COVID-19 drive-through testing survey: Measuring the burden on healthcare workers

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Abstract
Objective: To survey individuals who tested positive for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) at 1 of 4 Trinity Health of New England drive-through testing centers to assess their demographic information, hospitalization rate, preexisting conditions, possible routes of exposures, duration of symptoms, and subsequent household infections of healthcare workers (HCWs) when compared to non-HCWs.

Methods: Data were collected via a telephone survey using a standardized script. Between March 1, 2020 and June 17, 2020, 28,903 people were tested at 4 Connecticut drive-through testing centers. Individuals who tested positive between March 16 and April 21, 2020 were randomly contacted. Of those individuals, 100 people agreed to complete the survey. Bivariate analysis and logistic regression were performed.

Results: HCWs comprised 46% of the 100 survey respondents during the study period. Similarly, HCWs comprised 42.1% of all individuals who tested positive and listed an employer between March 1 and June 17, 2020. HCWs reported a longer duration of symptoms (17.39 vs 13.44 days) and were more likely to report work as their route of exposure (80.4% vs 27.8%) than non-HCWs.

Conclusions: HCWs may face a disproportionate risk of contracting COVID-19 and self-report a longer duration of symptoms than the general public. The data suggest a need for an increased recovery time away from work than is currently recommended by the Centers for Disease Control and Prevention, as well as an increase in infection precautions for HCWs.

KEYWORDS
COVID-19, healthcare workers, mental health, personal protective equipment, telephone survey
INTRODUCTION

1.1 Background

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is the causative agent of coronavirus disease 2019 (COVID-19), first described in Wuhan, China in December 2019. As of August 21, 2020, there have been 22.9 million confirmed cases of COVID-19 worldwide and nearly 800,000 deaths. Connecticut has seen 51,519 total confirmed cases in the same period. As the prevalence of COVID-19 rises, patient-facing healthcare workers (HCWs) are at a heightened risk of exposure. It has been estimated that HCWs comprised up to 19% of all COVID-19 cases in the United States. A few factors contribute to the increased physical health risks HCWs assume when working with patients during the COVID-19 pandemic: asymptomatic individuals can transmit the virus, standard face masks provide insufficient protection, and at various times there were critical shortages of personal protective equipment (PPE). Despite this increased risk, information on HCW infection rates and disease burden remains limited.

1.2 Importance

Epidemiological and demographic information on HCWs who test positive for COVID-19 is essential for informing policies to protect those who are most vulnerable and ensure adequate sick leave and recovery time following infection, yet the current literature is lacking. Data on HCWs who are patient facing, but not on the frontline, is even scarcer. Thus, we conducted a follow-up survey of individuals who tested positive at drive-through testing centers to compare the disease burden and demographic information of HCWs when compared to the general population.

1.3 Goals of the investigation

This study aims to survey individuals who tested positive at 4 Trinity Health of New England drive-through testing centers to assess their demographic information, hospitalization rate, preexisting conditions, possible routes of exposures, duration of symptoms, and subsequent household infections of HCWs when compared to the general population.

METHODS

2.1 Data collection

The drive-through testing service of Trinity Health of New England was open to HCWs and people in the community who had a physician’s order for COVID-19 testing. Out of all individuals who used the drive-through testing service at 1 of 4 Trinity Health of New England sites between March 16 and April 21, 2020, 1,607 received a positive test result and were subsequently included in the survey contact list. Over-all testing numbers, test results, and employment data were also collected for the period of March 1 to June 17, 2020.

Data were collected using a telephone survey tool and from Trinity Health medical records. This study focused on a predefined cohort of potential responders. Given this, the method used for selecting potential participants most closely resembled registration-based sampling (RBS), a method for conducting election polls employing a list of registered individuals that acts as a representative sample. For random sampling, the phone numbers listed on medical records were exported to Microsoft Excel, and their order was randomized before calls were made. To ensure that a maximal number of potential responders were contacted, both landline and cellphone numbers were used if listed on the records.

