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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Brief Report

Asymptomatic carriers of COVID-19 in a confined adult community population in Quebec: A cross-sectional study

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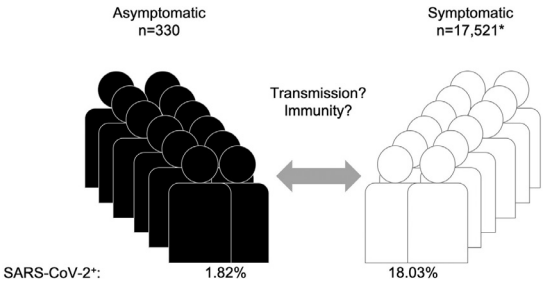
Asymptomatic frequency estimate during lockdown. * According to public data during the time of the study.



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Several countries have undertaken social distancing measures to stop SARS-CoV-2 spread. Asymptomatic carriers' prevalence is unknown and would provide essential information on hidden viral circulation. In our cross-sectional study, 1.82% of 330 asymptomatic confined individuals living in the community carried SARS-CoV-2 despite no contact with declared cases, raising concerns about unnoticed transmission.

As of August 9th 2020, nearly 20 million individuals contracted COVID-19 and about 720,000 died.[1] The United States counts for one fourth of these cases. SARS-CoV-2 transmission occurs principally through respiratory droplets or direct contact.[2] Viral load peaks before or at the time of symptoms onset, raising the possibility that presymptomatic people significantly contribute to viral spread.[3, 4] Other individuals remain asymptomatic despite viral detection, suggesting that they may participate in transmission.[5-7]

Studies conducted on individuals from the same households have convincingly shown that presymptomatic or asymptomatic SARS-CoV-2 carriers might transmit to their family members.[8-10] In a long-term care facility, 23 (30.3%) residents carried the virus, including 13 asymptomatic of the 76 that were tested.[11] An investigation on the Diamond Princess cruise ship in Japan identified 17.9% of SARS-CoV-2 infected cases as asymptomatic.[12] All these reports were carried out in a specific context of strong contacts between individuals.

Very few studies have assessed the proportion of asymptomatic individuals in the reality of a community that followed social distancing measures. In an isolated city of Italy, screening 3 thousand

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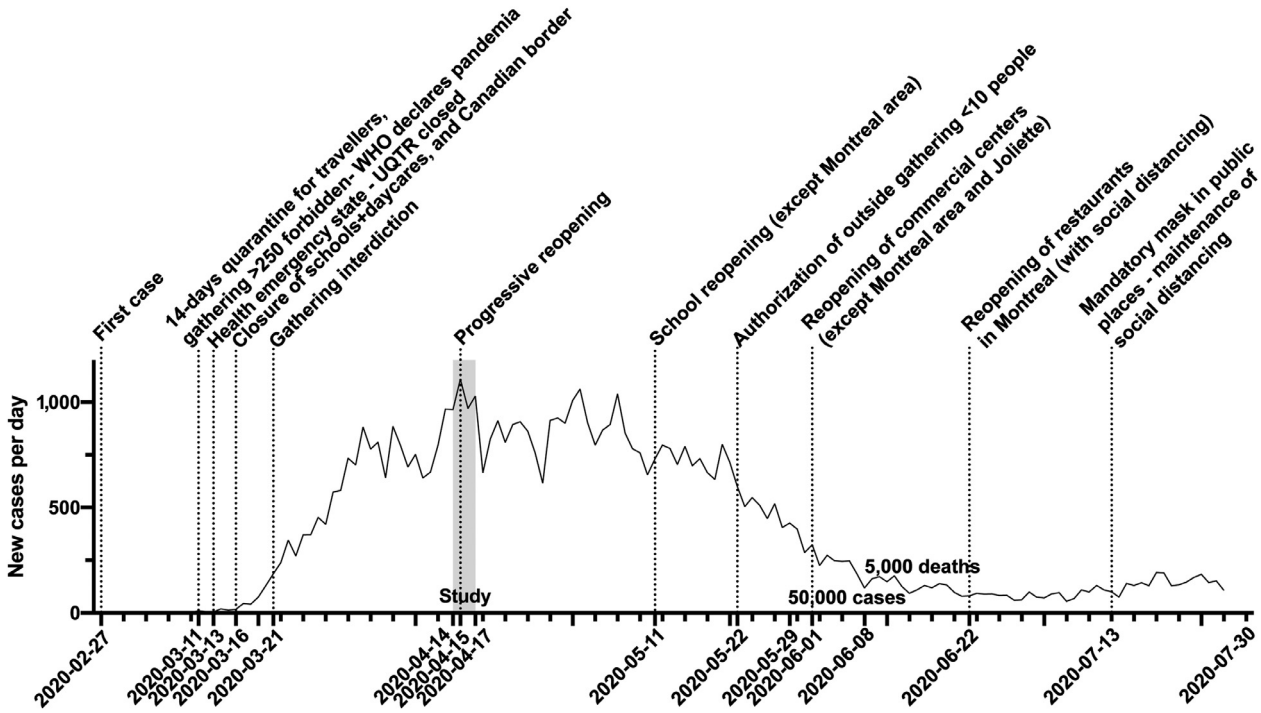

