

Examining Common Characteristics Among Healthcare Personnel Positive for COVID-19 and the Effectiveness of Healthcare Personnel Mask Use in Preventing COVID-19 in a Large Health System in Central Michigan

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The aim of this quality improvement project was to survey commonalities among healthcare personnel (HCP) who tested positive for COVID-19 and to evaluate the effectiveness of the organizational intervention to require HCP wear masks throughout their shift. Information regarding the 40 HCP who tested positive for COVID-19 between the dates of March 18, 2020 and May 13, 2020 were included in the analysis. Nurses ($n=9$) made up the majority of HCP positive for COVID-19. The most common types of symptoms reported were cough ($n=26$), headache ($n=20$), and fever ($n=13$). Fourteen days after the requirement for HCP across the organization to wear masks throughout their shift was implemented, a 67% reduction in positive tests among HCP involved in a workplace exposure was observed.

Keywords: common symptoms, contact tracing, coronavirus 2, COVID-19, mask, prevention, quality improvement, SARS-CoV-2, symptomology, workplace exposure

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2 or COVID-19) is spread via respiratory droplets from an infected person when they cough, sneeze, or talk.¹⁻³ Individuals who are asymptomatic, presymptomatic, or symptomatic are capable of transmitting the virus to others.¹ The risk of contracting this virus increases during prolonged and unprotected contact with an individual with confirmed COVID-19 who is symptomatic.^{4,5} For healthcare personnel (HCP), this type of contact may occur within the workplace.

According to the Centers for Disease Control and Prevention, the use of masks for HCP providing care to patients with suspected or confirmed COVID-19 are essential in preventing the spread of the virus.^{2,6,7} The Centers for Disease Control and Prevention do not offer recommendations regarding mask for HCP who provide care for patients without suspected or confirmed COVID-19.⁷ According to the Infectious Disease Society of America, there are no studies that examine the effectiveness of universal masking in healthcare settings.⁸

The infection prevention and epidemiology department in Sparrow Health System, located in central Michigan, conducted an analysis for HCP who tested positive for COVID-19 since testing was implemented by the organization's employee health

department. The purpose of conducting this analysis was to determine if there were any common characteristics shared among HCP who tested positive for COVID-19 and to evaluate if the health system's initiative to prevent the spread of COVID-19 through having HCP wear masks throughout their shift influenced the number of newly COVID-19 positive HCP over time.

METHODS

Data was pulled from a cumulative list of HCP who received testing and tested positive for COVID-19 that is provided by Sparrow's employee health department to the infection prevention department twice daily. HCP included in this list were tested based on symptom identification during pre-shift screening, report of COVID-like symptoms by HCP during the call-in process, or symptom development during their shift. HCP who were involved in a workplace exposure and developed symptoms during the established 14-day self-monitoring period were also tested and included in this cumulative list. These cases were then further line listed according to HCP: age, gender, job title, department, history of potential work exposure, and date of positive test. This project was approved by Sparrow's institutional review board. It was undertaken as a quality improvement initiative and as such does not constitute human subjects research.

HCP who tested positive for COVID-19 from the first positive test which occurred March 18, 2020 to the last known positive test at the time of analysis which occurred May 6, 2020 ($n=40$) were included in the sample. Resources regarding contact tracing from the Centers for Disease Control and Prevention were reviewed and compared to Sparrow's exposure investigation and follow-up process that was being implemented at the time the analysis conducted.^{4,9} Common symptomology among infected HCP were compared to a meta-analysis completed by Li et al regarding symptomology and disposition of patients infected with COVID-19.¹⁰ Common themes and patterns in the data were then considered after the analysis was completed.

RESULTS

There were 40 out of 8084 (0.49%) HCP who tested positive for COVID-19 from March 18, 2020 to May 6, 2020 (Fig. 1). The average age of affected HCP was 39.5 years. Approximately 78% of cases occurred among female and approximately 23% among male HCP. The highest incidence (22.5%) occurred among nurses, with the second highest incidence (12.5%) occurring among emergency department HCP, which includes physicians, patient registration, and transcribers (Fig. 2). The most common symptoms reported (Fig. 3) among infected HCP were cough (65%), headache (50%), and fever (32.5%). According to the meta-analysis from authors Li et al who examined common clinical characteristic among patients infected with COVID-19, the most common symptom reported among patients were fever (88.5%), cough (68.6%), and myalgia or fatigue (35.8%).¹⁰

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Clinical Significance: Our findings regarding common characteristics among healthcare personnel who are positive for COVID-19 cultivates understanding of how this virus impacts those who serve patients in various settings. Results regarding mask use by healthcare personnel as a barrier to protect them against exposure to COVID-19 offers evaluation of this control measure.