Using the study population of 1,607 individuals mentioned previously, calls were made until a sample of 100 surveys had been conducted. Only one attempt was made to call each patient, unless they answered and requested a callback.

2.2 Survey design

Phone calls were conducted by 5 researchers, all of whom received the same training prior to their engagement in the study. All researchers used a preapproved script for making calls and were encouraged not to deviate from the script. The survey is included in the appendix (Supporting Information).

Survey respondents were asked about demographic information (sex, race, and ethnicity) as well as comorbidities, hospitalizations, subsequent household infections, and number of people who share their dwelling. Respondents were asked to identify where they believe they were exposed to COVID-19 and their answers were categorized as “Work,” “Home,” or “Other.” Answers were categorized under the “Other” label if the location of suspected exposure was outside of the workplace and their home, such as the grocery store, a friend’s house, or school, or if the location of exposure was unknown.

The study classified participants as HCWs or non-HCWs based on self-identification. No distinction was made in terms of the healthcare settings (inpatient, outpatient, or private practice), interaction with patients (direct or indirect contact), or roles of participants (delivering care directly, administration, or hospitality services).

Individuals who were not surveyed were also classified as HCWs or non-HCWs based on the employer listed on their records at the time of testing, if the employer was listed.

2.3 Statistical and qualitative analysis

To test the bivariate relationship between risk factors and HCW status, the Fisher’s exact test was utilized to compare all categorical variables, and an independent samples t test was used for the continuous variables.

A model of HCW-status was made using a binary logistic regression analysis. A backward stepwise elimination approach was used to
remove non-significant variables. For 2 independent variables with a HCW population proportion of 0.46, the required minimum sample size is 43.5. The sample size of 100 in this study exceeds this requirement. Both analyses were conducted using SPSS v26.

The methods used in this study, including the survey script, were approved by the institutional review board (IRB) committee at Trinity Health of New England. Researchers read the informed consent document to potential participants before conducting the survey. Participants provided verbal consent before the start of the survey. All phone calls were made from Saint Mary’s Hospital, a site of Trinity Health of New England, for security and confidentiality.

### TABLE 1 HCW roles

| HCW role   | Count (%) |
|------------|-----------|
| CNA/MA     | 19 (41.3%) |
| RN         | 14 (30.4%) |
| APRN       | 3 (6.5%)  |
| Administrative | 3 (6.5%) |
| Support Staff | 3 (6.5%) |
| Dietician  | 2 (4.3%)  |
| MD         | 1 (2.2%)  |
| PA         | 1 (2.2%)  |
| Total      | 46        |

APRN, advanced practice registered nurse; CNA, certified nursing assistant; HCW, healthcare worker; MA, medical assistant; MD, medical doctor; PA, physician assistant; RN, registered nurse.

### 4 LIMITATIONS

There are some limitations to this study. As mentioned, the study does not have a definition for HCWs. Self-identification of HCWs, the lack of HCW stratification based on the degree of direct patient interaction, and the small sample size may have introduced overestimation in the findings. For example, 6.5% of HCWs included in the study population held administrative, non-patient-facing roles. Additionally, although all surveyed individuals reported their HCW-status, not all individuals getting tested listed their occupation initially, which makes the high percentage (42.1%) of HCWs in the overall testing population difficult to interpret.

There are some other possible explanations for potential HCW overrepresentation in the data. This study surveyed individuals who used the drive-through testing services of Trinity Health of New England, a hospital-based network that, although available to the general public, may be more accessible and navigable to HCWs. Additionally, HCWs likely have greater access than the general population to a physician who could prescribe the order necessary to obtain access to testing. HCW’s increased medical knowledge may facilitate earlier symptom recognition and testing and may increase the likelihood that they will respond to research surveys. Finally, there has been some research suggesting selection bias in COVID-19 surveys and that may play a role in the overrepresentation of HCWs here. Of course, selection bias may contribute to over- or underestimation of other variables as well.

