Assessment of an enhanced COVID-19 case and contact management protocol in controlling a SARS-CoV-2 Alpha (B.1.1.7) variant outbreak on a construction site

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BACKGROUND: To control the spread of SARS-CoV-2 variants of concern (VOCs), Kingston, Frontenac, and Lennox & Addington (KFL&A) Public Health implemented a more stringent COVID-19 case and contact management (CCM) protocol than what was used across Ontario at the time. We describe epidemiological data and public health measures employed during one of the largest COVID-19 outbreaks in the KFL&A region at the time, caused by the SARS-CoV-2 Alpha (B.1.1.7) VOC, to assess this enhanced protocol. **METHODS:** We obtained line lists of workers associated with the construction site outbreak, and subsequent cases and contacts from case investigators. Case testing, mutation status, and whole genome sequencing were conducted by Public Health Ontario Laboratories. **RESULTS:** From 409 high-risk contacts of the outbreak, 109 (27%) developed COVID-19. Three generations of spread were associated with the outbreak, affecting seven public health regions across three provinces. Using an enhanced approach to the CCM, KFL&A Public Health caught 15 cases that could have been missed by standard provincial protocols. **CONCLUSIONS:** Rapid initial spread within the construction site produced a relatively high attack rate among workers (26%) and their immediate contacts (34%). KFL&A Public Health's implementation of stringent CCM protocols and fast testing turn-around time effectively curbed the spread of the disease in subsequent generations – illustrated by the large reduction in attack rate (34%–14%) and cases (50–10) between the second and third generations. Lessons learned from this analysis may inform guidance on the CCM for future SARS-CoV-2 VOCs as well as other highly transmissible communicable diseases.

KEYWORDS: case and contact management, COVID-19, outbreak management, public health, SARS-CoV-2

HISTORIQUE : Pour contrôler la propagation des variants inquiétants (VOC) du SRAS-CoV-2, la région sociosanitaire de Kingston, Frontenac, Lennox et Addington (KFL&A) a adopté un protocole plus rigoureux de gestion des cas et des contacts (GCC) qui était utilisé partout en Ontario à l'époque. Les auteurs décrivent les données épidémiologiques et les mesures sanitaires employées pendant l'une des plus grosses éclosions de COVID-19 de la région sociosanitaire de KFL&A, causée par le VOC Alpha (B.1.1.7) du SRAS-CoV-2, afin d'évaluer ce protocole amélioré. **MÉTHODOLOGIE :** Les auteurs ont obtenu les listes des lignes des travailleurs associés à l'éclosion sur le chantier de construction, ainsi que des cas et des contacts subséquents des enquêteurs de cas. Les Laboratoires de Santé publique Ontario ont procédé au dépistage des cas et ont vérifié l'état mutationnel et le séquençage du génome entier. **RÉSULTATS :** Des 409 contacts à haut risque de l'éclosion, 109 (27%) ont contracté la COVID-19. Trois générations de propagation étaient associées à l'éclosion et touchaient sept régions sociosanitaires réparties dans trois provinces. Au moyen d'une approche améliorée de la GCC, la région sociosanitaire de KFL&A a dépisté 15 cas qui auraient pu être omis par les protocoles provinciaux standards. **CONCLUSIONS :** Une propagation initiale rapide sur le chantier de construction a produit un taux d'attaque relativement élevé chez les travailleurs (26%) et leurs contacts immédiats (34%). L'adoption de protocoles rigoureux de GCC dans la région sociosanitaire de KFL&A et l'obtention rapide des résultats du dépistage ont enrayé la propagation de la maladie avec efficacité dans les générations suivantes, ce qui est démontré par une forte réduction du taux d'attaque (de 34% à 14%) et de cas (de 50 à 10) entre la deuxiéme génération et la troisiéme. Les leçons tirées de cette analyse pourraient éclairer les conseils sur la GCC des futurs VOC du SRAS-COV-2 et des autres maladies contagieuses hautement transmissibles.