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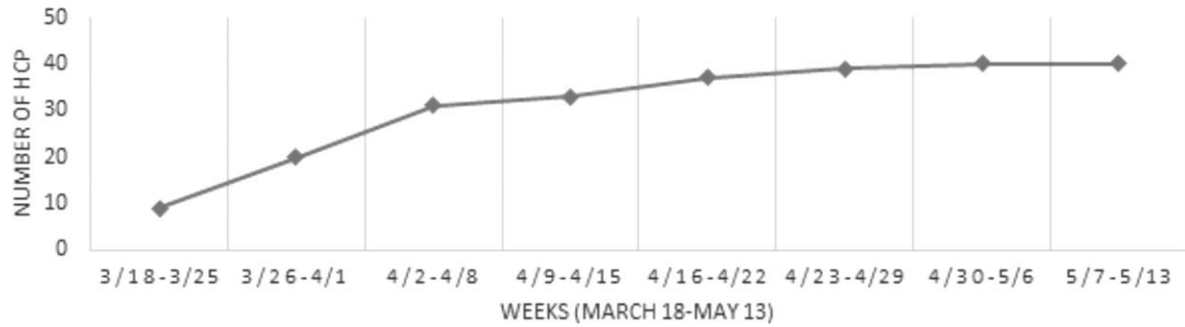


FIGURE 1. Number of COVID-19 positive HCP by week from March 18, 2020 and May 13, 2020.

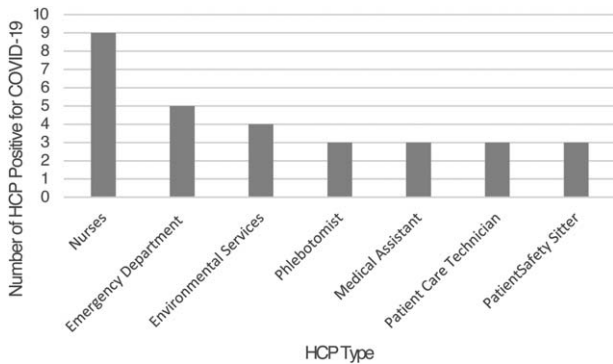


FIGURE 2. Positive HCP from March 18, 2020 and May 6, 2020 by job type.

Traced Healthcare Personnel Involved in Exposure Investigations

The CDC describes the process of contact tracing as that a process intended to support patients with suspected or confirmed COVID-19.⁹ Traditionally, public health staff connect with the patient to assist them in recalling their contacts with other persons 48 hours prior to symptom onset. The public health worker then

notifies these contacts of the potential exposure from the suspected or infected patient and provides these contacts with education on symptom monitoring and transmission prevention along with other support according to risk. Contacts are also asked about their own interactions with others, and those contacts are notified and given education and support as well. The purpose of contact tracing is to prevent transmission of COVID-19 through supporting patients and warning contacts of exposure.⁹ HCP who test positive have their information and testing results reported to their respective local health department. A health department representative conducts an interview with the patient and/or HCP and conducts contact tracing.

Currently, Sparrow’s infection prevention and epidemiology (IPE) department is notified when a patient does not have appropriate transmission-based precautions in place and tests positive for COVID-19 during their inpatient stay. After determining an exposure occurred and a case definition is developed, the infection IPE department initiates an exposure investigation. This case definition includes HCP who provided care to the COVID-19 positive patient and did not have any of the following personal protective equipment (PPE): gown, mask, eye protection, and gloves. An exposure follow-up form that includes the determined case definition is provided to the manager(s) of each potentially affected department(s). The HCPs manager notifies them of the potential exposure and asks the HCP what PPE was used when care was provided to the COVID-19 positive patient. After this information is collected and is shared with infection

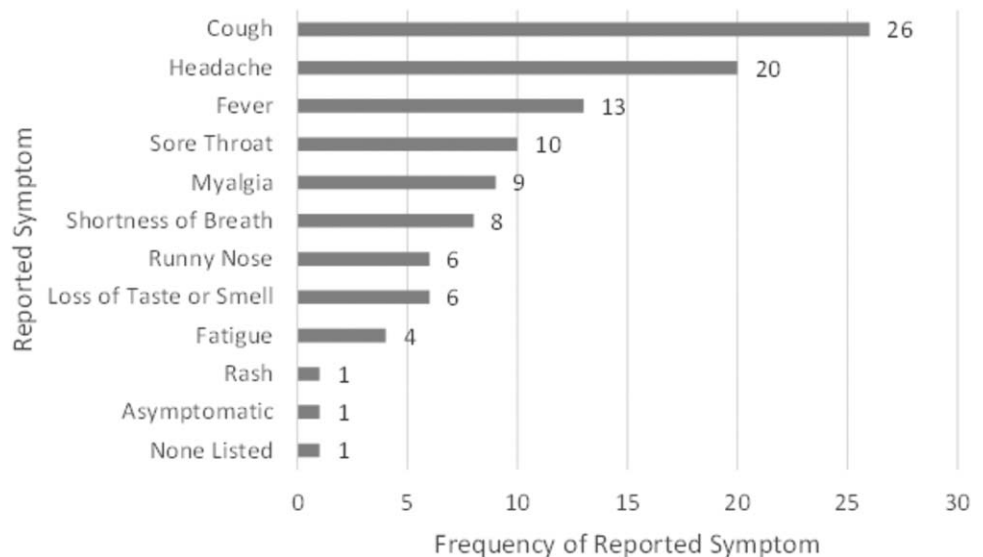


FIGURE 3. Symptoms reported by HCP.

