen daily for symptoms and were required to undergo testing for SARS-CoV-2 if they had unprotected close contact with anyone with COVID-19 (day 5 and 10 from exposure), travelled outside of Canada, or if they developed any symptoms whether minimal or atypical. Each HCW SARS-CoV-2 positive interviewed to confirm role, work schedule, symptom onset, testing results, vaccination status, and compliance with infection prevention and control (IPAC) precautions.

Between 1 October 2020 and 30 April 2021, any patient-facing HCW with laboratory-confirmed COVID-19 who worked during the period of communicability (POC) triggered a review of patient or resident assignment. All patients or residents who received direct care were not placed in precautions, but underwent prospective symptom surveillance for 14 days, including day 5 and 10 testing if they remained asymptomatic.⁴ Among those discharged prior to the end of the 14-day follow-up period, testing was repeated for any readmission within 30-days. Patients and residents were excluded if there was another potential source of exposure identified such as a positive roommate or an outbreak on the unit at the time of the exposure. The primary outcome was the incidence of SARS-CoV-2 infection among patients and residents with at least 14 days of follow-up from the exposure to the masked HCW with COVID-19.

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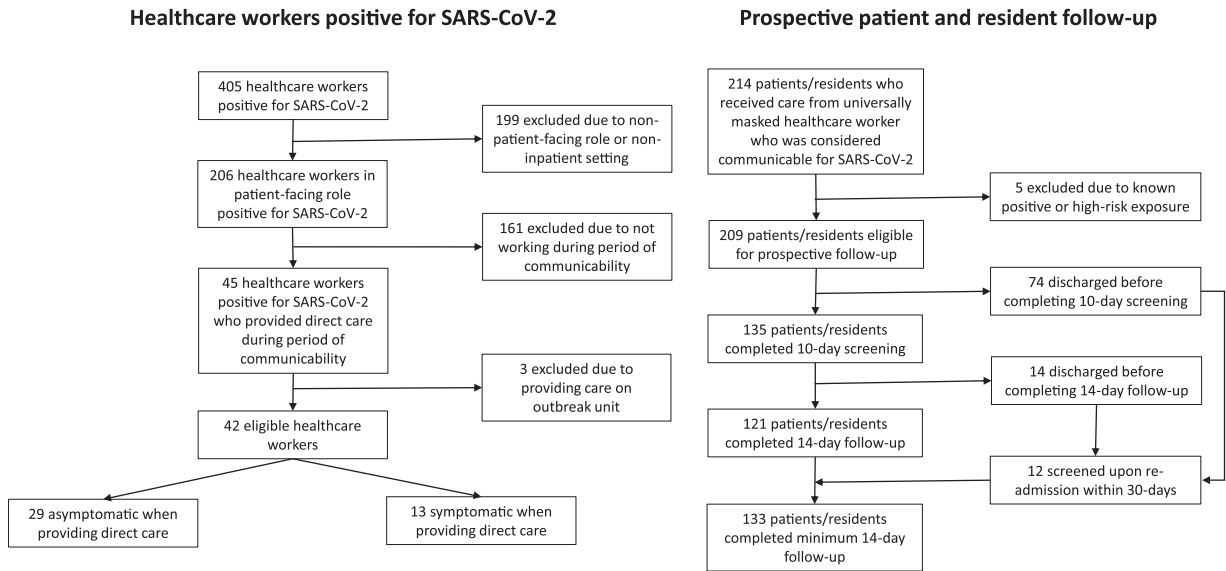


Fig 1. Identification of universally masked healthcare workers (HCW) who tested positive for SARS-CoV-2 and were considered infectious while providing direct care, and subsequent prospective follow-up of patients or residents.

The period of communicability was defined as 48 hours prior to the onset of symptoms (pre-symptomatic) up to and including 10 days after onset of symptoms (symptomatic) to reflect the limit for recovery of replication-competent virus.⁵ If the HCW did not report any symptoms, the period of communicability was defined as 48 hours prior and up to and including 10 days after the testing date. The incidence of SARS-CoV-2 infection in patients and residents was compared between those exposed to HCWs who worked while symptomatic versus those who did not using the χ^2 test. Research ethics review was not required because the study met criteria for exemption as the project was deemed improvement in quality and not human subject research.

