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.

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RESEARCH NOTES

Prevalence of SARS-CoV-2 antibodies among North Dakota community pharmacy personnel: A seroprevalence survey

Amanda Johnson, Brenda Vincent, Paul Carson, Elizabeth Skoy*

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ABSTRACT

Background: Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the cause of the coronavirus disease 2019 (COVID-19) pandemic, has disrupted much of the health care system. Despite changes in routine practices, community pharmacists have continuously served their patients throughout the pandemic. Frontline health care workers, including community pharmacy personnel, are at risk of becoming infected with SARS-CoV-2.

Objective: The purpose of this observational study was to report the prevalence of antibodies to SARS-CoV-2 from a sample of North Dakota community pharmacy personnel.

Methods: This observational study was conducted in 2 cities in North Dakota with the highest COVID-19 rates at the time of investigation. Community pharmacy personnel were tested for the presence of the SARS-CoV-2 IgG and IgM antibodies using a rapid antibody test. In addition to antibody testing, participants completed a questionnaire reporting on demographics, previous COVID-19 exposure, previous COVID-19 symptoms, and personal protection equipment (PPE) practices.

Results: A total of 247 pharmacy personnel from 29 pharmacies were tested for SARS-CoV-2 antibodies. The timing and use of PPE varied by location. Among the 247 community pharmacy personnel, 14.6% tested positive for IgM, IgG, or both. Survey data revealed a statistically significant association ($P < 0.05$) between a positive antibody test and direct contact with an individual who tested positive for COVID-19 (odds ratio: 2.65 [95% CI: 1.18–5.95]), but there were no statistically significant effects related to the workplace, including PPE use, personnel role, or the number of hours worked. The self-reported loss of taste or smell was the only significant symptom associated with a positive antibody test (18.91 [3.10–115.59]).

Conclusion: Community pharmacy personnel may be at an increased risk for SARS-CoV-2 exposure compared with the general population.

Background

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which causes coronavirus disease 2019 (COVID-19), has disrupted societies worldwide. Studies have shown that after initial exposure to SARS-CoV-2, IgM antibodies first appear within 1-2 weeks and are then followed by more durable IgG antibodies within approximately 2-4 weeks.[1] Evidence has shown that SARS-CoV-2 IgG is detected by antibody tests for more than 50 days after symptom onset, whereas IgM commonly falls below the limits of detection approximately 36 days after symptom onset.[1] Currently, it is unknown if antibodies for SARS-CoV-2 provide long-term immunity against COVID-19.

Health care workers have continued to work on the front lines to serve their patients during the COVID-19 pandemic. Studies have investigated the presence of SARS-CoV-2 antibodies as an indicator of health care exposure to the virus. A wide range of seroprevalence among frontline health care providers have been reported: 7.6% in Nashville, 36% in New York City, 44% in London, and 4.9% in Michigan.[2-5] Most studies have found that health care providers have a greater seropositivity than the estimated general population ranging from 2.8% to 6.9%.[6-9]

Community pharmacy personnel, similar to other health care workers, have been deemed essential workers and have

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* **Correspondence:** Elizabeth Skoy, PharmD, Associate Professor, Pharmacy Practice, College of Health Professions, North Dakota State University, PO Box 6050, Fargo, ND 58108-6050.

E-mail address: Elizabeth.Skoy@ndsu.edu (E. Skoy).

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continued to serve their patients. During the COVID-19 pandemic, pharmacies have been called on to expand their roles within communities through the expansion of immunization practices, SARS-CoV-2 testing, and point-of-care testing.[10-12] Despite the increased exposure, little is known about the risk of SARS-CoV-2 infection among pharmacy personnel. At the time of writing this article, no study has been conducted to estimate the risk of infection of SARS-CoV-2 among this group of health care workers.

