SARS-CoV2 virus outbreak amongst physicians at a curling bonspiel in Canada: a retrospective cohort study

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ABSTRACT

Background

Between March 11-14, 2020, 73 participants (56 healthcare workers) from four Canadian provinces attended a curling bonspiel in Edmonton, Alberta. Although precautions were taken, an outbreak of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV2) occurred following the event.

Methods

SARS-CoV2 testing was done according to provincial guidelines at the time. We used a standardized survey tool to interview consenting participants, collecting information on demographics, travel history, symptoms (type, onset, and duration) and clinical outcomes.

Results

Of the 73 participants (75.3% male, median age 51 [range 26 – 79], 72.6% physicians), 40 curlers (54.8%) tested positive for SARS-CoV2 using reverse transcriptase polymerase chain reaction (RT-PCR) on nasal, nasopharyngeal or throat swabs. An additional 16 participants developed symptoms but had negative swabs or were not tested. Six false negative RT-PCR tests occurred on initial swabs (estimated sensitivity of 70.8%). The most common symptoms were nasal congestion / rhinorrhea (85%), cough (80%), myalgia (80%), anosmia (77.5%), and headache (62.5%). The clinical course was mild in the majority of cases (1 emergency visit, no hospitalizations). Careful analysis points to transmission from multiple individuals, who had minor non-specific symptoms during the event. Secondary transmission, in the home, occurred to 35 individuals.

Interpretation

This represents one of the largest reported outbreaks amongst healthcare workers, although transmission was in the community. The 76.7% attack rate (confirmed or presumptive cases) highlights the infectivity of SARS-CoV2 during sporting and social events. Our data supports the inclusion of anosmia in an updated COVID-19 case definition.

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INTRODUCTION

Canada confirmed its first case of the novel coronavirus disease 2019 (COVID-19), a respiratory illness caused by the SARS-CoV2 virus, on January 25, 2020 (1). As of May 15, 2020, there have been more than 74,000 confirmed cases and more than 5,600 deaths in Canada (1). The World Health Organization declared a global pandemic on March 11, 2020, which was also the date that physicians from around Canada gathered for a curling bonspiel in Edmonton, Alberta. Curling is a winter sport that originated in Scotland, but today ninety percent of all curlers worldwide come from Canada (2). The 63rd Annual Western Canadian Medical Bonspiel took place between March 11–14, 2020, and at the onset of the event, there were only nineteen confirmed cases of COVID-19 in Alberta, including nine cases from Edmonton (*Supplementary Figure 1*). These cases were directly associated with international travel and no known community spread had been documented.

In early March, criteria for SARS-CoV2 testing in Canada was generally limited to symptomatic individuals (fever, cough or dyspnea) with history of international travel or close contact with a confirmed case. At the time, unusual symptoms of COVID-19, such as anosmia and diarrhea, were not well described in the scientific literature nor were they included in clinical case definitions used in Canada. Since the start of the pandemic, there has been great interest amongst healthcare workers about the risk of secondary transmission to household contacts, but this has yet to be well defined.

This community-based outbreak allowed us to study the following objectives:

1) Describe the onset, frequency and duration of the full spectrum of symptoms experienced by individuals with confirmed or suspected COVID-19.
2) Estimate the clinical sensitivity of SARS-CoV2 testing by RT-PCR of upper respiratory tract samples.

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3) Describe the secondary transmission of SARS-CoV2 among close household contacts of confirmed and suspected cases.

METHODS

Study Population and Data Collection

We conducted a retrospective cohort study of bonspiel participants. All 73 curlers consented to be interviewed by telephone (KWB or BLM) between April 17 and May 5, 2020. Data collection included; demographics, occupation, residence, travel history, bonspiel social activity participation, symptoms, clinical outcomes and SARS-CoV2 testing results. We recorded duration of self-isolation, meetings or patient encounters conducted prior to entering isolation, and awareness of transmission to family members, co-workers or patients. Public health authorities in the Canadian provinces where participants reside collected upper respiratory tract samples and tested for SARS-CoV2 by reverse transcriptase polymerase chain reaction (RT-PCR) according to local protocols.

Case Definitions

Symptomatic participants were defined as “confirmed case” if they had laboratory-confirmed results for SARS-CoV2 using RT-PCR of upper respiratory tract samples (nasal, nasopharyngeal or throat), at any point during the course of their symptoms. Participants with symptoms who tested negative, or who were not tested, were categorized as either a “presumptive case” or “non-specific case” by consensus amongst authors. As anosmia is recognized as a strong indicator of SARS-CoV2 positivity, cases with loss of smell were categorized as presumptive cases (3).

Analysis and statistics

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Continuous variables were summarized and results reported as median and interquartile range, while categorical variables were summarized as counts and percentages. Pearson chi-squared test was used to compare the proportions of symptomatic and asymptomatic groups attending various social events. Comparison of non-normally distributed data was done using the Kruskal Wallis test and pairwise comparisons using the Mann-Whitney U tests. Analysis was performed using SPSS™ version 26 (IBM Corporation).