RESULTS

During the study period, 42 HCWs worked during the period of SARS-CoV-2 communicability, including 29(69%) asymptomatic and 13(31%) symptomatic, resulting in 214 eligible protected patient and resident exposures (Fig 1). Among these, 194(91%) occurred within

48 hours prior to 72 hours after the onset of symptoms and/or positive test. Table 1 summarizes further characteristics of these HCWs who remained mostly unvaccinated when the study was performed. Prospective follow-up occurred among 116(56%) patients in acute care, 26(12%) residents in long-term care, and 67(32%) patients in rehabilitation or complex continuing care. Among the 133(64%) patients or residents who completed at least 14 days of follow-up, 3 (2.3%) tested positive for SARS-CoV-2 (95% CI, 0.77-6.4). In all 3 cases, no alternate source of transmission was present on the day of exposure but an outbreak was subsequently declared on the unit where the patient was located during the follow up period. There was no significant difference in the risk of transmission if the HCW was working while symptomatic or not (4.3% vs 1.2%; $P = .285$).

DISCUSSION

We prospectively identified 3 instances of transmission from HCWs to patients and residents in the context of universal masking across different healthcare settings. In each case, an alternate source

Table 1
Characteristics of healthcare workers (n = 42) who tested positive for SARS-CoV-2 and considered infectious when providing direct care to patients or residents

Characteristic	Did not work symptomatic (%) N = 29	Worked symptomatic (%) N = 13	Total (%) N = 42
Setting			
Acute care	17(59)	9(75)	26(62)
Long-term care	6(21)	1(8)	7(17)
Rehabilitation/complex care	6(21)	2(17)	9(21)
Role			
Physician	3(10)	1(8)	4(10)
Nursing	15(52)	11(85)	26(62)
Allied health	-	1(8)	1(2.4)
Other clinical*	11(38)	-	11(26)
Vaccinated	5(17)	2(15)	7(17)
Median cycle threshold value (min, max)	19.6(15.6,35.0)	21.4 (16.1,32.0)	20.5(15.6,35.0)
Mask worn			
Surgical mask exclusively	22(76)	9(69)	31(74)
Surgical mask, N95 as indicated	5(17)	2(15)	7(17)
N95 respirator exclusively	-	1(7.7)	1(2.4)
Median exposed patients/Residents per healthcare worker (min, max)	3(1-14)	4(1-49)	4(1-49)

*Other Clinical includes observers, personal support workers, activity aides, and patient transport.

of COVID-19 infection cannot be excluded given that an outbreak was declared on the unit during the follow-up period.

This experience is consistent with evidence for other respiratory seasonal viruses showing that wearing a surgical mask as source control is highly protective against transmission to patients and residents in healthcare settings. A prior randomized study of surgical masks found that detection of viral RNA in exhaled breath samples decreased from 30% to 0% in respiratory droplets and 40% to 0% in aerosols.⁶ Prior to the COVID-19 pandemic, an intervention study of universal surgical masking on a bone marrow transplant unit resulted in a significant decrease in the incidence of healthcare acquired respiratory viral infection among patients.⁷ Studies on the impact of masking on SARS-CoV-2 transmission to patients and residents is more limited. In one small study, 2 universally masked HCWs who tested positive for SARS-CoV-2 and worked while pre-symptomatic or symptomatic resulted in no transmission to the 33 exposed patients within 30 days of the exposure.⁸

Although the absolute risk appears low, transmission of SARS-CoV-2 from HCWs to patients and residents has been documented in some institutions despite wearing surgical masks.² This risk of transmission may be influenced by the quality of other IPAC practices including whether or not masks are worn securely, the grade of the mask, whether HCWs are touching or manipulating their mask, and the adherence to hand hygiene.^{9,10} Current SARS-CoV-2 vaccination efforts of HCWs remain vital to further reducing the risk of transmission to patients and residents. In situations where HCWs are unvaccinated against SARS-CoV-2, maintaining universal masking may remain an important mitigation measure.

This study is limited by the observational design and absence of a comparison group. The small sample size across 3 different healthcare settings may not necessarily have captured HCWs with highest level of infectivity. In the absence of viral sequencing, we were unable to confirm transmission between the HCW and patient and/or resident but this may have resulted in an overestimate in the risk of

transmission. Finally, the risk of HCW to patient and resident transmission may differ in other institutions based on the quality of other IPAC practices.

Our study provides evidence that universal masking, embedded with other infection control practices, is associated with low risk of transmission of SARS-CoV-2 from healthcare workers to patients and residents.

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