MOTS-CLÉS : COVID-19, gestion des cas et des contacts, gestion des éclosions, santé publique, SRAS-CoV-2

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INTRODUCTION

The SARS-CoV-2 Alpha (B.1.1.7) variant was first identified in the United Kingdom in September 2020. This was the first SARS-CoV-2 strain deemed a variant of concern (VOC) by the World Health Organization, due to its increased transmissibility and virulence on a global scale (1). To help control the spread of this SARS-CoV-2 VOC in addition to other circulating VOCs, Kingston, Frontenac, and Lennox & Addington (KFL&A) Public Health implemented a more stringent case and contact management (CCM) protocol than what was used throughout Ontario at the time (2). This enhanced approach differed from provincial guidance at the time by incorporating a more robust testing regimen for high-risk contacts, quarantine of household members of high-risk contacts, and extension of the period of communicability for cases. Specific differences between these protocols are outlined in Table 1. These protocols were rationalized by KFL&A Public Health using an evidence-based approach, taking into account the increased transmissibility of SARS-CoV-2 VOCs, the role of transmission from asymptomatic and pre-symptomatic individuals, with the precautionary principle in mind given the uncertainties surrounding the impact of VOCs.

At the time of the investigated SARS-CoV-2 outbreak (May 2021), Ontario and the KFL&A region were experiencing a 'third wave' of COVID-19, which was primarily driven by the Alpha VOC and accounted for over 80% of cases (3). Initial evidence indicated that the Alpha VOC was more transmissible and resulted in more severe disease than non-VOC SARS-CoV-2, although this was based on preliminary data (4). Due to the limited availability of COVID-19 vaccines at the time, only individuals in certain high-risk groups were eligible to be vaccinated. Vaccine coverage in KFL&A residents was higher than in residents of Ontario at the time, with 39.9% of KFL&A residents having received one dose of a COVID-19 vaccine compared to only 34.2% of Ontario residents (5).

Table 1: Comparison of the case and contact management used by KFL&A Public Health with the case and contact management protocol used elsewhere in Ontario at the time of a SARS-CoV-2 Alpha VOC outbreak at a construction site in the KFL&A region

	KFL&A case & contact management	Provincial case & contact management (2)
Initial (day 0) testing for high-risk contacts?	Recommended	Recommended
Mid-quarantine testing for high-risk contacts?	Recommended day 5–7 testing	No
End of quarantine (day 14) testing for high-risk contacts?	Required day 10–12 testing to break quarantine on day 14. If no day 10–12 testing, 10-day extension of quarantine	Recommended testing on or after day 10 of quarantine
Quarantine of household contacts of high-risk contacts?	Yes, household contacts must quarantine until the high-risk contact receives their negative day 10–12 test	No
Quarantine of household contacts of cases?	Yes	Yes
Period of communicability	4 days prior to diagnosis and/or symptom onset until end of isolation	2 days prior to diagnosis and/or symptom onset until end of isolation

KFL&A = Kingston, Frontenac, and Lennox & Addington; VOC = Variant of concern

Construction sites are at increased risk of SARS-CoV-2 transmission due to the inability of workers to maintain physical distancing while performing certain tasks (6). Although a provincial stay-at-home order was issued by the Government of Ontario as of April 8, 2021, construction sites deemed essential were directed to continue working throughout the order with increased infection prevention and control (IPAC) measures (7). The construction site where this outbreak occurred employed workers from multiple different regions, at a time when the provincial stay-at-home order discouraged inter- and intra-provincial travel.

We report on the epidemiological data and public health measures employed during one of the largest SARS-CoV-2 VOC outbreaks in the KFL&A region at the time to describe the effectiveness of the enhanced CCM protocol used by KFL&A Public Health. Results from this investigation will provide evidence of an enhanced COVID-19 CCM protocol, which may be used to inform guidance on controlling the spread of future SARS-CoV-2 VOCs as well as other highly transmissible communicable diseases.

METHODS

Data sources and epidemiological analysis

Cases of COVID-19 are reportable to Ontario public health units under the *Health Protection and Promotion Act* (8). Using data from Ontario's CCM system (9), we analyzed cases and subsequent spread of COVID-19 from workers associated with the outbreak. For cases that lived in a different public health region, any subsequent secondary cases were not included in this report as the enhanced CCM protocols were unique to KFL&A Public Health. Case data were collected on age, sex, potential sources of acquisition and transmission, symptom profile and associated timeline, testing date, a result reported date, health unit, mutation testing, and whole genome sequencing (WGS). Case vaccination status was collected from the central data repository for COVID-19 vaccine data and reporting in Ontario (COVaxON) (10).