Ethics

This study was approved by Conjoint Health Research Ethics Board at the University of Calgary (Ethics ID:REB20-0514). Subjects received a copy of the consent form by email and provided verbal consent by phone.

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RESULTS

Table 1 summarizes the demographic details of the bonspiel participants. Of the 73 curlers, 59 are physicians. The median age was 51, with one-quarter being above the age of 60, and the majority (75.3%) were male. Twenty-seven participants (37%) reported international travel in the 28 days preceding the bonspiel, with travel to USA being the most common destination. Interestingly, a higher of proportion of travel was seen amongst asymptomatic subjects (47.2% vs 35.7%), although this was not statistically significant (p=0.326).

Fifty-six participants developed symptoms, 40 (54.8%) ultimately tested positive for SARS-CoV2 by RT-PCR. Eight of the 11 presumptive cases and all five of the non-specific cases were tested and found to be negative. Six of 17 participants who did not develop symptoms were tested and found to be negative (Figure 1). Non-specific symptomatic cases had shorter median duration of symptoms (3 days, IQR 2.8-

6.5) compared to presumptive cases (16 days, IQR 11.8-27) and confirmed cases (11 days, IQR 7-15.3; p<0.002) (*Supplemental Figure 2*). Among confirmed cases, six individuals initially tested negative (4 negative, 2 indeterminate) but tested positive on repeat testing within a median of 3 days (IQR 1.5-5.3) of initial test. The estimated sensitivity of SARS-CoV2 testing by RT-PCR of upper respiratory tract samples is therefore 70.8%, based on the initial testing results of symptomatic individuals in this cohort.

The most common symptoms described among confirmed and presumptive COVID-19 positive cases were nasal congestion/rhinorrhea (82.4%), cough (76.5%), myalgia (74.5%), anosmia with aguesia (loss of taste)/dysguesia (altered taste) (74.5%), and headache (62.7%) (Figure 2). Fatigue and exhaustion were common (62.7%), and were reported more commonly in presumptive cases. Fever was only seen in 50% of confirmed cases and was less commonly seen in presumptive cases, in which chills was more common. Sore throat was seen (45.1%) and in total 70.6% had gastrointestinal symptoms (including anorexia, diarrhea, nausea, abdominal pain and dyspepsia).

Some symptoms including night sweats, productive cough, dyspnea and gastrointestinal symptoms tended to occur later in the course (Figure 3). Anosmia was reported by 32 cases, and was associated with aguesia or dysguesia in the majority (75%). In one confirmed positive case, anosmia was the only symptom. Although anosmia could be present at onset of illness, the median onset was at 4 days (IQR 2-5.3). At the time of data collection, all but four cases had fully recovered their sense of smell.

Fortunately, the clinical course was mild for most. Symptomatic cases reported use of acetaminophen (60.7%), non-steroidal anti-inflammatories (23.2%), and decongestants (17.9%), but no use of experimental therapies. Only three individuals (5.9%) formally sought advice from a physician. One

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subject was assessed in the emergency department, where chest X-ray was normal and blood work demonstrated only mild lymphopenia. No participants were hospitalized and there was no mortality.

Three days after conclusion of the event, we became aware of the first confirmed positive case, leading to the isolation of all curlers within 72 hours (Figure 4). The median isolation for symptomatic curlers was 17 days (range 10-30). In a few cases, symptoms of fatigue or intermittent dry cough (possibly post-viral) persisted for several weeks, beyond the end of isolation.

From the beginning of the event, the median time to symptom onset was 6 days (IQR 4.5-8), consistent with the known incubation period of SARS-CoV2. In retrospect, ten participants identified that they had mild symptoms during the bonspiel (Figure 4). None of these individuals had symptoms consistent with the clinical case definition at the time and only three had travelled internationally prior to the event. These individuals reported mild, non-specific symptoms, including fatigue, myalgia, sore throat, nasal congestion, rhinorrhea, diarrhea, and indigestion and only two curlers reported mild cough. Two curlers withdrew from the event after the first day, and one did not participate on the final day because of their mild symptoms.

Four curlers developed symptoms more than 14 days after the onset of event (Figure 4). Three of these curlers were spouses of other confirmed cases, indicating possible secondary transmission in the home. Participants reported that 35 family members also developed symptoms consistent with COVID-19 (12 tested positive), of which only three were present at the bonspiel. Forty (54.8%) bonspiel participants reported having meetings or seeing patients before entering isolation and six (9.2%) reported being aware of a co-worker or patient subsequently testing positive for COVID-19.