In addition, there is the possibility of recall bias, given that participants were asked to recall details of their illness that had occurred prior to the date of the survey.

### 5 DISCUSSION

In this study of 100 individuals who tested positive for SARS-CoV-2 at drive-through testing centers, almost half of the survey respondents identified as HCWs. The large proportion of HCWs in our survey sample is consistent with the rate of HCWs in the larger testing pool, where 42.1% of individuals who listed an employer were HCWs. In the study population, 93.5% of HCWs held positions that are traditionally patient facing. The observed rate of almost 90% of surveyed HCWs identifying as female is consistent with the nearly 80% reported in the literature. HCWs were estimated to account for 11% to 19% of positive COVID-19 cases in the United States, indicating that our data likely overrepresent HCWs. The drive-through testing required a physician order and familiarity with a hospital system, both of which may have contributed to increased HCW access as discussed in the limitations.

Despite this, our findings could still point to the inadequate PPE and working conditions that may have contributed to the disproportionate infection rate of HCWs when compared to the general public. A recent prospective cohort study found that frontline HCWs had a 12-fold increase in risk of a positive test when compared with the general community, possibly attributed to misuse of or inadequate PPE. According to current Centers for Disease Control and...
Prevention (CDC) guidelines, adequate PPE for HCWs consists of an N95 or equivalent respirator and eye protection, with the addition of a gown and gloves for HCWs who interact with known or suspected cases of SARS-CoV-2 infection. Although survey respondents were not asked about PPE availability, it is well documented that the global increase in demand for PPE led to a national shortage during the study period. As of May 2, 2020, over 6,000 healthcare organizations or individuals in 50 states had submitted requests for PPE, with hospitals making up the highest percentage of requesting organizations at 27%. Moreover, previous reports have indicated that frontline HCWs face increased psychological burden which may lead to immunosuppression and an increased likelihood of contracting the disease. It is not surprising that work exposure was found by regression analysis to be a statistically significant predictor of HCW status. A full 80.4% of HCWs self-reported work to be their route of exposure, which is consistent with other surveys of HCWs.
TABLE 2  Bivariate analysis: demographics and comorbidities

