Risk factors for contracting COVID-19 in Canadian healthcare personnel, prior to and during the omicron wave

Brenda L Coleman[1,2], Joanne M Langley[3,4], Shelly McNeil[3,4,5], Louis Valiquette[6], Otto Vanderkooi[7,8], Robyn Harrison[8,9], Samira Mubareka[2,10], Matthew Muller[2,11], Kevin Katz[2,10,12], Mark Loeb[13,14], Jeff Powis[15], Curtis Cooper[16,17], Saranya Arnoldo[18], Jeya Nadarajah[2,19], Marek Smieja[14,20], Anne-Claude Gingras[1], Sarah Bennett[1], Julia Policelli[1], Dawn Bowdish[14], Allison McGeer[1,2]

1) Sinai Health, Toronto, ON; 2) University of Toronto, Toronto, ON; 3) Canadian Centre for Vaccinology, Halifax, NS; 4) Dalhousie University, Halifax, NS; 5) Nova Scotia Health, Halifax, NS; 6) Université de Sherbrooke, Sherbrooke, QC; 7) University of Calgary, Calgary, AB; 8) Alberta Health Services, AB; 9) University of Alberta, Edmonton, AB; 10) Sunnybrook Health Sciences Centre, Toronto, ON; 11) Unity Health, Toronto, ON; 12) North York General Hospital, Toronto, ON; 13) Hamilton Health Sciences Centre, Hamilton, ON; 14) McMaster University, Hamilton, ON; 15) Michael Garron Hospital, Toronto, ON; 16) University of Ottawa, Ottawa, ON; 17) The Ottawa Hospital, Ottawa, ON; 18) William Osler Health System, Brampton, ON; 19) Oak Valley Health, Markham, ON; 20) St. Joseph's Healthcare, Hamilton, ON

Background

The ongoing COVID-19 pandemic continues to cause illness and death across the world. SARS-CoV-2 is an RNA virus and susceptible to mutations as it is transmitted from person-to-person. During the two years of the pandemic, several variants with the ability to transmit effectively through the human population have been isolated. mRNA and other vaccines appeared to be effective against the original and first several mutations, but may not be as effective against the omicron strain. Determining factors associated with infection may identify risks of transmission for everyone, including healthcare personnel.

Research question: What factors were associated with contracting COVID-19 [confirmed by polymerase chain reaction (PCR) or rapid COVID-19 antigen test (RAT)] among adults working in Canadian healthcare prior to and during the omicron wave that started December 1, 2021.

Methods

Design

Test-negative interim analysis of prospective cohort study

Rolling enrolment from June 2020 to July 2022

19 hospitals in 9 Canadian cities in 4 provinces

Eligibility

18-75 years old

Worked in participating healthcare setting ≥20 hours/week

Study procedures

Baseline risk factor assessment, updated annually

Illness / test reports: when tested for COVID-19; also collects exposures in previous 14 days

Analysis

Multivariable generalized estimating equations (GEE), Poisson regression models with exchangeable correlations and robust variance estimation to account for repeated measures. Adjusted for days at risk, age, gender, and province.

Results

Figure 1: Location of study sites: Canada

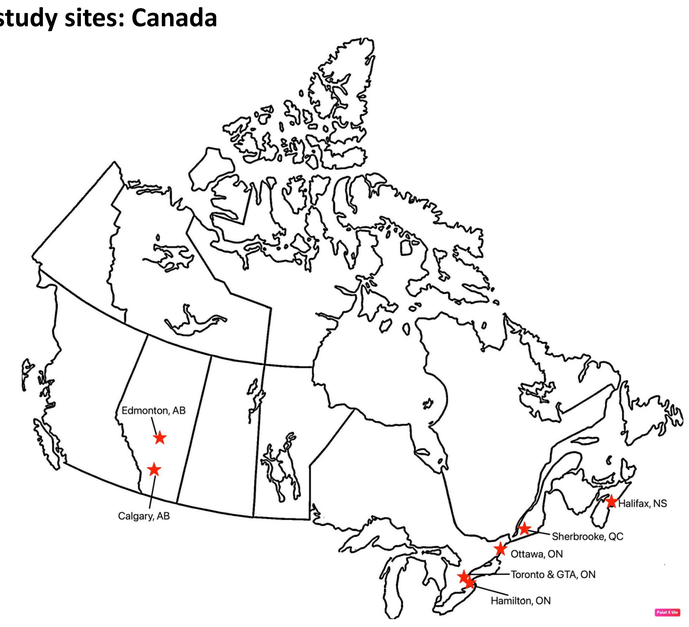


Table 1: Characteristics of participants in the cohort study compared with those in the test-negative analysis