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An analysis of social events at the bonspiel (Table 1), highlighted a significantly greater proportion of symptomatic cases attended the buffet style lunches at the curling rink (98.2% vs. 70.6%; p=0.002). Specifically, confirmed and presumptive cases were more likely to have attended the lunches than those with non-specific or no symptoms (98.0% vs. 77.3%; p=0.003).

INTERPRETATION

Seventeen of 18 teams who participated in the bonspiel had at least one confirmed case of COVID-19, with one team having all four members affected. Our high attack rate (76.7% of curlers were confirmed or presumptive cases), highlights the infectivity of SARS-CoV2 during sporting and social events. At the time of the event, public health officials had recommended gathering should be restricted to fewer than 250 individuals. During the event, we took precautions including not shaking hands and disinfecting the curling stones between games. However, our analysis suggests that attending buffet lunches may have been important for transmission. These findings are particularly relevant as we begin to ease physical distancing restrictions.

Our study represents one of the largest single outbreak events documented amongst physicians, and highlights that community transmission can be an important mode of infection in healthcare workers (HCWs). A recent analysis of occupational risk in Alberta, found the overall risk amongst HCWs to be 0.14% compared with 0.1% risk in the community (absolute occupational risk of 0.01%), with 20 of 22 cases of COVID-19 amongst Alberta physicians being related to this bonspiel (4). HCWs worry about the risk of transmitting SARS-CoV2 to their family members (5), and in our study symptomatic curlers reported that 35 family members developed symptoms of COVID-19 with 12 confirmed positive by RT-PCR. This appears higher than the secondary clinical attack rate of 4.6% (95%CI, 2.3%-9.3%) reported among 151 household contacts in a study from Taiwan (6).

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Eligibility criteria for SARS-CoV2 testing varied by Canadian province and evolved over time during the early days of the pandemic. In mid to late March, clinical criteria (fever or cough or dyspnea) and a risk factor (contact with a known or suspected COVID-19 case or return from international travel within 14 days) were required in most jurisdictions to qualify for testing. As one early case in our cohort was eligible for immediate testing and promptly received a positive result, we were able to self-isolate and expedite testing for other participants. More than half of bonspiel participants reported having meetings or seeing patients before entering isolation, but only six (9.2%) reported being aware of a co-worker or patient subsequently testing positive for COVID-19. Our early access to testing, and the rapidly reporting of results, likely prevented the secondary spread of SARS-CoV2 during our outbreak.

Our confirmed cases reported cough (80%), fever (50%), and dyspnea (30%) at any time during their illness; however, 19.6% never had any of these symptoms. Based on our analysis, the clinical spectrum of COVID-19 varies widely from person to person and includes influenza like illness (ILI) symptoms, but also atypical symptoms such anosmia, noted in over three-quarters of our confirmed or presumed cases. A recent systematic review and meta-analysis of ten studies (n= 1627) demonstrated olfactory dysfunction in 52.7% (95%CI: 29.6%-75.2%) of COVID-19 patients (7). Another study of 803 HCWs from the Netherlands with mild symptoms (90 positive for SARS-CoV2) found that anosmia was the most important symptom in a predictive model to diagnose SARS-CoV2 (3). Our study, demonstrates that anosmia tends to occur a few days after onset of other symptoms (Figure 3), but it can occur without other symptoms such as nasal congestion or rhinorrhea in 15.7% of patients. In fact, anosmia was the only symptom for one of our confirmed cases.

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As we continue to learn more about this novel pathogen, it is important to recognize and consider atypical symptoms as part of the expanding clinical case definition of COVID-19 (Table 2). On April 27, 2020, the Center for Disease Control (CDC) added additional symptoms to qualify individuals for SARS-CoV-2 testing. Similarly, on May 4, 2020, Alberta Public Health officials expanded the list of symptoms. Our data supports this expanded case definition list and we encourage the Public Health Agency of Canada to update their information for Canadians.

The sensitivity of initial SARS-CoV2 RT-PCR testing in our cohort is estimated to be 70.8%, which is consistent with a 60-70% sensitivity of a single nasopharyngeal or pharyngeal swab reported in the literature (8,9). The accuracy of nucleic acid tests is likely affected by a number of factors including lack of a reference standard, variable collection technique, type of swab used and variable viral shedding at different time points (10). Our false negative results were obtained from nasal swabs (4 cases) or nasal and throat swabs together (2 cases). Results of nucleic acid testing obtained from the upper respiratory tract must be interpreted in the context of symptoms and clinical suspicion (pre-test probability). Given the limitations of current nucleic acid based testing strategies, there is worldwide interest in developing serologic assays in the hope of better understanding the true epidemiology of this novel coronavirus in the community. However, a number of questions regarding the usefulness of serologic assays, including the specificity for SARS-CoV-2 with respect to other known coronaviruses, as well as the durability of protection provided by IgG immune response (11).