Although rapid SARS-CoV-2 antibody tests are available through the Food and Drug Administration (FDA) under Emergency Use Authorizations, at the time of writing, only 1 SARS-CoV-2 antibody test had been authorized for point-of-care testing under a Clinical Laboratory Improvement Amendments (CLIA) waiver.[13] However, FDA does not require testing to be done under a CLIA waiver if the testing is done for surveillance purposes through a health department.

Objective

The purpose of this observational study was to report the prevalence of antibodies to SARS-CoV-2 from a sample of North Dakota community pharmacy personnel.

Methods

An observational study was conducted analyzing the prevalence of SARS-CoV-2 antibodies among a convenience sample of community pharmacy personnel in the cities of Fargo and Grand Forks, ND. At the time of conducting this study (July 2020), these 2 cities were the highest populated cities within North Dakota and located in the counties with the highest number of COVID-19 cases.[14,15] The SARS-CoV-2 antibody test, BioSys Plus (BioSys Laboratories), and relevant supplies were provided from the North Dakota Department of Health to conduct this study for surveillance purposes.[16] This study was approved through the North Dakota State University Institutional Review Board.

The BioSys Plus COVID-19 IgM/IgG Rapid Test was provided an Emergency Use Authorization by FDA but was not CLIA-waived at the time of study.[16] It is a lateral flow immunoassay for the qualitative detection and differentiation of IgG and IgM antibodies in whole blood.[16] The reported clinical sensitivity and specificity of the test are 93.5% and 100%, respectively.[16] The sample requires approximately 20 μL of blood and is obtained from the finger using a single-use lancet and pipet. Results of the antibody test can be read between 10 and 15 minutes.[16]

All community pharmacy personnel in Fargo or Grand Forks were eligible to participate in the study. Pharmacists-in-charge were contacted by phone to determine interest. After consenting to participate, pharmacies were provided with a time of testing and asked to provide an approximate number of employees at each location. Personnel wishing to be tested were asked to report on the specific date and time assigned. Consent was obtained, and participants completed a questionnaire (Appendix 1) before testing. The questionnaire included demographic information, past personal protective equipment (PPE) practices, previous symptoms related to COVID-19, previous exposure to a person known to be positive for SARS-CoV-2, and previous tests for SARS-CoV-2 antibodies or active infection.

Participants were from 29 pharmacies, 21 in Fargo and 8 in Grand Forks, and were tested between July 20 and July 23, 2020. There are 24 community pharmacies in Fargo and 11 in Grand Forks. Of the 35 pharmacies between the 2 cities, 33 agreed to participate. However, the research team ran out of allocated tests from the state health department so were unable to provide testing to the final 4 locations.

Seropositivity and its associations with risk factors were assessed by chi-square analysis. Multiple logistic regression was used to evaluate COVID-19 symptoms significantly associated with SARS-CoV-2 antibodies. Odds ratios (ORs) and corresponding 95% CIs were estimated. Statistical significance was determined as a P value less than 0.05. All statistical analyses were performed using SAS 9.4 (SAS Institute Inc, Cary, NC).

Results

Most participants were female (72.1%) and aged between 18 and 25 years (32.8%) followed by those aged 26 to 35 years (26.7%). Among the 247 community pharmacy personnel, 36 (14.6% [95% CI 10.4–19.6]) were seropositive. Among the 36 individuals that tested positive, 2 (5.6%) had IgG antibodies only, 10 (27.8%) had IgM antibodies only, and 24 (66.7%) had IgM and IgG antibodies.

The seroprevalence did not significantly differ based on the personnel's role (cashier, technician, pharmacist, intern, or other) nor the hours worked. The use of PPE was also not a significant factor associated with seropositivity (Table 1).

There were no self-reported COVID-19 outbreaks within any of the community pharmacies visited. There was a variance among the community pharmacies' responses to the pandemic and the protective measures taken. Most of the pharmacy personnel began wearing PPE in March. The most commonly used PPE was masks, with 89.5% of individuals reporting use. Of those who used masks, 63.8% used surgical masks and 36.2% used cloth masks. Other PPE included plexiglass, closing the lobby, glove use, and goggles/face shields.