Fig. Timeline of new cases count and of socio-sanitary measures implementation. In the province of Quebec, the first case was declared on February 27th, 2020. On March 11th, travelers were isolated at home for 14 days upon return, and gatherings of more than 250 people were forbidden. On March 13th, the health emergency state was declared. On March 14th, nonessential visits to hospitals and long-term care facilities were prohibited. Between March 15th and April 5th, borders, public places, daycares, schools, businesses, nonessential services were closed, social distancing measures were implemented, gatherings of more than 5 individuals and travels between regions were prohibited. This study was conducted between April 14th (612 positive cases on that day for a total of 14 860, a prevalence of 0,173% and an incidence of 0,007%) to April 17th (723 positive cases for a total of 17,521; a prevalence of 0,204% and an incidence of 0,008%) (data have been extracted from public health resources [22]).

individuals lead to the identification of 88 carriers, including 50-75% of asymptomatic individuals.[13,14] Nishiura et al. reported 13 SARS-CoV-2 positive individuals, including 4 (30.8%) asymptomatic, corresponding to a prevalence of 0,7% out of 564 citizens evacuated from Wuhan.[15] These investigations depict a wide range of possible rates for asymptomatic carriers and their proportion in a confined environment remains unknown, especially in the North American context. Despite early social distancing measures, Quebec is one of the most impacted nation with 735 confirmed cases per 100,000 individuals and a fatality rate of 675 per million.[16]

Our cross-sectional study was held between April 14th and 17th, 2020 in the Mauricie region, Québec, Canada. We aimed to identify the proportion of asymptomatic carriers in a confined community of adults. The term *confinement* is used herein to reflect social restrictions instructed by Quebec's government, progressively implemented starting on March 11th (Fig 1). On April 17th, the last day of this study, 723 positive cases were identified for a total of 17,521 with a prevalence of 0.204% and an incidence of 0.008% in the Quebec's Province.

THE STUDY

A total of 2,250 employees between 18 and 69 years old from the Université du Québec à Trois-Rivières (UQTR) residing in the region were solicited by email on April 13th 2020 after exactly 1 month of confinement. Informed consent was obtained from all participants by using an online secured platform. The study was approved by the Ethical committees of the 3 implicated institutions. Recruited participants were asked to fill out an online questionnaire to evaluate inclusion and exclusion criteria. Individuals presenting COVID-19 symptoms were excluded (supplemental methods). A second form was used within 24 hours post-test. The protocol included a recommendation to seek medical attention if any COVID-19-related symptoms emerged. A dedicated clinic where nurses collected a single upper respiratory tract specimen (oropharyngeal and nares swab) was set up (supplemental methods). Detection of SARS-CoV-2 was performed the day of collection by direct rRT-PCR using See Gene Allplex 2019-nCoV Assay, approved by Health Canada [17](supplemental methods). Out of 2,250 potential participants, swabs

Table 1
Attitudes towards social distancing measures and perception of self conduct towards the measures of confinement (Likert scale 1-7)

	Last 2 weeks of March		First 2 weeks of April	
	Positive cases (n = 6)	Negative cases (n = 306)	Positive cases (n = 6)	Negative cases (n = 306)
	M ± ET	M ± ET	M ± ET	M ± ET
Agreement towards social distancing measures	1.17 ± 0.41	1.25 ± 0.60	1.17 ± 0.41	1.18 ± 0.41
Perception of self-conduct towards social distancing measures	1.17 ± 0.41	1.32 ± 0.69	1.33 ± 0.52	1.24 ± 0.53

Attitudes towards measures of social distancing and confinement were analysed through a Likert scale ranging from 1 to 7; 1 being complete agreement. Results presented in Table 1 show very little variation in the scores. All participants being very much in agreement with the measures issued by the government during the 2 periods. The vast majority also stated that they were abiding by those rules. All differences noted between groups and within groups were not statistically significant.

were collected from 330 individuals, including 210 women (63.6%) and 120 men (36.4%) of age 45.7 ± 11.2 years [18.6-69.8] (Table 1). We detected 6 SARS-CoV-2-infected individuals (1.82%; ranging from 0% to 4%; CI = 87.5%) at C_t values ranging from 36.7 to 38.6. For that same period, a mean of 18.03% of tested symptomatic people carried the virus in Quebec's Province (Fig).[16]

Four of 6 positive-participants had travelled to North and Central America within the past 6 months and their trip lasted 5-16 days. The last return was on March 16th 2020. None of the SARS-CoV-2-positive cases reported symptom at time of post-test questionnaire. In a nonofficial statement to the local press, 1 participant reported experiencing cough and general fatigue a few days later.[18]

None of the SARS-CoV-2-positive individuals reported having contacts with COVID-19 patients. Both negative and positive individuals agreed with and respected confinement rules, and left their home only a few times a week (Table 1).

CONCLUSION

Our study identified 1,82% of asymptomatic carriers in a confined community. Their presence could be explained by 3 scenarios. First, they could be in fact presymptomatic individuals, as viral load peaks at the time of, or before symptoms onset.[12,19] Our study was not designed to assess this possibility if symptoms developed later than 24-hour post-test. Second, following symptomatic infection, some cases experience prolonged viral nucleic acids detection by rRT-PCR.[20] Consequently, some individuals could be postsymptomatic cases with residual viral shedding that were not screened at the beginning of the pandemic.

The third possibility is true asymptomatic infection. The rate of this kind of infection is unknown. Presymptomatic people significantly contribute to viral spread, but we do not know if true asymptomatic and late postsymptomatic participate in transmission at this point. All positive cases had high C_t values, which most probably reflects low viral shedding, although data are sparse on correlation between C_t values and contagiousness.

1,82% of asymptomatic carriers is high when compared to the 0,204% prevalence. However, there were 18.03% of carriers among the thousands of screened symptomatic individuals in the Province, ten times more than in our asymptomatic cohort. Our sample size is relatively small. At the time we designed our study, supplies in lab materials and staff availability were problematic, we chose a convenience sample size. Rates of asymptomatic carriers could be different in high-density urban area and in population with different socioeconomic characteristics.

Despite its limitations, this is the first methodically designed study that evaluates the rate of asymptomatic carriers in a confined population. Six SARS-CoV-2 asymptomatic carriers that agreed with social distancing measures is a significant number and could suggest that prevalence is underestimated. This could represent ~100,000 asymptomatic carriers at the scale of the adult population of Quebec's Province at the time of this study. Interestingly, a preliminary analysis of the seroprevalence on 7,691 blood donors from Québec reported a similar rate of positivity.[21] Our results raise concerns about the possibility of viral spread through asymptomatic transmission, specifically in the context of an apprehended resurgence of SARS-CoV-2 infections following deconfinement. Since public health focuses on symptomatic cases, it is urgent to determine if asymptomatic cases contribute to transmission and to elucidate the dynamics of SARS-CoV-2 in distinct populations.

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SUPPLEMENTARY MATERIALS

Supplementary material associated with this article can be found in the online version at https://doi.org/10.1016/j.ajic.2020.08.015.

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