The next phase of this study will examine serology in all bonspiel participants to compare to our clinical definitions and RT-PCR testing. Our data suggests there may have been more than one introduction event into this cohort rather than a single index case. However, this is difficult to confirm based on only

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epidemiologic methodology. To explore the transmission dynamics SARS-CoV2 infection in this community-based outbreak, we hope to perform phylogenetic analysis of the positive samples.

Our study has limitations. RT-PCR testing was not available for all symptomatic participants. No "gold standard" test is currently available to confirm SARS-CoV2 infection; as such, we used a clinical case definition in this study. As many symptoms of SARS-CoV2 infection are similar to other ILI, the use of a clinical case definition may not be entirely accurate. We recognize that the retrospective nature of data collection may have been influenced by emerging reports of atypical symptoms, and we did not use a validated test of anosmia. Complete public health contact tracing data of each participant was not available to the study team for comparison. Therefore, the estimate of possible secondary spread of SARS-CoV2 to close contacts outside of the bonspiel cohort may be an underestimate.

CONCLUSIONS

This study describes the variable clinical presentation of COVID-19 among a group of healthcare providers in a community setting. In addition to fever, cough and dyspnea, unusual symptoms such as anosmia are common and should be included in clinical case definition of COVID-19. It highlights how quickly SARS-CoV2 can spread between asymptomatic or pauci-symptomatic individuals gathering for social or sporting events. Due to the limited sensitivity of RT-PCR testing from upper respiratory tract samples, it is important to isolate all symptomatic individuals, particularly in a health care setting, to prevent further spread of SARS-CoV2.

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TABLES

TABLE 1. Clinical characteristics of participants according to symptoms.

Characteristics	All Participants (N = 73)	Symptomatic (N = 56)	Asymptomatic (N = 17)	*p*-value
Median age (IQR range) – years	51 (39 – 60)	51 (39 – 60)	54 (49 – 68)	
Age distribution – no. (%)				
20-29 years	4 (5.5)	3 (5.4)	1 (5.9)	
30-39 years	18 (24.7)	16 (28.6)	2 (11.8)	
40-49 years	9 (12.3)	7 (12.5)	2 (11.8)	
50-59 years	23 (31.5)	18 (32.1)	5 (29.4)	
60-69 years	14 (19.2)	10 (17.9)	4 (23.5)	
70-79 years	5 (6.8)	2 (3.6)	3 (17.6)	
Female sex – no. (%)	18 (24.7)	15 (26.8)	3 (17.6)	
Occupation – no. (%)				
Physician	53 (72.6)	42 (75)	11 (64.7)	
Other health care worker	3 (4.1)	3 (5.4)	0 (0)	
Other	17 (23.3)	11 (19.6)	6 (35.3)	
Residence – no. (%)				
Alberta	46 (63)	36 (64.3)	11 (58.8)	
Saskatchewan	20 (27.4)	14 (25)	6 (35.3)	
Ontario	4 (5.5)	3 (5.4)	1 (5.9)	
Manitoba	3 (4.1)	3 (5.4)	0 (0)	
International travel within 4 weeks – no. (%)				
Total	27 (37)	19 (35.7)	8 (47.2)	0.326
USA	20 (27.4)	13 (23.2)	7 (41.2)	
Caribbean / Central America	3 (4.1)	2 (3.6)	1 (5.9)	
Africa	1 (1.4)	1 (1.8)	0 (0)	
Asia	1 (1.4)	1 (1.8)	0 (0)	
Europe	1 (1.4)	1 (1.8)	0 (0)	
Activities – no. (%)				
Did you participate in the following activities?				
Curling				
Thursday	71 (97.3)	55 (98.2)	16 (94.1)	0.365
Friday	68 (93.2)	52 (92.9)	16 (94.1)	0.857
Saturday	63 (80.1)	51 (84)	12 (70.6)	0.394
Social Events				
Wednesday Evening Reception	57 (78.1)	45 (80.4)	12 (70.6)	0.395
Thursday Evening Bowling	34 (46.6)	27 (48.2)	7 (41.2)	0.610
Saturday Evening Banquet	46 (65.8)	37 (66.1)	9 (52.9)	0.326
Hotel Breakfasts	48 (65.8)	38 (67.9)	10 (58.8)	0.492
Curling Rink Buffet Lunches	67 (91.8)	55 (98.2)	12 (70.6)	**0.002**

no. = number, IQR = interquartile range

TABLE 2. Clinical Case Definition for COVID-19 Based on Symptoms		
Health Canada	Alberta Public Health (updated May 4, 2020)	Center for Disease Control (updated April 27, 2020)
Cough Fever Difficulty breathing Pneumonia in both lungs	Cough (new cough or worsening chronic cough) Fever Shortness of breath or difficulty breathing (new or worsening) Chills Muscle or joint aches Sore throat Loss of sense of smell or taste Runny nose Stuffy nose Painful swallowing Headache Feeling unwell in general, or new fatigue or severe exhaustion Gastrointestinal symptoms (nausea, vomiting, diarrhea or unexplained loss of appetite) Conjunctivitis, commonly known as pink eye	Cough Fever Shortness of breath or difficulty breathing Chills Muscle pain Sore throat New loss of taste or smell

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FIGURE 1. Number of bonspiel participants with confirmed COVID-19 (swab positive), presumptive COVID-19 (swab negative or not done), other non-specific symptoms (swab negative), or no symptoms.