Of the 36 pharmacy workers who were seropositive, 16 (44.4%) were asymptomatic. The loss of sense of taste or smell was the only symptom of COVID-19 that was significantly associated with seroconversion (OR 18.91 [95% CI 3.10–115.59]) (Figure 1). Difficulty breathing, chills, runny nose, shortness of breath, fatigue, headache, body aches, sore throat, fever, or cough were not significantly associated with seroconversion.

Discussion

This is the first reported study examining the SARS-CoV-2 seroprevalence in community pharmacy personnel. When comparing our study with other studies that examined the seroprevalence of the general population, community pharmacists appear to have a much greater seroprevalence (14.6% vs. 2.8%-6.9%).[6-9] In addition, published seroprevalence for U.S. health care providers range from 4.9% to 36% with the highest rate in New York City. However, these studies have been conducted within health care systems and not community settings and within varying population densities.[2,3,5]

Table 1
Characteristics and seroprevalence of pharmacy workers tested for IgG/IgM antibodies

Characteristics	Overall, n (%)	Seropositive, n (%)	Seronegative, n (%)	Odds ratio (95% CI)	*P* value
Total	247	36 (15.6)	211 (85.4)	—	—
Male	69 (27.9)	8 (11.6)	61 (88.4)	0.70 (0.30–1.63)	0.41
Female[a]	178 (72.1)	28 (15.7)	150 (84.3)	1.00	
Age, y					
18–25[a]	81 (32.8)	12 (14.8)	69 (85.2)	1.00	0.86
26–35	66 (26.7)	7 (10.6)	59 (89.4)	0.68 (0.25–1.84)	
36–45	42 (17.0)	7 (16.7)	35 (83.3)	1.15 (0.42–3.18)	
46–55	35 (14.2)	6 (17.1)	29 (82.9)	1.19 (0.41–3.47)	
> 55	23 (9.3)	4 (17.4)	19 (82.6)	1.21 (0.35–4.18)	
Work					
< 10 h[a]	16 (6.5)	2 (12.5)	14 (87.5)	1.00	0.21
11–20 h	25 (10.1)	2 (8.0)	23 (92.0)	0.61 (0.08–4.82)	
21–30 h	35 (14.2)	9 (25.7)	26 (74.3)	2.42 (0.46–12.80)	
31–40 h	122 (49.4)	14 (11.5)	108 (88.5)	0.91 (0.19–4.42)	
> 40 h	49 (19.8)	9 (18.4)	40 (81.6)	1.58 (0.30–8.19)	
Role					
Cashier	22 (8.9)	3 (13.6)	19 (86.4)	1.00	0.86
Technician	71 (28.7)	9 (12.7)	62 (87.3)	0.92 (0.23–3.74)	
Intern	58 (23.5)	9 (15.5)	49 (84.5)	1.16 (0.28–4.76)	
Pharmacist	84 (34.0)	12 (14.3)	72 (85.7)	1.06 (0.27–4.12)	
Other	12 (4.9)	3 (25.0)	9 (75.0)	2.11 (0.35–12.59)	
Fargo pharmacy	181 (73.3)	27 (14.9)	154 (85.1)	1.11 (0.49–2.50)	0.80
Grand Forks pharmacy[a]	66 (26.7)	9 (13.6)	57 (86.4)	1.00	
Any symptoms	151 (61.1)	20 (13.2)	131 (86.8)	0.76 (0.37–1.56)	0.46
Known exposure	41 (16.6)	11 (26.8)	30 (73.2)	2.65 (1.18–5.95)	0.01
Early PPE access[b]	163 (66.0)	23 (14.1)	140 (85.9)	0.90 (0.43–1.88)	0.77
Face mask	221 (89.5)	31 (14.0)	190 (86.0)	0.69 (0.24–1.95)	0.48
Gloves	37 (15.0)	3 (8.1)	34 (91.9)	0.47 (0.14–1.63)	0.23
Glasses or shields	9 (3.6)	1 (11.1)	8 (88.9)	0.73 (0.09–5.98)	0.76
Plexiglass	156 (63.2)	22 (14.1)	134 (85.9)	0.90 (0.44–1.87)	0.78
Closed lobby	41 (16.6)	5 (12.2)	36 (87.8)	0.78 (0.29–2.15)	0.64

Abbreviation used: PPE, personal protective equipment.
Note: All comparisons are unadjusted.
[a] Denotes reference category.
[b] Early PPE access refers to those pharmacies who provided PPE before April 2020.