The Public Health Ontario Laboratory (PHOL) in Kingston conducted real-time polymerase chain reaction (RT-PCR) on samples associated with the outbreak and reported confirmed cases according to the Ministry of Health's case definition of COVID-19 (11). Samples with sufficient viral load were assessed for SARS-CoV-2 spike gene mutations N501Y and E484K, with samples being identified as the SARS-CoV-2 Alpha VOC via mutation testing (N501Y+/E484K–) and/or WGS results, according to Public Health Ontario guidance (12). SARS-CoV-2 mutation testing results were available within 3 days on CCM, and WGS results were available within 2–4 weeks (12). KFL&A Public Health used an internal outbreak case definition as: A COVID-19 positive worker or any subsequent close contacts epidemiologically linked to a prior outbreak case, with mutation testing and/or WGS results indicative of the SARS-CoV-2 Alpha VOC.

We defined first-generation cases to be individuals who tested positive for SARS-CoV-2 and worked on the construction site, with second- and third-generation cases being those who had known SARS-CoV-2 exposure from an individual in a prior generation. KFL&A Public Health obtained line lists of workers on site each day after April 20, 2021, to determine the number of initial at-risk contacts in the first generation. The conservative decision was made to designate all these individuals as high-risk contacts, as they were on-site 7 days before the index case's reported symptom onset and therefore could have had a common exposure source. The number of high-risk contacts in second and third generations were obtained from sources of acquisition/transmission of cases in Ontario's CCM system. Risk-stratification of contacts was completed by case investigators, with high-risk contacts being identified as per provincial ministry guidelines (based on an overall assessment which included case symptomology, nature of the interaction, and presence or absence of face coverings) (13). All high-risk contacts associated with the outbreak who were residents of KFL&A were contacted by the health unit and were required to obtain at least one COVID-19 test on day 10–12 to exit quarantine, as per Table 1. The attack rate of the SARS-CoV-2 Alpha VOC for each generation was calculated as the percentage of high-risk contacts per generation who became cases during the outbreak.

RESULTS

On May 1, 2021, KFL&A Public Health identified a COVID-19 positive individual that worked on a large construction site in the region. On May 2, 2021, two more cases were identified as individuals working on the same construction site. At this time, KFL&A Public Health recommended all workers on-site undergo testing at a local assessment center. By May 4, 2021, 30 cases had been identified and associated with the construction site, leading to a declaration of the outbreak by KFL&A Public Health and voluntary closure of the construction site the same day to stop the ongoing exposure. The final first-generation case of the outbreak was tested on May 13, 2021, and the last subsequent case was reported on May 25, 2021. KFL&A Public Health declared the outbreak over on May 27, 2021, 2 weeks after the final first-generation case was tested.

A total of 109 cases of COVID-19 were associated with the outbreak between May 1 and May 25, 2021 (Figure 1). Three generations of transmission were identified by case investigators, as described in Table 2. Spread amongst workers