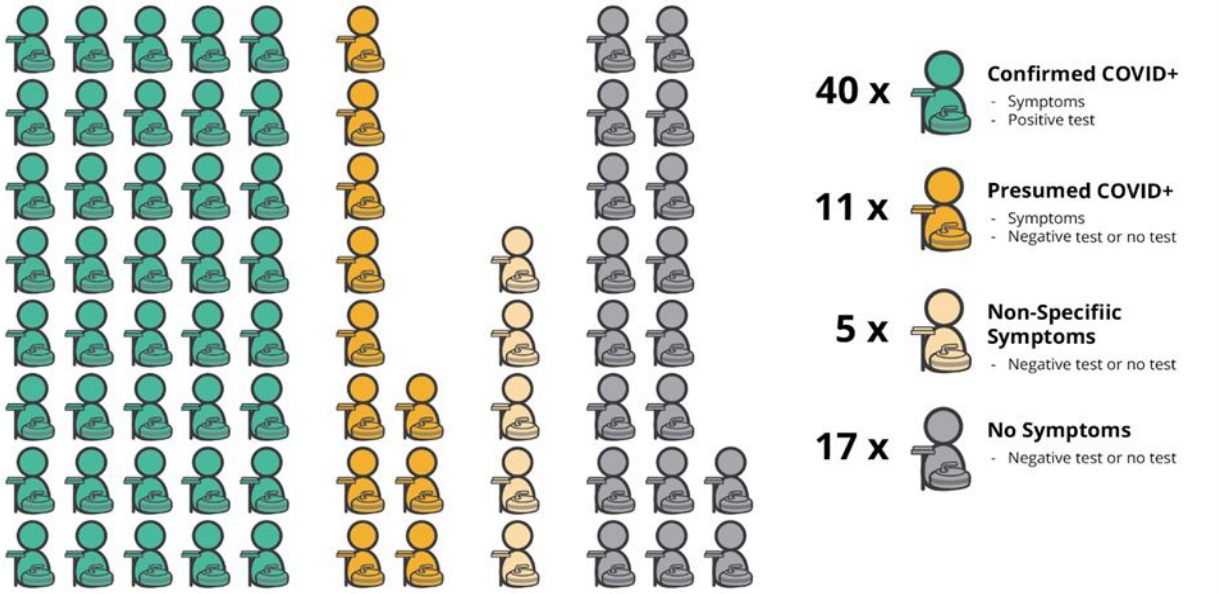

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FIGURE 2. Frequency of symptoms amongst confirmed COVID-19 (swab positive) and presumptive COVID-19 (swab negative or not done) cases.