preventionist who is conducting follow-up, cases are assigned to specific stratified risk categories based on what PPE is used during the time care was provided in accord to CDC guidelines.⁴

The determination of risk is based on CDC guidelines, which include low, medium, and high-risk categories.⁴ Level of risk is determined by the type of PPE that was worn by the HCP during patient care. HCP in the low risk category include those who wore a mask while providing care to a patient who also was wearing a mask. HCP assigned within the medium-risk category include those who provided care to an infected patient while the patient or HCP were unmasked. Exposures that are determined to be high-risk include unmasked HCP who provided care to an infected patient who was also unmasked.

Lists of exposed HCP and their assigned risk categories are then communicated to the employee health department. HCP who have had a workplace exposure, regardless of determined risk level, were instructed to not report to work and receive testing if they developed symptoms during the 14-day symptom self-monitoring period instructed by an employee health department representative. Health care personnel who subsequently test positive for COVID-19 are notified by the designated assigned employee health physician. During this notification process, the COVID-19 positive HCP is given a work exclusion and return-to-work instructions. Case follow-up is conducted by a nurse from the employee health department every 7 days and as needed for COVID-19 positive HCP. Positive cases are reported to the HCP's respective county health department automatically through Sparrow's employee electronic medical record program.

Twelve out of the 40 HCP who were positive for COVID-19 (30%) occurred among HCP who were included in exposure investigations conducted by the IPE department. Sixty-seven percent of positive HCP who were included in an exposure investigation were nurses. Eight out of the 12 (67%) HCP who were involved in an exposure investigation were included in an exposure from a COVID-19 positive patient that occurred in one of Sparrow's inpatient cardiac step-down unit that was not designated as a COVID cohort unit from March 23, 2020 to March 31, 2020. Out of the 391 HCP who were involved an exposure investigation, 3% were positive for COVID-19 within the 14-day post-exposure self-monitoring period (Fig. 4).

The remaining 28 (70%) COVID-19 positive HCP who were not included in an exposure investigation were presumed to have community-acquired infection. Since the implementation of requiring HCP to wear masks during their shifts on March 26, 2020 by the organization, there was a 67% decrease in workplace exposure-related positive cases (Table 1; Fig. 5). Post-implementation data includes the number of HCP who were positive for COVID-19 on or

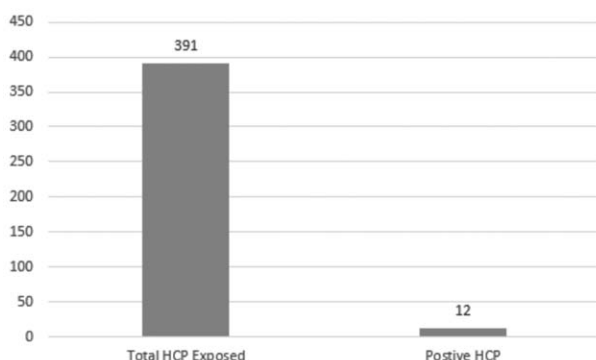


FIGURE 4. HCP exposed to COVID-19 positive patients compared to HCP who tested positive for COVID-19 within 14-day self-monitoring period at Sparrow Main Hospital (SMH) from March 20, 2020 and May 14, 2020.

TABLE 1. Positive HCP Previously Exposed to a COVID-Positive Patient

March 18, 2020 to April 9, 2020	April 10, 2020 to May 6, 2020
10 (83%)	2 (17%)

after April 10, 2020 due to COVID-19's 14-day incubation period. Seventy-five percent of HCP who were positive for COVID-19 have recovered and returned to work (Table 2).