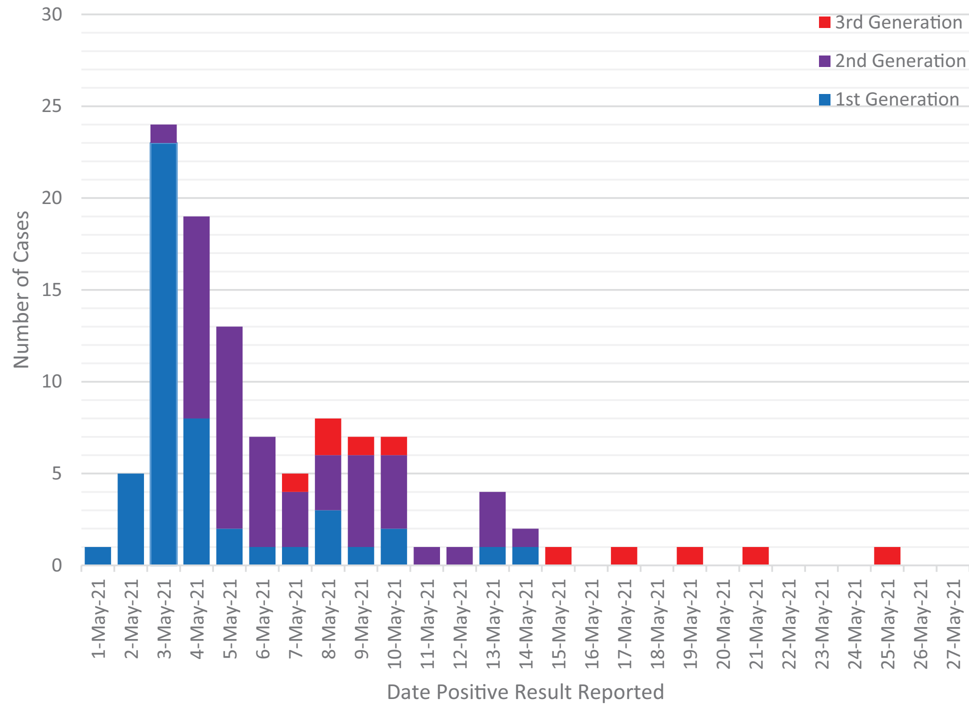

Figure 1: Number of confirmed cases of COVID-19 (*n* = 109) associated with a SARS-CoV-2 Alpha VOC outbreak at a construction site in the KFL&A region, by the date the positive result was reported
KFL&A = Kingston, Frontenac, and Lennox & Addington; VOC = Variant of concern

at the construction site was not localized to a single shift or region of the building, with employees from 11 different subcontractors becoming cases. Forty-eight (98%) of the first-generation cases and 72 (66%) of the total cases were male. Secondary and tertiary spread shows a similar burden across both sexes with slightly more (60%) cases in females as a result of household and non-household contacts who became cases. The average age of cases was 32 years, with a range of 1–70 years. Although it was difficult to determine the exact number of workers employed at the construction site, line lists provided by the employer indicate there were ~700–900 employees. However, only 189 workers were deemed high-risk contacts as they were on-site on or after April 20, 2021. Therefore, within the first generation, there were 49 cases with 189 known high-risk contacts of the construction site, yielding a workplace attack rate of 26%. The second and third generations had attack rates of 34% (50 cases and 148 high-risk contacts) and 14% (10 cases and 72 high-risk contacts), respectively. There were no fourth-generation cases associated with the outbreak. Of the 109 cases, 49 (45%) resulted from direct exposure to the construction site, 35 (32%) were household contacts of a case, 24 (22%) were from close (non-household) contact with a case, and the remaining 1 (1%) was undetermined. Cases from this outbreak affected seven public health regions, reaching multiple cities in Ontario and two other provinces.

The Ontario Ministry of Health workplace guidance for construction sites outlined the following key steps to reduce the risk of SARS-CoV-2 workplace transmission: physical distancing between workers, face coverings to be worn at all times, daily cleaning of high-touch surfaces and bathrooms, and adequate screening processes (14). KFL&A Public Health and Ministry of Labour site investigators conducted a site visit on May 12, 2021, and interviewed the site supervisor to assess if the Ministry's guidance was followed. Unsurprisingly, it was noted by the site supervisor that certain tasks could not be completed independently or with proper physical distancing. However, further investigation revealed that physical distancing was not being followed in certain areas such as break areas and where group meetings were held. Although it is difficult to determine how well face covering guidance was upheld by workers as they were not present during the inspection, most workers were reported to not wear medical grade masks at the time, instead using cloth or single-use disposable masks. Cleaning practices on-site were deemed adequate, with high-touch surfaces being disinfected four times daily and washrooms being cleaned twice daily. The screening process on-site was also suitable,

Table 2: Demographic characteristics, symptoms, hospitalizations, and vaccination status of confirmed COVID-19 cases among first ($n = 49$), second ($n = 50$), and third ($n = 10$) generations associated with a SARS-CoV-2 Alpha VOC outbreak at a construction site in the KFL&A region

Variable	No. (%) of total cases	No. (%) of 1st generation cases	No. (%) of 2nd generation cases	No. (%) of 3rd generation cases
Confirmed cases	$n = 109$	$n = 49$	$n = 50$	$n = 10$
High-risk contacts	$n = 409$	$n = 189$	$n = 148$	$n = 72$
Attack rate	27%	26%	34%	14%
Sex				
Male	72 (66)	48 (98)	20 (40)	4 (40)
Female	37 (34)	1 (2)	30 (60)	6 (60)
Age, median (range)	32 (1–70)	35 (18–67)	29 (1–70)	33 (19–68)
Ever symptomatic				
Yes	100 (92)	41 (84)	50 (100)	9 (90)
No	9 (8)	8 (16)	0 (0)	1 (10)
Vaccination status*				
Fully vaccinated	1 (1)	0 (0)	1 (2)	0 (0)
Partially vaccinated	16 (15)	1 (2)	11 (22)	4 (40)
No vaccination	92 (84)	48 (98)	38 (76)	6 (60)
Symptom frequency (% of those symptomatic)†				
Cough	64 (64)	24 (59)	33 (66)	7 (78)
Headache	57 (57)	21 (51)	30 (60)	6 (67)
Muscle aches/pains	55 (55)	19 (46)	22 (44)	4 (44)
Fatigue, lethargy, or malaise	53 (53)	25 (61)	23 (46)	5 (56)
Nasal congestion	52 (52)	17 (41)	31 (62)	4 (44)
Chills	38 (38)	19 (46)	15 (30)	4 (44)
Loss of smell/taste	29 (29)	10 (24)	17 (34)	2 (22)
Runny nose	27 (27)	9 (22)	16 (32)	2 (22)
Sore throat	27 (27)	9 (22)	12 (24)	6 (67)
Fever	23 (23)	12 (29)	8 (16)	3 (33)
Shortness of breath	15 (15)	4 (10)	9 (18)	2 (22)
Diarrhea	13 (13)	6 (15)	6 (12)	1 (11)
Hospitalized‡				
Yes	3 (3)	0 (0)	2 (4)	1 (10)
No	106 (97)	49 (100)	48 (96)	9 (90)

* *Partially and fully* vaccinated status implies the individual has received *one or two dose(s)* of a COVID-19 vaccine approved in Canada ≥ 14 days prior to diagnosis/symptom onset, respectively

† All symptoms were self-reported to case investigators

‡ Only those hospitalized with COVID-related symptoms are included

KFL&A = Kingston, Frontenac, and Lennox & Addington; VOC = Variant of concern

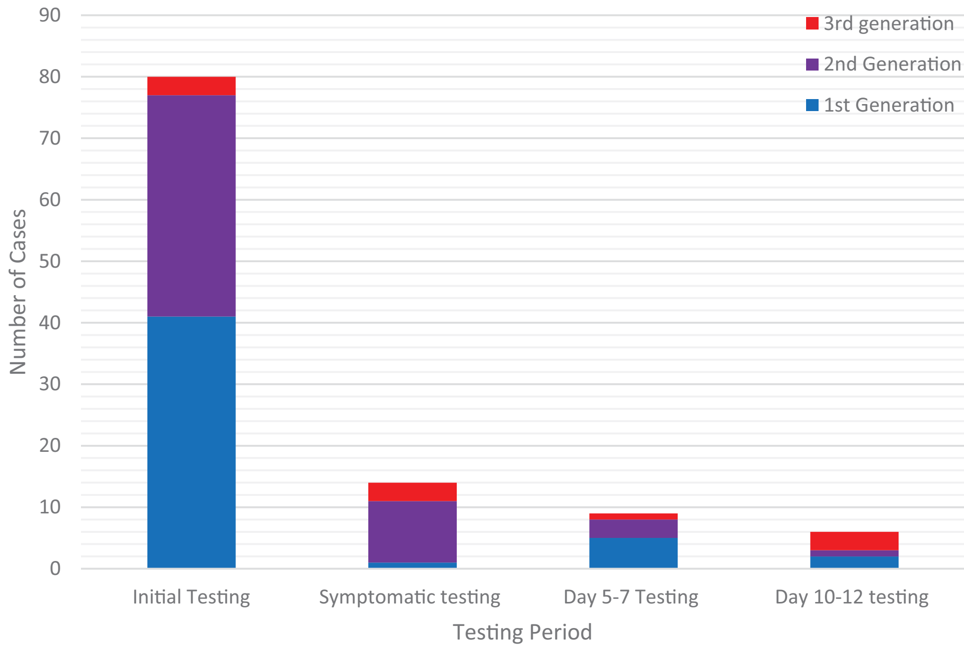

Figure 2: Number of cases caught from initial, symptomatic, day 5-7 and day 10–12 of quarantine testing associated with a SARS-CoV-2 Alpha VOC outbreak at a construction site in the KFL&A region
KFL&A = Kingston, Frontenac, and Lennox & Addington; VOC = Variants of concern

with workers required to give demographic information, any COVID-19 symptoms, and any recent travel history to be granted access to the site.

At the time of the outbreak, there was limited vaccination coverage across Ontario, with only certain individuals being eligible to receive the vaccines. Of the 109 total cases, 16 (15%) were partially vaccinated (received one dose of a COVID-19 vaccine 14 days prior to symptom onset and/or diagnosis) and 1 (1%) was fully vaccinated (received two doses of a COVID-19 vaccine 14 days prior to symptom onset and/or diagnosis). Sixteen of these individuals were symptomatic, including the fully vaccinated individual. Fifteen of the 16 partially vaccinated cases as well as the fully vaccinated individual received Comirnaty's (Pfizer-BioNTech) COVID-19 vaccine, and one partially vaccinated case received Vaxzevria's (AstraZeneca) COVID-19 vaccine. Of the 17 partially and fully vaccinated individuals, there was only one unconfirmed instance of further SARS-CoV-2 transmission. The singular case of transmission from a partially vaccinated individual is unconfirmed as the contact that became positive had multiple SARS-CoV-2 exposures.

Twenty-five (23%) of the total cases were asymptomatic at the time of diagnosis. Nine (8.3%) remained asymptomatic, with 16 (15%) later developing symptoms and being deemed pre-symptomatic. The proportion of asymptomatic cases reported here (8.3%) falls below the range reported in the literature of 15.6%–35.1% (15–18) for the SARS-CoV-2 Alpha VOC, suggesting some asymptomatic cases may have been missed. In total, three cases of SARS-CoV-2 were the result of asymptomatic transmission.

As seen in Table 2, the most common COVID-19 symptoms reported were cough (64% of symptomatic cases), headache (57%), muscle aches (55%), fatigue (53%), and nasal congestion (52%). Three cases required hospitalization, with one requiring supplemental oxygen and two individuals requiring mechanical ventilation and admission to the intensive care unit. Both of the individuals requiring mechanical ventilation received one dose of the Comirnaty vaccine, one over 14 days, and one over 7 days prior to their respective symptom onset dates. These individuals had underlying medical risk factors and were over 60 years of age. No deaths were associated with the outbreak.

The average turn-around time (TAT) for samples associated with the outbreak was 21 hours, with 93% of samples having a TAT of 24 hours or less. The average time from the positive result being reported to the case being contacted by the health unit was 13 hours, with 97% of cases being contacted in 24 hours or less. All positive cases associated with the outbreak were interviewed by KFL&A Public Health investigators.

Of the 109 cases associated with this outbreak, 80 (73%) tested positive on their initial COVID-19 test and 29 (27%) received an initial negative test. Of the 29 cases who received an initial negative test, nine tested positive on day 5–7 testing during quarantine, six on day 10–12 of quarantine, with the remainder testing positive during symptomatic testing (Figure 2). If there was no required testing on day 10–12, up to 15 cases may have gone undetected if individuals did not undergo day 10–12 or symptomatic testing recommended by provincial CCM.

DISCUSSION

Outbreaks of SARS-CoV-2 VOCs continued to predominate in Ontario after this outbreak (5), but there have been few analyses of the CCM protocols employed to control their spread. We report on one of the first large-scale construction site outbreaks in Ontario caused by the Alpha VOC (19), which led to multiple generations of spread affecting seven public health regions across three provinces. The epidemiological data suggest that the transmissibility of the Alpha VOC and the setting of the outbreak played a large role in the rapid spread amongst workers and their contacts. However, the stringent CCM protocol used by KFL&A Public Health likely limited the additional burden, catching 15 cases that could have been missed by provincial protocols as well as any resultant spread from these cases and household members of high-risk contacts that became cases.

The rapid initial propagation (49 first-generation cases with an attack rate of 26%) noted in this outbreak is likely due to various factors, including the workplace setting, the increased transmissibility of the Alpha VOC, and lack of complete adherence to IPAC protocols and public health measures. Forty-eight of 49 cases in the first generation were male, which was unsurprising given construction workers are predominately male (20), with a spread in later generations skewed towards females (60% of second- and third-generation cases being female) due to the spread in gender-balanced households of first-generation cases. Construction sites have been reported to play a key role in the large and rapid propagation noted with various communicable disease outbreaks, including dengue fever (21), coccidioidomycosis (22), and COVID-19 (23). Within the construction site, we suspect that the lack of medical grade masks, the safety issues making it difficult to maintain physical distancing, and the frequent volumes of over 100 people on-site contributed to the rapid workplace spread. Although the screening process at the construction site was sufficient, given the fact that most workers are only financially compensated when they are on-site, this may create an economic incentive for individuals to hide their COVID-19 symptoms. Social interactions among workers at and outside of work were also noted by IPAC inspectors and case investigators, with some out-of-region employees inhabiting the same transient living space over the course of the outbreak. Given the rapid workplace spread described in this outbreak which has also been noted with other communicable disease outbreaks in this setting (21,22), we believe construction sites should begin to be regarded as high-risk settings for communicable disease transmission.

Although the number of cases associated with this outbreak indicates widespread SARS-CoV-2 propagation, the approach to the CCM described in Table 1 likely prevented additional burden with the required testing on day 10–12 for contacts to exit quarantine and the quarantine of their households. The relatively high first- and second-generation attack rates (26 and 34%) were due to rapid initial spread on the construction site and in the households of first-generation cases, prior to when CCM protocols could have curbed the propagation. The secondary attack rate we report (34%) falls at the upper end of the rate reported in the literature for the SARS-CoV-2 Alpha VOC of 25.1%–38.7% (24–26). The substantial reduction in attack rate (34%–14%) and cases (50–10) from second to the third generation, and no further spread from third-generation cases delineates the effectiveness that the enhanced protocols had on curbing the spread from prior generations.

Due to the multifactorial nature of these enhanced protocols, it is difficult to assess the impact of its component's individuals (for example, the impact of the period of communicability extension). Despite this, we suspect that the required quarantine of all household contacts of high-risk contacts was, at the time, a novel public health measure that played the most significant role in preventing SARS-CoV-2 transmission. In total, 35 cases associated with the outbreak were attributed to household transmission, 29 of which were contacts of first-generation cases. Had quarantine not been required for these household members, these individuals may have transmitted the virus to additional contacts while not experiencing symptoms. The quarantine of entire households can have a significant social and economic burden for families, and the decision to implement increased restrictions was made considering these burdens while taking into account the impact of the outbreak on families and the community as a whole. This outbreak illustrates the effectiveness of increased restrictions in limiting the burden of localized communicable disease outbreaks in the larger community.

The ability of both laboratories and case investigation teams to respond quickly in the event of an outbreak is a key factor in preventing additional community spread. The PHOL located in KFL&A was and continues to be very efficient, with a higher proportion of tested samples with a TAT within 24 hours (93%) in comparison with the provincial standard (60%) at the time (27). As SARS-CoV-2 can be transmitted from individuals with symptomatic, pre-symptomatic, and asymptomatic infection, short TAT is necessary to mitigate transmission from individuals who may not currently be symptomatic (28). Case investigation teams must also be efficient in rapidly contacting confirmed cases to notify them of their result, relay isolation instructions, and begin contact tracing. KFL&A case investigators contacted 97% of individuals who received positive results in 24 hours or less. Despite the importance of both factors, quick TAT and investigation initiation may not always be feasible due to insufficient resources and staffing, location/access issues, as well as other factors. Ensuring adequate public health laboratory and personnel resources will be important to maintain the timeliness of public health responses.

Strengths of this investigation include substantiating the importance of the enhanced CCM, shortened testing TAT, and rapid initiation of case management through managing one of the largest SARS-CoV-2 VOC outbreaks in the KFL&A region at the time. Prior to implementation of the enhanced CCM protocol described, almost all cases and outbreaks were managed with a standard protocol provincially. The cases that were caught by these enhanced protocols but may have been missed by standard protocols help illustrate the impact that stringent public health measures can have on effective communicable disease control. This investigation has several limitations. As this was a retrospective observational report of a single COVID-19 outbreak, future research should attempt to study multiple outbreaks where different CCM protocols were used to make stronger conclusions about the effectiveness of various protocols. Another limitation of this investigation is that eight samples from confirmed cases did not undergo WGS and/or mutation testing. These samples were assumed to be the SARS-CoV-2 Alpha VOC due to known epidemiological links to the outbreak. Incomplete information on the number of construction workers onsite and underreporting of contacts suggests that cases and contacts were likely underrepresented in this investigation. Finally, this outbreak occurred in an almost fully susceptible population due to limited vaccination coverage, making the results more applicable to novel communicable disease outbreaks and possible future ‘immune escape’ SARS-CoV-2 VOCs. Regardless, this report identifies a gap in the literature about the effectiveness of CCM protocols and provides real-world evidence as to how more stringent protocols can be used to control the spread of novel SARS-CoV-2 VOCs.

CONCLUSION

As illustrated by the rapid initial spread of SARS-CoV-2 within the construction site, this investigation provides evidence as to why construction sites should be deemed high-risk settings for communicable disease transmission, which has a limited discussion in the literature (19). The substantial decrease in propagation following this initial spread highlights the need for a multi-factorial approach to the CCM for highly transmissible pathogens, making it difficult to attribute its effectiveness to a singular factor. Given how the pandemic has progressed and testing eligibility has changed, variations of these protocols should be considered such as symptom monitoring for concentric circle quarantining measures. While this novel CCM protocol was implemented in response to the SARS-CoV-2 Alpha VOC, lessons learned from this investigation are applicable to future SARS-CoV-2 VOCs and other highly transmissible communicable diseases in susceptible populations given there is sufficient resource allocation. As an early proof of the efficacy of these more stringent protocols, in response to the spread of the SARS-CoV-2 Delta (B.1.617.2) VOC, more robust CCM protocols such as required day 10–12 testing for high-risk contacts were implemented throughout Ontario as well as other countries such as England and Italy (29).

ACKNOWLEDGEMENTS: The authors would like to thank all staff at KFL&A Public Health who contributed to the analysis of this outbreak, including the investigators, nurses, case and contact management team, and assessment centre personnel, as well as the staff at the local Public Health Ontario Laboratory and Kingston Health Sciences Centre.

CONTRIBUTORS: Conceptualization, J Hamilton, M Tripp, T Li, L Bowthorpe, T Hugh Guan; Data Curation, J Hamilton; Investigation, J Hamilton and M Tripp; Supervision, T Hugh Guan and L Bowthorpe; Writing – Original Draft, J Hamilton, M Tripp, T Li; Writing – Review & Editing, J Hamilton, M Tripp, T Li, L Bowthorpe, T Hugh Guan.

ETHICS APPROVAL: Ethics approval was not required by the Health Sciences and Affiliated Teaching Hospitals Research Ethics Board (HSREB) at Queen’s University in accordance with Article 2.5 in the Tri-Council Policy Statement (TCPS 2).

INFORMED CONSENT: N/A

DATA ACCESSIBILITY: All data will not be made publicly available. Researchers who require access to the study data can contact the corresponding author for further information.

FUNDING: No funding was received for this study.

DISCLOSURES: The authors have nothing to disclose.

PEER REVIEW: This manuscript has been peer reviewed.

ANIMAL STUDIES: N/A

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