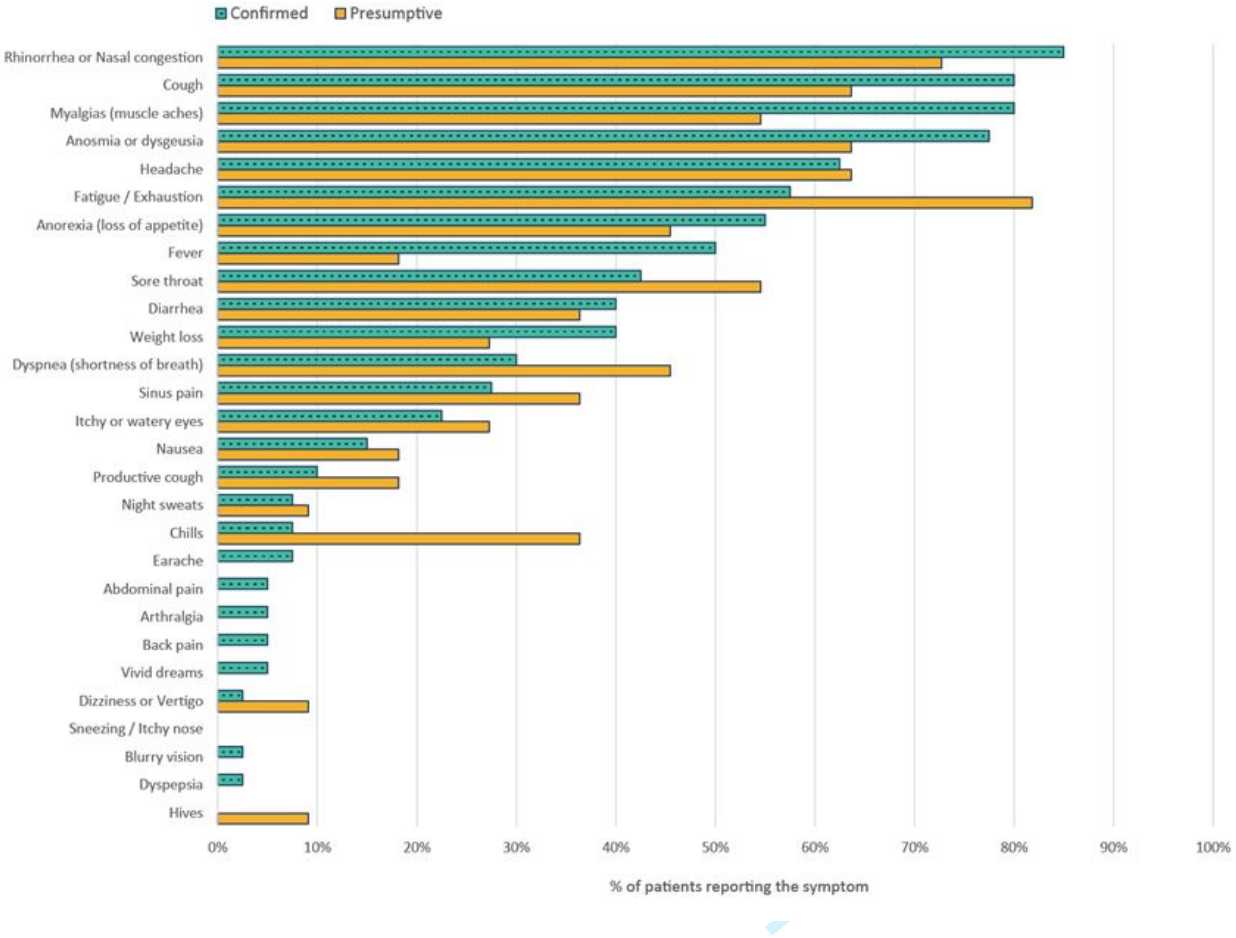


FIGURE 3. The median onset of common symptoms amongst confirmed and presumptive COVID-19 cases. Dysguesia (altered taste) includes 18 with aguesia (loss of taste). Box and whiskers plots show the median, interquartile ranges (IQR). Outliers within three times IQR are shown with open circles, and those outside by an asterisk (*).