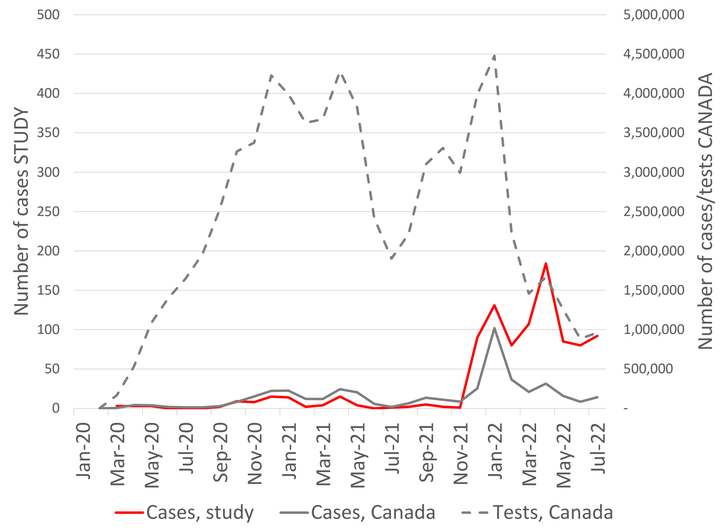
Characteristic	Full cohort (N=2537) Number (%)	Test-negative (N=1938) Number (%)
Gender: female/other	2177 (86)	1692 (87)
male	357 (14)	242 (12)
Age (median, IQR)	40 (32-50)	41 (32-49)
Health: excellent	764 (30)	561 (29)
very good	1188 (47)	914 (47)
good/fair	587 (23)	459 (23)
Smokes tobacco: never	1950 (77)	1475 (76)
former	461 (18)	356 (18)
current	126 (5)	103 (5)
Household size (median, IQR)	2 (1-3)	2 (1-3)
COVID-19 vaccine doses: 0 or 1	145 (5)	42 (2)
2	520 (20)	307 (16)
3	1684 (66)	1429 (74)
4	190 (7)	160 (8)
Profession: nurse	836 (33)	658 (34)
physician	277 (11)	210 (11)
other healthcare personnel	1205 (48)	897 (47)
administrative	194 (8)	165 (8)
Province: Alberta	477 (19)	382 (20)
Ontario	1529 (60)	1081 (56)
Quebec	295 (12)	257 (13)
Nova Scotia	238 (9)	218 (11)

Results

Rate of reported positive tests

- Prior to omicron (2020-01-01 to 2021-11-30): 5.6 per 100,000 participant-days (92 cases/1,632,585)
- Omicron wave (2021-12-01 to 2022-08-01): 188.8 per 100,000 participant-days (850 cases/450,109)

Figure 2: Number and month of study cases compared with cases across Canada



Note: PCR testing was discontinued except for high risk individuals and people working in high-risk settings December 31, 2021

Source of data for Canada: https://health-infobase.Canada.ca/covid-19

Table 2: Factors associated with testing positive for COVID-19, by pandemic period (pre-omicron vs during omicron): Incident rate ratio (IRR)

Factor	Prior to omicron Jan 1, 2020 to Nov 30, 2021 (92 cases: 2523 controls) IRR (95% CI)	Omicron wave Dec 1, 2021 to Aug 1, 2022 (850 cases: 3047 controls) IRR (95% CI)
Age	1.00 (0.98, 1.03)	1.00 (0.99, 1.00)
Gender (male vs female/other)	1.39 (0.65, 2.96)	1.07 (0.89, 1.29)
Smokes tobacco: never	Referent	Referent
former	0.70 (0.39, 1.23)	1.02 (0.88, 1.18)
current	1.26 (0.49, 3.23)	***1.50 (1.24, 1.82)***
Exposed to positive co-worker (vs not)[1]	***2.26 (1.36, 3.75)***	0.73 (0.55, 1.00)
Exposed to positive adult in home (vs not)[1]	***9.49 (5.20, 17.3)***	***1.83 (1.61, 2.10)***
Exposed to positive child in home (vs not)[1]	***5.15 (2.27, 11.7)***	***2.23 (1.93, 2.59)***
Exposed to positive patient (vs not)[1]	***1.88 (1.18, 3.00)***	0.89 (0.73, 1.10)
Exposed to positive friend (vs not)[1]	***3.47 (1.63, 7.37)***	***1.24 (1.04, 1.49)***
Group activity with 5 or more people[1]: 0	Referent	Referent
1	0.88 (0.55, 1.41)	1.05 (0.88, 1.25)
2	0.60 (0.27, 1.33)	1.16 (0.97, 1.39)
3-4	1.24 (0.61, 2.51)	***1.25 (1.05, 1.50)***
Doses of COVID-19 vaccine[2]: 0	Referent	
1	***0.27 (0.11, 0.65)***	Referent: 0 or 1
2	***0.13 (0.05, 0.34)***	0.82 (0.47, 1.43)
3	NA	***0.55 (0.35, 0.95)***
4	NA	***0.33 (0.18, 0.60)***
Work area: one-person office	Referent	Referent
office with co-workers &/or clients	1.04 (0.49, 2.20)	***1.48 (1.18, 1.86)***
open area with co-workers & clients	0.74 (0.39, 1.41)	***1.45 (1.17, 1.81)***
no defined workspace	0.49 (0.19, 1.26)	***1.43 (1.08, 1.89)***
work from home	0.99 (0.26, 3.67)	1.40 (1.00, 1.96)
other	0.93 (0.29, 2.95)	1.16 (0.86, 1.57)
Province: Ontario	Referent	Referent
Alberta	*2.87 (1.60, 5.13)*	0.94 (0.82, 1.08)
Quebec	*4.80 (3.01, 7.65)*	0.98 (0.84, 1.15)
Nova Scotia	NA	*0.65 (0.54, 0.78)*
Days at risk[3]	1.00 (0.93, 1.07)	*1.10 (1.07, 1.13)*

1) In previous 14 days
2) ≥14 days before positive test
3) Jan 1, 2020 to test date (pre-omicron); Dec 1, 2021 to test date (omicron)

Limitations

- Observational study with self-reported infections
- COVID-19 restrictions varied across time and province

Highlights/Conclusions

- The rate of reported infections was significantly higher during the omicron wave than previous
- Exposure to people known to be infected with SARS-CoV-2 increased the risk of infection; exposure to infected household contact(s) had the highest IRR
- COVID-19 vaccination reduced the risk of infection
- Group activities and working in close proximity with other people were risk factors during the omicron wave (when masking and social gathering restrictions were also lifted)

Funding

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