|                          | Total 100 | HCW 46 (46.0%) | non-HCW 54 (54.0%) | P value |
|--------------------------|-----------|-----------------|--------------------|---------|
| Mean Age (years)         |           |                 |                    |         |
|                          | 50.85 (±13.85) | 48.98 (±12.42) | 52.33 (±14.83)     | 0.347   |
| Sex                      |           |                 |                    |         |
| Male                     | 31 (31.0%) | 5 (10.9%)       | 26 (48.1%)         | <0.001**|
| Female                   | 69 (69.0%) | 41 (89.1%)      | 28 (51.9%)         |         |
| Race                     |           |                 |                    |         |
| White                    | 54 (54.0%) | 22 (47.8%)      | 32 (59.3%)         | 0.066   |
| Black or African American| 43 (43.0%) | 21 (45.7%)      | 22 (40.7%)         |         |
| Other                    | 3 (3.0%)  | 3 (6.5%)        | 0 (0.0%)           |         |
| Ethnicity                |           |                 |                    |         |
| Not Hispanic or Latino   | 89 (89.0%) | 39 (84.8%)      | 50 (92.6%)         | 0.064   |
| Hispanic or Latino       | 11 (11.0%) | 7 (15.2%)       | 4 (7.4%)           |         |
| Route of Exposure        |           |                 |                    |         |
| Work                     | 52 (52.0%) | 37 (80.4%)      | 15 (27.8%)         | <0.001**|
| Home                     | 25 (25.0%) | 8 (17.4%)       | 17 (31.5%)         |         |
| Other                    | 23 (23.0%) | 1 (2.2%)        | 22 (40.7%)         |         |
| Comorbidities            |           |                 |                    |         |
| Hypertension             | 44 (44.0%) | 23 (50.0%)      | 21 (38.9%)         | 0.314   |
| Hyperlipidemia           | 27 (27.0%) | 9 (19.6%)       | 18 (33.3%)         | 0.175   |
| Asthma                   | 24 (24.0%) | 10 (21.7%)      | 14 (25.9%)         | 0.647   |
| COPD                     | 1 (1.0%)  | 0 (0.0%)        | 1 (1.9%)           | 1.000   |
| Heart disease            | 6 (6.0%)  | 2 (4.3%)        | 4 (7.4%)           | 0.684   |
| Diabetes                 | 16 (16.0%) | 6 (13.0%)       | 10 (18.5%)         | 0.587   |
| Kidney disease           | 4 (4.0%)  | 2 (4.3%)        | 2 (3.7%)           | 1.000   |
| Autoimmune disease       | 5 (5.0%)  | 0 (0.0%)        | 5 (5.0%)           |         |
| Days Symptomatic         | 15.26 (±9.77) | 17.39 (±9.21) | 13.44 (±9.94)     | 0.043*  |
| Hospitalized             | 4 (4.0%)  | 1 (2.2%)        | 3 (5.6%)           | 0.622   |
| Other Household Members  | 2.24 (±1.61) | 2.56 (±1.90) | 1.98 (±1.28)      | 0.206   |
| Subsequent Household Infections (persons) | 0.44 (±0.61) | 0.33 (±0.47) | 0.54 (±0.69)      | 0.024*  |

COPD, chronic obstructive pulmonary disease; HCW, healthcare worker.
*Meets 0.05 P value level.
**Meets < 0.001 P value level.

Despite HCWs citing a longer duration of symptoms and a higher average number of household members, HCWs infected fewer people in their household after receiving their positive result than non-HCWs, as seen in Table 2. This is not necessarily a contradiction but rather might be explained by HCWs having a higher degree of medical literacy and a better understanding of COVID-19, leading to better adherence to standard precautions and self-quarantine. Though the difference between subsequent household infections in HCWs and non-HCWs is statistically significant, the magnitude of the difference is relatively small, as is the sample size. Although it is difficult to conclude the clinical significance of this finding, it raises a question that might be worth examining in future studies.

The logistic regression analysis supports the findings of the bivariate analysis, as duration of symptoms was found to be a statistically significant predictor of HCW-status. Moreover, the duration of symptoms reported by HCWs is longer than the return-to-work criteria of the CDC. At the time of writing this manuscript, the CDC recommended that HCWs with confirmed or suspected COVID-19 infections should be excluded from work for at least 3 days after recovery. In this case, recovery includes resolution of fever without the use of antipyretic medications, improvement in respiratory symptoms, and a duration of at least 10 days after symptoms first appeared. This study suggests that infected HCWs may be symptomatic for longer than the minimum 10-day period. Therefore, a longer minimum period of recovery time away from work may be necessary to ease the physical health burden of the pandemic on HCWs.

Overall, the results from this study suggest that HCWs faced an increased risk of testing positive for COVID-19 compared to the general public and the self-reported duration of symptoms may be longer than what the current guidelines anticipate. Guaranteeing adequate PPE and adequate time off work to reduce the spread of infection in healthcare settings could help alleviate the disproportionate burden faced by HCWs.

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AUTHOR CONTRIBUTIONS
AAS and PSP conceived the study. AAS designed the survey. AAS, JA, JD, and TNMD conducted the phone calls and collected data. AAS conducted statistical analysis. AAS, JA, JD, and TNMD wrote the manuscript. All authors contributed to editing the manuscript. PSP takes responsibility for the paper as a whole.

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SUPPORTING INFORMATION
Additional supporting information may be found online in the Supporting Information section at the end of the article.

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