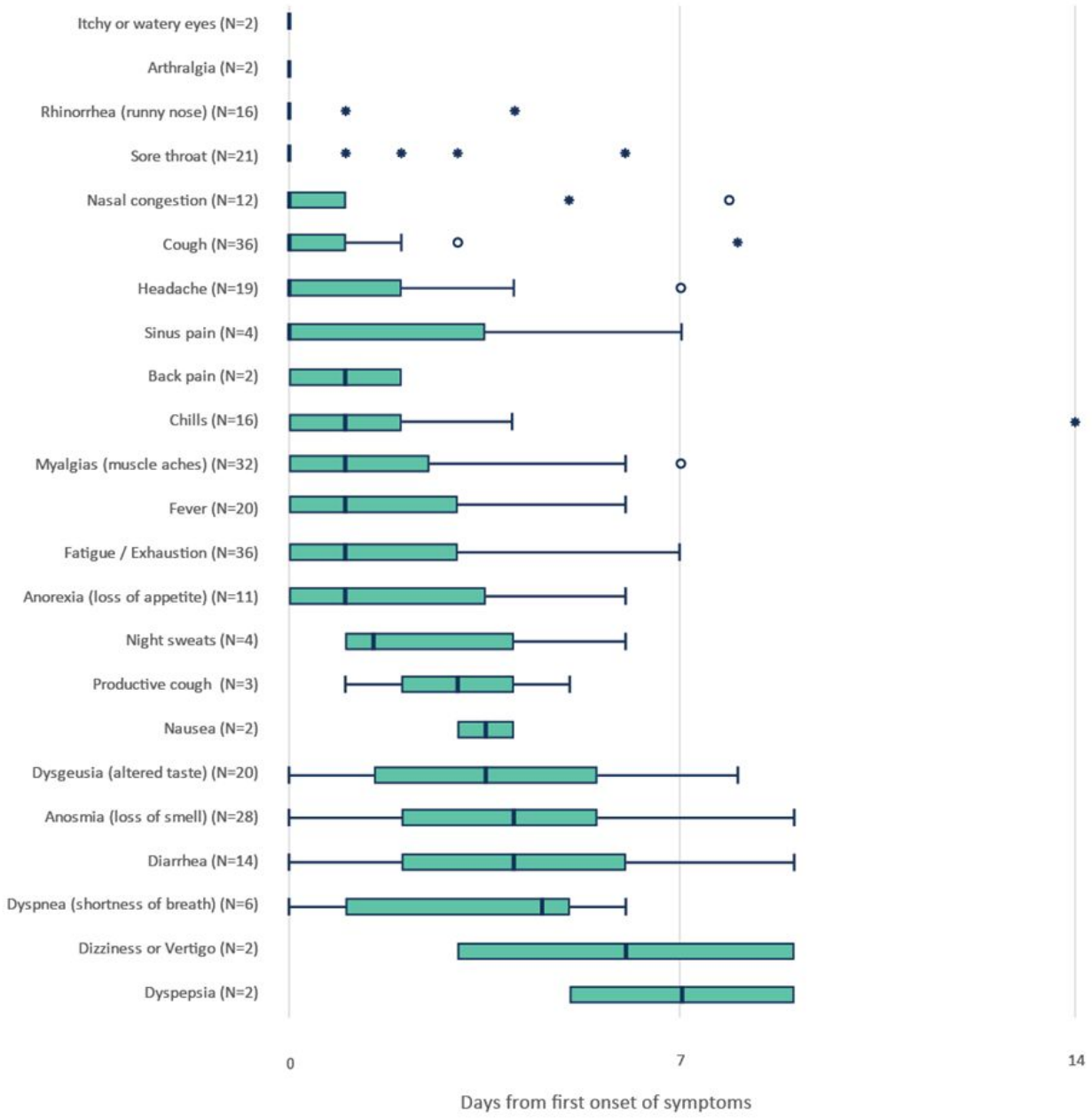
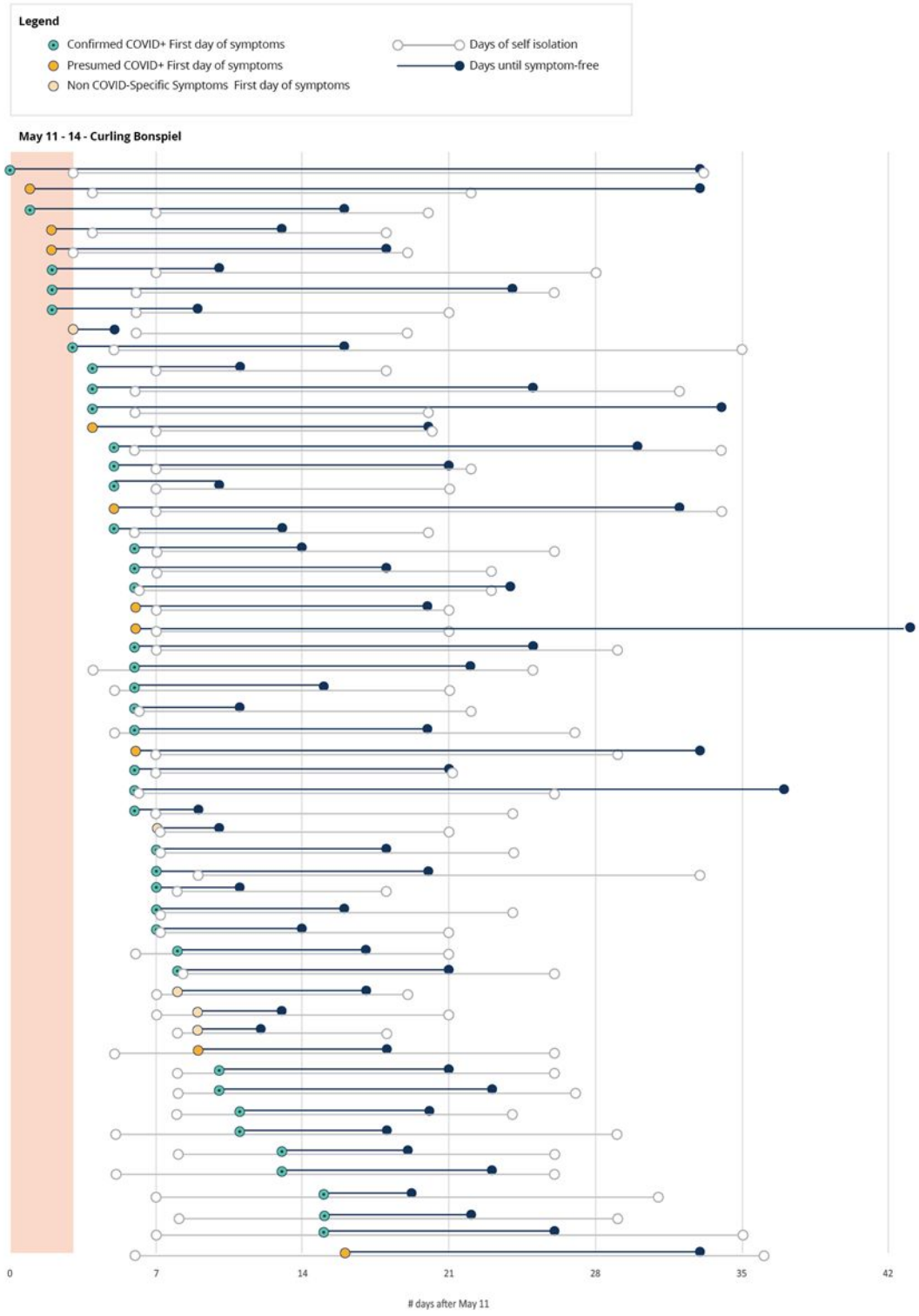


FIGURE 4. In relation to the event, the onset and duration of symptoms and isolation in confirmed COVID-19 (swab positive), presumptive COVID-19 (swab negative or not done), other non-specific symptoms (swab negative) cases.



SUPPLEMENTAL APPENDIX

FIGURE S1. COVID-19 Cases in Alberta, Canada. Image source: www.CHI-CSM.ca [downloaded May 15, 2020].

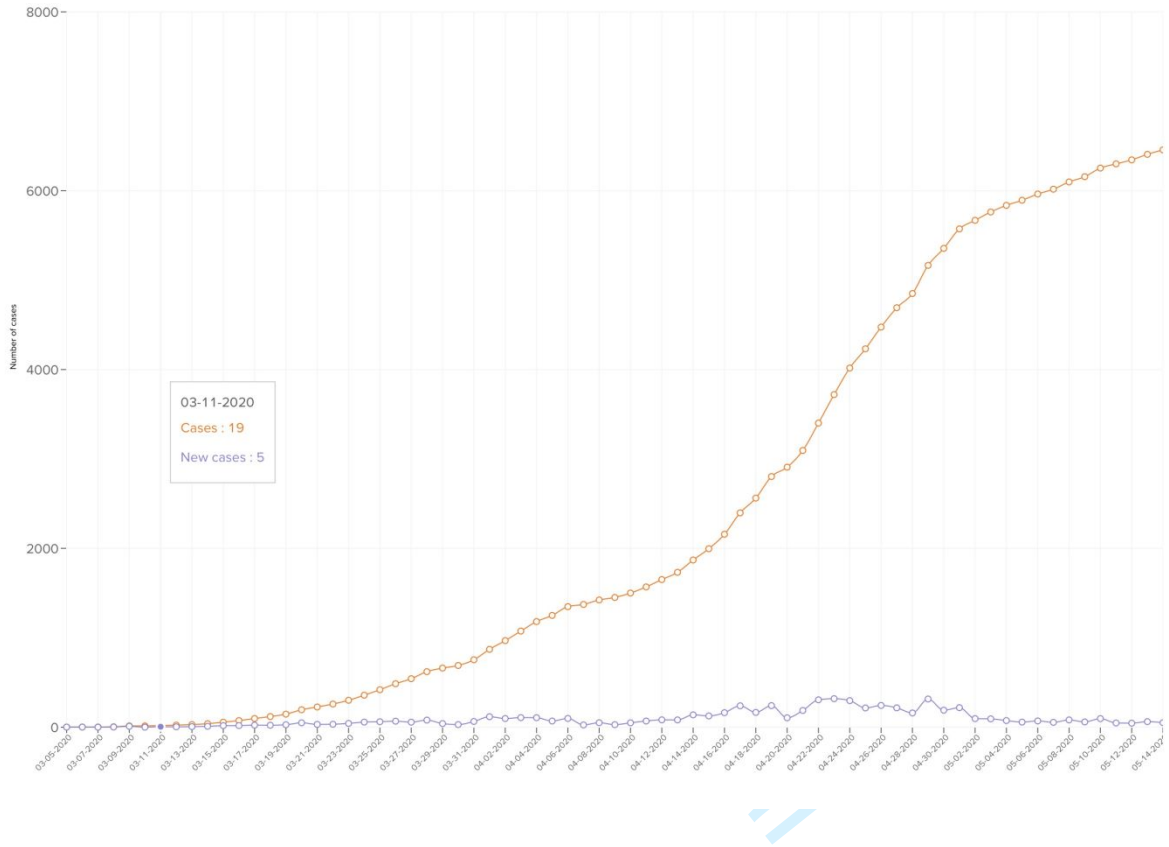


FIGURE S2. The median duration patients experienced symptoms amongst confirmed and presumptive COVID-19 cases compared to those showing non-specific symptoms. Box and whiskers plots show the median, interquartile ranges (IQR). Outliers within three times IQR are shown with open circles, and those outside by an asterisk (*). The median duration of symptoms was significantly affected by COVID-19 status ($p<0.002$), with those experiencing non-specific symptoms experiencing significantly shorter durations (3 days, IQR 2.8-6.5) compared to presumptive cases (16 days, IQR 11.8-27, $p=0.003$). Presumptive cases experienced symptoms for significantly longer than confirmed cases of COVID-19 (11 days, IQR 7-15.3; $p=0.036$).