Although, to date, there have not been any widespread SARS-CoV-2 seroprevalence studies completed in North Dakota, one could also compare our findings with those from the nucleic acid test used to detect SARS-CoV-2. As of July 31, 2020, there was a cumulative of 12,319 positive tests for SARS-CoV-2 and a 14-day rolling average positivity rate of 2.74% for North Dakota residents.[15] SARS-CoV-2 spread in North Dakota was primarily through community contact, followed closely by close contact.[15] This number represents 1.7% of the state's general population who had tested positive for SARS-CoV-2 infection at the time of our study.[17]

The Centers for Disease Control and Prevention estimates that in neighboring Minnesota around the same time, the seroprevalence among the general population was 6.1%.[9] This number of seropositive cases represented 7 times the number of reported cases of active COVID-19 infections in Minnesota. North Dakota conducts approximately 2.2 times more COVID-19 tests per capita than Minnesota for the general population. Therefore, if data were extrapolated from North Dakota to Minnesota, this would infer that 5.4% of the general population of North Dakota was infected with SARS-CoV-2 at that time. This number is much lower than our findings of community pharmacy personnel with a seroprevalence of 14.6%.

Almost half of the seropositive pharmacy workers were asymptomatic. This demonstrates the importance of using PPE. Furthermore, there were not any reported outbreaks within the pharmacies; this could indicate that the PPE was effective in preventing the spread of infection among personnel. Previously testing positive by a nucleic acid test, previous exposure to a positive COVID-19 case, and the loss of the sense of taste or smell were associated with antibody positivity. Differing roles within a pharmacy and the number of hours worked were not associated with antibody positivity, which may have been due to the limited sample size.

There were some limitations to our study. First, there was the potential for false negatives or false positives. Any line on the BioSys Plus was considered a positive result regardless of the intensity, so faint lines could have been read as negative. To diminish the potential for error, all test results were confirmed by the 2 individuals conducting the test. With a sensitivity of 93.5% and 36 positive cases, it is estimated that approximately 38 or 39 were truly positive, so approximately 3 false negatives would be expected. However, this is not enough to change the findings. In addition, the small sample size and low prevalence of SARS-CoV-2 led to low power to detect differences between those who were seropositive and those who were seronegative. In addition, the BioSys Plus is known to have potential cross-reaction with other common coronavirus strains: HKU1, NL63, OC43, or 299E.[6] Unfortunately, there is not statewide data to compare community pharmacy personnel