DISCUSSION

Nurses made up the majority of HCP who were involved in a workplace exposure. The high incidence of COVID-19 among nurses may be due to nurse's tendency to have close and prolonged contact with patients. Nurses are also likely to perform aerosol-generating procedures, which further increases their risk of COVID-19 exposure.³ Common symptoms reported by HCP closely matched those that were included in Li et al's meta-analysis.¹⁰

Both the Infectious Disease Society of America and CDC recommend that HCP caring for patients with suspected or confirmed COVID-19 wear either a surgical mask or an N95.^{3,8} According to the Infectious Disease Society of America, evidence suggests an increased risk of HCP contacting COVID-19 when they do not wear masks.⁸ The CDC recommends mask use for patients as source control to prevent infectious respiratory droplets from reaching others.¹¹ There has been a substantial decrease in HCP exposures since the organization's implementation of requiring HCP to wear masks throughout their shift. However, HCP continue to be at risk for COVID-19 exposure from patients, and patients are at risk of COVID-19 exposure from HCP. According the CDC's guidelines on assessing risk of exposed healthcare personnel, HCP are considered to have had a low-risk exposure if both the patient and HCP had simple masks on during close and prolonged interactions.⁴ There continues to be potential of medium-risk exposure for both patients and HCP when patients do not to wear a mask during their interactions with HCP.⁴

This quality improvement project was beneficial in exploring common characteristics among HCP who tested positive for COVID-19. There were a significant number of COVID-19 positive HCP who were involved in an exposure investigation. It is difficult to determine if other COVID-positive HCP had a previous unidentified workplace exposure or if they were exposed within the community. HCP who work in high-risk areas including the emergency department and designated COVID cohort units inherently have an increased risk of exposure, which is lessened through the implementation of control measures including mask use. The majority of HCP who have tested positive for COVID-19 have recovered and returned to work.

It may be beneficial to have descriptive studies with larger sample sizes that explore common symptoms of COVID-19 reported among HCP in hospitals within in the United States. Further research regarding the effectiveness of having HCP wear masks in all inpatient areas, including those areas where patients without suspected or confirmed COVID-19 infection, may also be beneficial in determining if this intervention influences the number of HCP who become positive with COVID-19.

Limitations

Positive cases among HCP examined were limited to those who were tested at an employee health collection site or HCP-reported positive results after an off-site collection. It was difficult to obtain reliable surrounding hospitals' data on their number of COVID-positive HCP compared to the number of HCP employed. Due to its sensitivity, organizations may be reluctant to share this information. Data regarding the number COVID-19 positive HCP in surrounding hospitals were only available through press release briefings in local

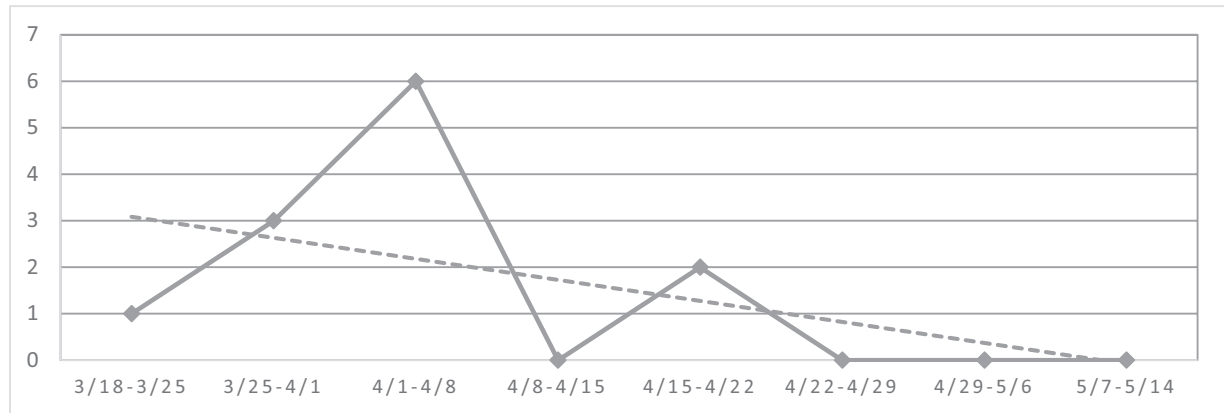


FIGURE 5. Positive HCP by week from March 18, 2020 and May 14, 2020 related to exposure.

TABLE 2. Disposition of COVID-19 Positive HCP

Positive HCP	Recovered HCP
40/963 (4.2%)	30 (75%)

journal websites, which only included the number of infected HCP and not the total number of HCP employed by the organization. An equitable comparison would need to be based on many variables including: number of employees, size of service areas, PPE availability, and service suspension timeline (eg, elective surgery, in-office visits).

Contact tracing can be a labor-intensive process that requires meticulous management and organization of gathered information to make sound conclusions. Even the world-renowned John Hopkins University acknowledges such challenges and has suggested the use of tracing technology to decrease the burden of data collection and organization.¹² Although the health system’s electronic medical record does offer a list of potentially exposed patients and HCP, the list provided does not include HCP who do not document in the medical record, such as those who work in nutritional or environmental services departments. Technology that helps the user narrow down true exposures based on pathogen and mode of transmission would also be beneficial to support tracing efforts.¹²

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