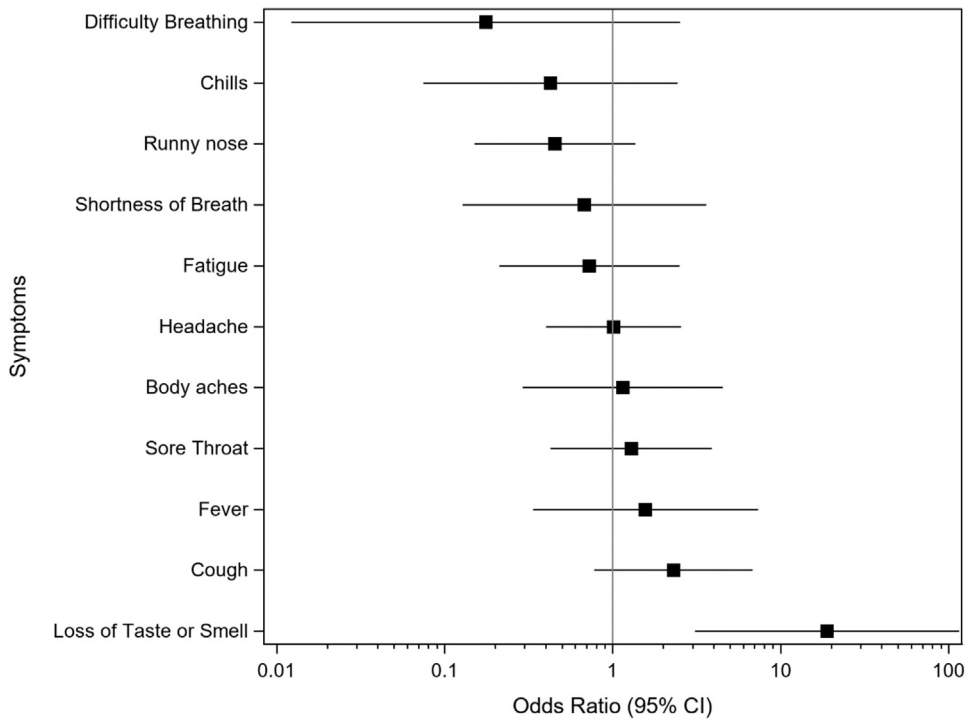

Figure 1. Associations with severe acute respiratory syndrome coronavirus-seropositivity and reported COVID-19 symptoms. Abbreviations used: COVID-19, coronavirus disease 2019.

seroprevalence with seroprevalence of the general population. Therefore, comparisons must be made with other studies conducted in other states. In addition, we did not have data about the percentage of pharmacy personnel who volunteered to get tested. Participants volunteered to enroll in the study, so there may have been bias associated with decision to enroll. Furthermore, the self-report nature of the questionnaire may have been another source of bias. Finally, this study was conducted in 2 cities within 1 state, therefore, our sample was not representative of all community pharmacy personnel.

Conclusion

Seropositivity for SARS-CoV-2 was higher among community pharmacy personnel than estimated regional samples of the general population and measured seropositivity in other groups of health care workers. Greater attention and more studies in community pharmacy personnel are needed as this population may be at a higher risk of exposure to SARS-CoV-2.

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Amanda Johnson, Student Pharmacist, MPH Candidate, College of Health Professions, North Dakota State University, Fargo, ND

Brenda Vincent, MS, PhD Candidate, Department of Statistics, North Dakota State University, Fargo, ND

Paul Carson, MD, Professor of Practice, Department of Public Health, North Dakota State University, Fargo, ND

Elizabeth Skoy, PharmD, Associate Professor, Pharmacy Practice, North Dakota State University, Fargo, ND

Appendix 1.

Questionnaire

Demographics:

- What is your gender: _____
- What is your ethnicity: _____
- What is your age:
  - 18-25
  - 26-35
  - 36-45
  - 46-55
  - 56-65
  - 66-75
  - 76+

Questions:

- What is your role in the pharmacy?
  - Cashier
  - Technician
  - Intern
  - Pharmacist
  - Other:_____
- How many average hours do you work per week?
  Less than 10
  - 11-20
  - 21-30
  - 31-40
  - 40+
- Check all PPE equipment you currently use regularly in the pharmacy:
  - Gloves
  - Masks
    - Cloth
    - Surgical
  - Plexiglass
  - Other: _____
- When did you start using PPE majority of the time: _____
- Have you been exposed to an individual with laboratory confirmed COVID-19?
  - Yes
    - Approximate date of exposure: _____
  - No
- Circle any of the following symptoms you have experienced between now and January 2020:
  - Cough Shortness of breath Difficulty breathing Fever
  - Chills Sore throat Runny nose Fatigue
  - Headache Body aches Loss of taste and/or smell
- Have you had any prior tests for COVID-19, and what were the results?
  - Yes
    - Antibody (circle one): Positive Negative
    - Active infection (circle one): Positive Negative No
- Comments: