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The COVID-19 Pandemic: Informing Policy Decision-Making for a Vulnerable Population

Nicholas Spence, Vivian Chau, Maryam S. Farvid, Jerry P. White, Paranthaman Rasalingam et Lawrence Loh

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Résumé de l'article

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Nicholas Spence
University of Toronto, Canada, nicholas.spence@utoronto.ca

Vivian Chau
Rotman Research Institute, Baycrest Health Sciences, Canada, v4chau@uwaterloo.ca

Maryam S. Farvid
Harvard T.H. Chan School of Public Health, United States, mfarvid@hsph.harvard.edu

Jerry P. White
Western University, Canada, white@uwo.ca

Paranthaman Rasalingam
Department of Health and Society, University of Toronto, Canada, james.rasalingam@utoronto.ca

Lawrence Loh
Dalla Lana School of Public Health, University of Toronto, *Canada*, lawrence.loh@peelregion.ca

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The COVID-19 Pandemic: Informing Policy Decision-Making for a Vulnerable Population

Abstract

The COVID-19 pandemic has significantly impacted society. Vulnerable populations are at heightened risk for exposure, as well as adverse health and social consequences. Policymakers are operating under difficult circumstances, making crucial policy decisions to maximize impact and mitigate harm, with limited scientific evidence. This article examines the pronounced vulnerability of Indigenous Peoples in Canada to the pandemic. We highlight the importance of moving beyond individual-level risk factors associated with COVID-19 by identifying and classifying Indigenous communities most vulnerable to the pandemic. We propose the use of a social diagnostic tool, the Community Well-Being Index, rooted in the social determinants of health, to predict community vulnerability and potentially guide policy decision-making in the fight against COVID-19.

Keywords

Corona virus, pandemic, policy, community risk, social determinants of health, COVID-19, well-being, vulnerable population, inequity, Indigenous Peoples, Aboriginal Peoples, First Nations

The COVID-19 Pandemic: Informing Policy Decision-Making for a Vulnerable Population

Pandemics are a relatively rare but potentially catastrophic disaster. Although it may seem distant in the past, it was just over 10 years ago that the World Health Organization announced the arrival of pandemic influenza H1N1/09. A decade has brought the emergence of a novel coronavirus, originating in Wuhan, China, called severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which causes the coronavirus disease 2019 (COVID-19).

On March 11, 2020, the World Health Organization declared this novel respiratory disease a pandemic. As of May 30, 2020, according to the COVID-19 Case Tracker from Johns Hopkins University (2020), there were about 6.1 million global confirmed cases and 368,604 deaths and, for Canada, there were 90,179 confirmed cases and 7,073 deaths (Health Canada, 2020a). A recent model in the United States estimates the infection mortality rate among symptomatic cases at 1.3%, which is 13 times higher than seasonal influenza at 0.1% (Basu, 2020). Indeed, the high contagiousness and mortality rate of COVID-19 indicate the severity of this infectious disease (Basu, 2020; Meyerowitz-Katz & Merone, 2020; Sanche et al., 2020).

As a novel virus, initial control measures were implemented, owing to concerns of widespread population susceptibility to infection from a biological perspective. Nevertheless, mounting evidence indicates that rates of infection and death mirror general patterns of social inequities (Grabb, 2007), notably those based on race and socioeconomic status (Chen & Krieger, 2020). These key social determinants of health operate in numerous ways to affect risk of infection, including limited capacity for physical distancing and increased virus exposure; for example, low socioeconomic status is positively associated with inadequate housing, characterized by crowding and housing in need of major repairs; high-risk working conditions requiring in-person interactions; and reduced access to health-promoting resources. Similarly, racialized minorities disproportionately have low socioeconomic status, reside in inadequate housing conditions, and work in high-risk jobs. For racialized minorities, such as Indigenous Peoples, the historic processes rooted in colonialism and ongoing systemic racism within social institutions accounts for many of the inequities across risk factors observed (Royal Commission on Aboriginal Peoples, 1996; Truth and Reconciliation Commission of Canada, 2015; White et al., 2007). This disproportionate risk associated with COVID-19 has not gone unrecognized by the public. A recent Ipsos poll across 15 countries showed that about 60% of people in Canada are concerned for those who are vulnerable or at-risk amid COVID-19 (Bricker, 2020).

These potentially disproportionate devastating effects of COVID-19 among vulnerable populations, including Indigenous Peoples, brings previous work on pandemic H1N1/09 into stark focus. During pandemic H1N1/09, we outlined this risk in detail:

> Efforts to mitigate the impact of [H1N1/09] . . . fail to address the underlying social factors, which leave many [Indigenous] communities "at risk." Until these social factors are ameliorated, we will continue to witness disastrous outcomes with many faces for years to come. (Spence & White, 2010, Conclusion section, para. 1)

Those previously outlined conditions continue to be a pressing issue in Canada's response to COVID-19. Despite improvements in the socio-economic well-being of Indigenous Peoples over time, the relative gap between Indigenous and non-Indigenous populations continues to be substantial

(Indigenous Services Canada, 2019), and the importance of intra-Indigenous differences are often overlooked (Spence, 2016).

The biomedical tools in our arsenal to combat COVID-19 are limited, with no clinically proven treatments or vaccines and limited testing capacity. This situation has led to the focus on non-pharmacological interventions, encouraging individual adherence to measures such as proper hygienic practices and physical distancing to reduce transmission of the virus (World Health Organization, 2020e). These efforts have been supplemented by macro-level policy responses, including large-scale closures, regulations limiting physical interactions, and strategic resource allocation.

Policy makers at all levels continue to be faced with making difficult decisions to address current shortfalls, anticipate future needs, and streamline limited resources, where they can maximize impact to mitigate harm. This is especially challenging for vulnerable populations. Another key characteristic of the pandemic is the rapidly evolving scientific understanding of the situation day-to-day, which means many decisions are made in a context with a shortage of sound scientific evidence to guide the decision-making process.

In this respect, we want to contribute to the discourse by leveraging an existing analytical tool to assist stakeholders in policy planning, responses, and assessing risk, which captures the vulnerability of communities, based on the social determinants of health. To accomplish this task, we will provide an in-depth overview of the epidemiological and clinical features of COVID-19, assess the unique vulnerability of Indigenous Peoples in Canada, and briefly summarize the country's pandemic response for Indigenous Peoples.

Consistent with an ecological approach, this work reviews the importance of moving beyond determining individual-level risk factors associated with COVID-19 by identifying and classifying Indigenous communities most vulnerable to the dire consequences of the pandemic. We argue that this can be accomplished by looking at intra-Indigenous community differences, using an extant social diagnostic tool called the Community Well-Being (CWB) Index. Applied properly, we posit that this tool can predict community vulnerability and potentially guide policy decision-making in the fight against COVID-19.

Epidemiology of COVID-19

Risk Factors for Severity

As a novel virus, all individuals are at risk of becoming infected with COVID-19 when exposed (Liu et al., 2020; World Health Organization, 2020a). However, the risk for disease severity is higher for individuals with existing health conditions (Guan et al., 2020). As seen in Figure 1, a Chinese study found that case fatality rates for patients with cardiovascular disease, diabetes, chronic respiratory disease, hypertension, and cancer were significantly higher than the case fatality rate of 0.9% for patients with no comorbid conditions (The Novel Coronavirus Pneumonia Emergency Response Epidemiology Team, 2020). Individuals who are immunocompromised either from an existing illness or from medical treatment are also at elevated risk for infection (Public Health Agency of Canada, 2020a). Additionally, increasing evidence has found that obesity is associated with worse clinical outcomes (Hajifathalian et al., 2020; Kalligeros et al., 2020; Palaiodimos et al., 2020).

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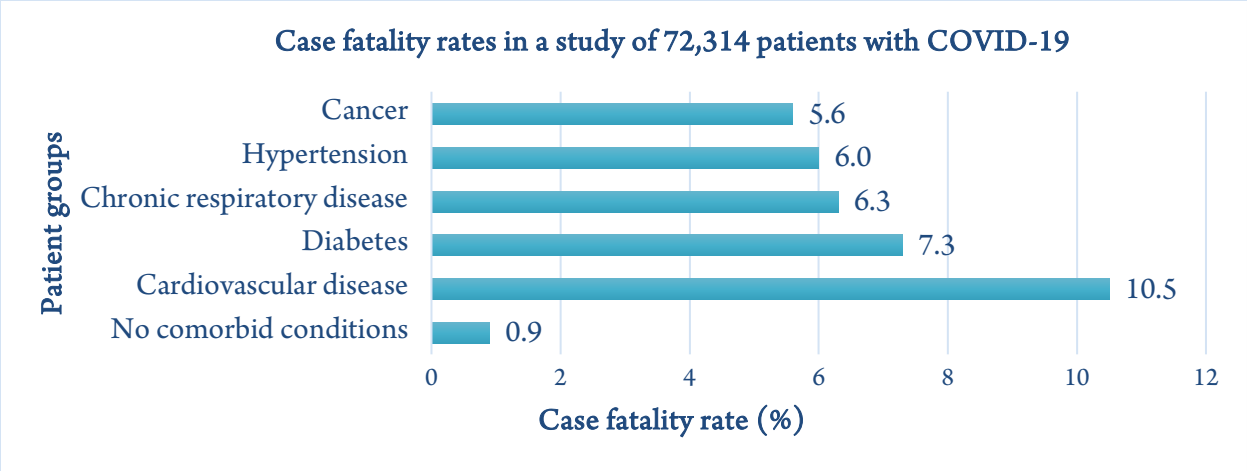

Figure 1. **Reported case fatality rates among patients grouped by existing health conditions in a study examining COVID-19 cases from China's Infectious Disease Information System (The Novel Coronavirus Pneumonia Emergency Response Epidemiology Team, 2020).**

Age has emerged as a primary risk factor for disease severity. A study comparing patients 60 years or older and under 60 years old found a higher percentage of older adults had a pneumonia severity index score of 4 or 5 compared to the younger cohort. A weaker immune system may be a contributing factor to the difference in disease severity between the two study groups (Liu et al., 2020). This is aligned with existing evidence that individuals experience physiologic changes in their innate and adaptive immune responses as part of aging. Coupled with natural age-related changes to organs that impact their functioning, it is challenging for older adults to fight infections such as COVID-19 (El Chakhtoura et al., 2017). The heterogeneity of older adult patients adds to the complexity of prevention and treatment as the risk for severity differs between healthy older adults and older adults with comorbidities. Specifically, older adults who have chronic diseases such as diabetes, cardiovascular disease, and hypertension are at greater risk for mortality (The Novel Coronavirus Pneumonia Emergency Response Epidemiology Team, 2020; World Health Organization, 2020a). Further, when examining the prognosis of older adult patients at the Renmin Hospital of Wuhan, researchers found that the risk for fatality increased 29.3 times for patients who had acute respiratory distress syndrome, 2.24 times for patients with chronic obstructive pulmonary disease, and 1.86 times for patients with cardiovascular disease (Wang et al., 2020).

Non-clinical factors often increase risk and severity of infection among some populations, particularly racialized minorities and the socioeconomically poor (Chen & Krieger, 2020; Public Health Agency of Canada, 2020a). These groups include people who may have limited access to resources, lack job security and/or flexibility, disproportionately work in high risk jobs, tend to be socially or geographically isolated, and live in precarious housing situations (Chen & Krieger, 2020; Public Health Agency of Canada, 2020a). Faced with such challenges, these individuals often have poorer baseline health status, and they may also find it difficult to isolate and access basic necessities such as groceries and care.

Additionally, smoking tobacco is a potential risk factor, as studies have shown that immune responses against infections are weakened from smoking (Qiu et al., 2016). Furthermore, smoking causes a multitude of chronic diseases and damage to the respiratory system (Qiu et al., 2016; West, 2017). Thus, individuals who smoke tobacco may be susceptible to serious health complications if infected with COVID-19. Similarly, smoking cannabis is a potential risk factor for disease severity. Evidence shows that smoking cannabis is associated with respiratory syndromes and causes chronic bronchitis (Ribeiro & Ind, 2016). These negative impacts on the respiratory system may exacerbate a COVID-19 infection. Lastly, use of e-cigarettes may impair activation of the immune response, as shown in a mice model that exposed mice to e-cigarettes and subsequently infected them with influenza A (Madison et al., 2020). Researchers found that mice exposed to e-cigarettes also had lung inflammation (Madison et al., 2020). Therefore, individuals who use e-cigarettes may also be a high-risk group for COVID-19.

Educational level and scientific literacy can be particularly important during a period of uncertainty, as the science evolves daily on COVID-19, and people find themselves overwhelmed with an overabundance of information from a variety of reliable and unreliable sources. Scientific literacy may be useful in light of the sea of messaging by enabling people to better interpret the scientific evidence, assess risk, and make informed decisions based on the best evidence available. For example, recent research in the United States has found that scientific knowledge is positively associated with educational attainment (Kennedy & Hefferon, 2019), and educational attainment is distributed unequally among racial groups with Blacks, Hispanics, and American Indians and Alaska Natives lagging behind Whites (National Center for Education Statistics, 2019). Moreover, vulnerability to conspiracy theories associated with COVID-19 is inversely associated with level of education (Schaeffer, 2020). Given the history of mistreatment by the healthcare system and social institutions systematically discriminating and excluding them from full participation in society (Allan & Smylie, 2015; Royal Commission on Aboriginal Peoples, 1996; Truth and Reconciliation Commission of Canada, 2015), racialized populations may also be more susceptible to conspiracy theories (Schaeffer, 2020). This may result in skepticism and a lack of trust in public officials and the health care system, which may lead to communities disregarding health information from authorities. Indeed, for Indigenous Peoples in Canada, the legacy of colonialism continues to plague relations with the broader society.

Transmission

At this time, the index case for COVID-19 has not yet been identified. Early COVID-19 cases were linked to a live animal and seafood market, called the Huanan Seafood Wholesale Market in China, with possible environmental and/or animal exposures as the source of disease (Li et al., 2020). In December 2019, human-to-human transmission was reported (Cowling & Leung, 2020; Li et al., 2020). COVID-19 is mainly spread through respiratory droplets of an infected individual (Luo et al., 2020). It is possible to become infected from direct contact with individuals who have COVID-19, as well as through aerosols and fomites (Luo et al., 2020; van Doremalen et al., 2020). In a study comparing levels of viable SARS-CoV-2 on different surfaces, researchers were able to find the virus on plastic and stainless steel surfaces for as long as 72 hours (van Doremalen et al., 2020). Therefore, contact with contaminated surfaces followed by contact with an individual's mouth, nose, or eyes may cause infection. A cluster of cases from a public bath house in Jiangsu, China, suggests that COVID-19 is transmissible in warm, humid environments (Luo et al., 2020). Although estimates of the characteristics of COVID-19 will become more precise over time, thus far, COVID-19 appears to have a relatively high transmissibility

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compared to other infectious diseases, while its virulence is lower than MERS and SARS, but higher than H1N1 and influenza (Table 1).

Table 1. Characteristics of Select Infectious Diseases

Disease	Transmission (R_0)[a]	Mortality (global)	Virulence
COVID-19	3.15 95% CI (2.41-3.90)[b]	368,604 deaths as of May 30, 2020[c]	1.8% case fatality rate 95% CI (1.18%-2.43%)[b]
Influenza	0.9 – 2.1[d]	294,000 - 518,000 deaths annually[e]	0.1% case fatality rate[f]
H1N1	1.4 – 1.6[d]	123,000 - 203,000 deaths in the year 2009[g]	0.05% symptomatic case fatality rate[h]
Middle East respiratory syndrome (MERS)	< 1.0[i]	866 deaths as of January 2020[j]	34.3% case fatality rate for end of January 2020[j]
Severe acute respiratory syndrome (SARS)	3.0[k]	623 deaths as of May 17, 2003[k]	11.0% case fatality rate[k]

Notes. [a] R_0 is the basic reproductive number that is used to describe the contagiousness or transmissibility of infectious agents; it can be interpreted as the number of secondary cases from one case, and it is a product of a wide range of factors (environmental, biological, sociobehavioral). An outbreak will continue if R_0 is greater than 1 and end if R_0 is less than 1 (Paul et al., 2019). [b] He et al. (2020). [c] World Health Organization (2020b). [d] Baldo et al. (2016). [e] Paget et al. (2019). [f] Lipsitch et al. (2009). [g] Simonsen et al. (2013). [h] Nishiura (2010). [i] World Health Organization (2017). [j] World Health Organization (2020d). [k] World Health Organization (2003).

Risk Mitigation

Strategies to mitigate risk of infection focus on reducing human-to-human transmission (Li et al., 2020; Wilder-Smith & Freedman, 2020). These include quarantining individuals with possible exposure to COVID-19 for 14 days, practicing physical distancing, and community-wide containment (Li et al., 2020; Wilder-Smith & Freedman, 2020). Where physical distancing of at least two metres between people cannot be maintained, individuals are encouraged to wear a face mask or covering (Health Canada, 2020b). Frequent cleaning and disinfection of surfaces is also recommended to prevent spread from contact with contaminated surfaces (Health Canada, 2020b). In China, additional measures such as provincial lockdowns and closure of public transportation services were used to curb disease spread (Wilder-Smith & Freedman, 2020).

In an article from the Chinese Center for Disease Control and Prevention summarizing lessons learned, isolating cities and widespread public education on hand hygiene, information on access to health

services, and use of face masks were effective in reducing the spread of COVID-19 (The Novel Coronavirus Pneumonia Emergency Response Epidemiology Team, 2020). A publication by the WHO–China Joint Mission on Coronavirus Disease 2019 also reported the importance of contact tracing, monitoring infected persons, and reporting illness as COVID-19 control measures (The Joint Mission, 2020).

Testing

Most countries test for COVID-19 by testing the RNA from a nose or throat swab using reverse transcription polymerase chain reaction (RT-PCR; Iacobucci, 2020; Subbaraman, 2020). This method produces results that have high accuracy in about one day (Iacobucci, 2020). With RT-PCR, some false negatives may result due to differing viral loads depending on when the sample was obtained and where the sample was taken (Udugama et al., 2020). For example, SARS-CoV-2 was detectable by nasal swabs within 14 days of disease onset, yet throat swabs could not reliably detect the virus after 8 days (Pan et al., 2020). This can be problematic if testing programs do not use additional testing or epidemiological data to confirm test results, as some individuals with COVID-19 may be misclassified as negative cases (Udugama et al., 2020). The cost of producing PCR assays for SARS range from $5.46 - $9.81 CAD, while commercial assays cost $40.37 (Mahony et al., 2004).

Serological tests are being explored as they can detect antibodies, which identify both current and past COVID-19 infections (Iacobucci, 2020; Subbaraman, 2020; Udugama et al., 2020). Serological tests can also be used for point-of-care testing, which would eliminate delays caused by sending samples to a laboratory for analysis (Udugama et al., 2020). However, compared to RT-PCR, some serological tests have lower sensitivity and specificity, which may result in more false positive and false negative test results (Iacobucci, 2020). Because of its ability to identify individuals who were infected with COVID-19, Singapore used serological tests to aid in contact tracing early in the outbreak (Subbaraman, 2020). Lateral flow antigen detection is an example of a serological test that can be used in a variety of settings to test for SARS-CoV-2 (Udugama et al., 2020). Lateral flow assays are inexpensive to produce and they can be easily produced; moreover, implementation cost is lowered as results are interpreted visually, without additional equipment (Koczula & Gallotta, 2016). Lateral flow assays that detect IgM in patients with COVID-19 were found to have 57% sensitivity and 100% specificity; when detecting IgG in patients with COVID-19, sensitivity was 81% and specificity was also 100% (Xiang et al., 2020). To better understand the spread of SARS-CoV-2 globally, the WHO launched Solidarity II, a serological study for COVID-19 (World Health Organization, 2020g). This study aims to understand the distribution and proportion of previously infected individuals on a global level, which aids in ascertaining the proportion of individuals missed by surveillance measures and estimating COVID-19 immunity (World Health Organization, 2020g).

Other potential testing options include Specific High Sensitivity Enzymatic Reporter unLOCKing (SHERLOCK) and DNA Endonuclease Targeted CRISPR Trans Reporter (DETECTR), with both using CRISPR gene-editing technology to identify viral RNA (Subbaraman, 2020). These tests can produce results within 5 to 10 minutes (Subbaraman, 2020). As SHERLOCK uses CRISPR technology, test results have high sensitivity and specificity (Kellner et al., 2019). For example, in a 1uL sample, SHERLOCK can detect a single molecule of DNA, while high specificity is achieved using Cas13 and Cas12 enzymes (Kellner et al., 2019). The cost of SHERLOCK and DETECTR are similar due to

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shared technology; one SHERLOCK reaction can be as low as $0.61 USD (Gootenberg et al., 2017). Overall, SHERLOCK has potential for scaling up from a cost and equipment availability perspective, since the cost per reaction is low and testing can be done on paper (Gootenberg et al., 2017). Also, SHERLOCK may be deployable for COVID-19, as it has been used before in other viral outbreaks, such as Zika and Dengue (Kellner et al., 2019).

Treatment

In the absence of an evidence-based cure for individuals infected with COVID-19, current treatment recommendations from the World Health Organization (2020a) focuses on symptom management. Individuals with mild symptoms are advised to isolate themselves and to treat their symptoms. For severe cases, patients receive supplemental oxygen therapy, while critical cases, such as individuals suffering from acute respiratory distress syndrome, receive advanced oxygen or ventilatory support. A study describing clinical characteristics of patients with COVID-19 in China cited the use of IV antibiotic treatment oseltamivir to manage influenza-like symptoms, oxygen therapy, and mechanical ventilation for severe cases (Guan et al., 2020).

The World Health Organization (2020f) established Solidarity, an international clinical trial involving over 90 countries, that is striving to find effective clinical treatments for COVID-19. The study started recruiting on March 1, 2020, and will end on March 25, 2021 (ISRCTN Registry, 2020). Within this study, enrolled participants are followed until an endpoint is met, either discharge from hospital or death (World Health Organization, 2020f). Different participants may also be receiving different study drugs as the list of treatment drugs is expected to change throughout the clinical trial based on effectiveness (ISRCTN Registry, 2020). Drug effectiveness will be chiefly determined by whether the participant died, followed by whether the participant required ventilation (World Health Organization, 2020f). One of the drugs being studied is remdesivir, as it yielded positive results in treating MERS-CoV and SARS. Lopinair/ritonavir, used for treating HIV, and Interferon beta-1a, used for treating multiple sclerosis, are also under investigation (World Health Organization, 2020f). Lastly, some studies conducted in China and France explored the use of chloroquine phosphate to treat COVID-19. As such, hydroxychloroquine was also included in Solidarity (World Health Organization, 2020f); however, use of hydroxychloroquine was subsequently stopped in the Solidarity trial as it did not show any benefit to patients (World Health Organization, 2020c).

Gilead Sciences, which manufactures remdesivir, has decreased production time from between 9 and 12 months to between 6 and 8 months, and it has been working to increase production of the drug (Gilead, 2020). The company aims to produce more than 140,000 treatment courses by May 31, 2020, and a continued increase to 500,000 treatment courses by October 2020 (Gilead, 2020). As of May 2020, Gilead Sciences also increased access to remdesivir by working with five generic drug manufacturers through a licensing agreement (Pharmaceutical Technology, 2020). As a result, the production and distribution of remdesivir will expand to 127 countries. As developer of lopinair/ritonavir, AbbVie (2020) continues to monitor the COVID-19 pandemic to ensure adequate supply and production of lopinair/ritonavir. A press release from pharmaceutical manufacturer Mylan (2020) also stated that they will increase availability of lopinair/ritonavir to support treating patients with COVID-19 should clinical trials show effectiveness.

Vaccine development has also been a focus of study. There were 115 vaccine candidates on April 8, 2020, with 73 candidates in either exploratory or preclinical stages (Le et al., 2020). As of June 11, 2020, three vaccine candidates were in phase two clinical trial: the Bacillus Calmette-Guerin live-attenuated vaccine; AZD1222, an adenovirus vaccine vector; and mRNA-1273 (Craven, 2020). As a vaccine for COVID-19 is urgently needed, the timeline for vaccine development may be shortened to make it available by 2021 (Le et al., 2020).

Though some vaccines have begun clinical trials, vaccine development is complex (Lurie et al., 2020). Thus, not all vaccines become viable and, when administering successful vaccines to the population, the number of doses required to gain immunity from COVID-19 remains unknown (Lurie et al., 2020). Achieving herd immunity from vaccines in a population may be challenging as well, depending on factors such as interactions within and between groups, including tight-knit populations, which may promote virus transmission, thereby requiring a higher vaccination threshold (Rashid et al., 2012).

The demand for vaccines will also be high and urgent for this pandemic. To meet these needs, mass-production of vaccines before accumulation of large amounts of safety and immunogenicity data on the vaccine will need to occur (Lurie et al., 2020). Scaling up production of vaccines may also be slow if facilities producing vaccines do not have proper technologies and processes in place to mass develop a novel vaccine (Lurie et al., 2020).

The epidemiological and biomedical aspects of COVID-19 continue to change at a rapid pace. We have highlighted some key work in the area, but this information is subject to revision as time goes on.

Social Inequities in Canada: Indigenous Peoples at Risk

Social inequities in Canada have driven vast differences in the health and well-being experienced by segments of society (Grabb et al., 2017; Raphael, 2016). The dimensions of inequities are numerous (Grabb, 2007), including disparities rooted in racialized identity, particularly for Indigenous Peoples, whose standard of living in some regions is comparable in many respects to that of several developing countries (Veenstra, 2017). This situation reflects the history of colonialism and policies that have eroded Indigenous institutions, relegating Indigenous Peoples to the margins of society and resulting in intergenerational trauma and durable inequity (Grabb et al., 2017; Greenwood et al., 2018; Raphael, 2016).

Numbering 1.67 million or 4.9% of the population in Canada in 2016, Aboriginal Peoples or Indigenous Peoples are the First Peoples of Canada and their descendants. The Canadian Constitution recognizes three sub-groups of Indigenous Peoples, including First Nations (n = 977,230), Métis (n = 587,545), and Inuit (n = 65,025). The term "Indians" is a legacy term from the Indian Act, which was applied to First Nations. "Indians" are distinguished as Registered or Treaty, otherwise referred to as Status Indians, and non-Registered or non-Status Indians, with the former making up 76.2% of the First Nations population (Statistics Canada, 2017c). Registered Indians are registered under the Indian Act, which confers specific rights and benefits. Treaty Indians are those individuals who are part of a First Nation or Indian band that signed a treaty with the Crown (Aboriginal Affairs and Northern Development, 2014). A band refers to Indians for whose collective use and benefit lands have been set apart or money is held by the Crown or declared to be a band for purposes of the Indian Act. A reserve is a tract of land that has been set apart by Her Majesty for the use and benefit of a band; however, the legal

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title of the land is vested in Her Majesty. At the end of 2016, there were 618 Bands or Registry Groups in Canada and 3,247 reserves, although they are not all inhabited (Government of Canada, 2018b).

Non-Status or non-Registered Indians are self-identified First Nations but cannot register under the Indian Act. Métis refers to a group of people that share mixed ancestry (First Nations and European) and a distinct political-cultural heritage. Inuit are Indigenous Peoples of the circumpolar region in Arctic Canada (Aboriginal Affairs and Northern Development, 2014). Overall, Indigenous Peoples are a rapidly growing group, and almost a decade younger, on average, than the non-Indigenous population (Statistics Canada, 2017c). Geographically, the Indigenous population is scattered across the country. They are characterized by diversity across history, languages, culture, customs, and traditional lands. Most First Nations people (Registered or Treaty and non-Registered) live off reserve, with only about 44% of the Registered First Nations population living on reserve (Statistics Canada, 2017e). Over two-thirds of Métis live in urban areas: Eight census metropolitan areas have a Métis population of more than 10,000 people (Vancouver, Calgary, Edmonton, Saskatoon, Winnipeg, Toronto, and Ottawa-Gatineau), which makes up one-third of the Métis population (Statistics Canada, 2017e). Finally, almost three-quarters of the Inuit population live in Inuit Nunangat, the Inuit homeland (Statistics Canada, 2017e).

Why are Indigenous Peoples at elevated risk for infection and adverse outcomes for COVID-19? This is captured by the social and health indicators in Table 2, which illustrate differences between the general population and Indigenous Peoples by Indigenous identity: in particular, within the context of previously identified risk factors for COVID-19. Among Indigenous Peoples, there is a high prevalence of pre-existing clinical (proximate) risk factors, such as diabetes and obesity, lifestyle factors (e.g., smoking), as well as markedly higher social (distal) risk factors, such as lower levels of education, income, employment, and adequate housing. Moreover, access to safe water and health services have been two longstanding issues, as the federal government has been unsuccessful in providing these essential services at an acceptable standard for Indigenous communities (Allan & Smylie, 2015; Government of Canada, 2017, 2018a, 2019; White et al., 2012), which are particularly salient during the COVID-19 pandemic. Thus, there is strong evidence for heightened susceptibility of Indigenous Peoples to the SARS-CoV-2 virus across both clinical (proximate) and social (distal) factors.

Table 2. Select Health and Socioeconomic Indicators Among Indigenous Peoples in Canada

Risk factor	General population	Inuit	Métis	First Nations on reserve	First Nations off reserve
Asthma, %	7.8 (2017)[a]	7.9 (2017)[b]	14.7 (2017)[b]	9.6 (2015/16)[c]	14.5 (2017)[b]
Diabetes, %	7.3 (2017)[a]	4.5 (2017)[b]	8.5 (2017)[b]	15.9 (2015/16)[c]	10.0 (2017)[b]
Chronic bronchitis, emphysema, COPD, %	4.3 (2017)[d]	3.2 (2017)[b]	5.2 (2017)[b]	2.5 (2015/16)[c]	5.5 (2017)[b]
Heart disease, %	8.5 (2012/13)[e]	3.4 (2017)[b]	5.6 (2017)[b]	4.2 (2015/16)[c]	5.7 (2017)[b]
High blood pressure, %	17.8 (2017)[f]	12.6 (2017)[b]	18.5 (2017)[b]	17.2 (2015/16)[c]	17.3 (2017)[b]
Obesity, %	16 (2007/10)[g]	26 (2007/10)[g]	22 (2007/10)[g]	40 (2008/10)[h]	26 (2007/10)[g]
Smoking (daily, ages 15+), %	11.6 (2017)[d]	55.9 (2017)[b]	21.7 (2017)[b]	40.3 (2015/16)[c]	25.8 (2017)[b]
Tuberculosis incidence rate per 100,000 (2016)[i]	0.6	170.1	2.1	34.1	14.5
Life expectancy (years) at age 1 (2011)[j]	84.3	73.0	79.5	75.2[k]	
Food insecure households, %	12.7 (2017)[l]	53 (2017)[m]	31 (2017)[m]	54.2 (2008/10)[n]	43.0 (2017)[m]
Median income pre-tax (2016), %[o]	34,604	24,502	31,916	16,907	25,134
Education, 25-64 years old, certificate, diploma, or degree at bachelor level or above (2016), %[p]	29.3	5.3	13.2	5.4	11.6

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Table 2. Select Health and Socioeconomic Indicators Among Indigenous Peoples in Canada (continued)

Risk factor	General population	Inuit	Métis	First Nations on reserve	First Nations off reserve
Education, 25-64 years old, less than high school (2016), %[p]	10.8	43.9	18.0	43.0	23.8
Unemployment, 15 years and over (2016), %[q]	7.4	22.4	11.2	24.9	15.3
Crowded housing (2016), %[r]	8.5	40.6	8.6	36.8	18.5[s]
Housing in need of major repairs (2016), %[r]	6.0	26.2	11.3	44.2	14.2[s]

Notes. [a] Statistics Canada (2019). [b] Custom calculations using the Aboriginal Peoples Survey 2017 (Statistics Canada, 2020). [c] First Nations Information Governance Centre (2018). [d] Statistics Canada (2018b). [e] Public Health Agency of Canada (2017). [f] Statistics Canada (2018c). [g] Gionet and Roshanafshar (2013). [h] Batal and Decelles (2019). [i] Vachon et al. (2018). [j] Tjepkema et al. (2019). [k] Refers to all First Nations. [l] Tarasuk and Mitchell (2020). [m] Arriagada et al. (2020). [n] First Nations Information Governance Centre (2012). [o] Statistics Canada (2017b). [p] Statistics Canada (2017a). [q] Statistics Canada (2018a). [r] Statistics Canada (2017d). [s] Registered or Treaty Indian Status.

Pandemic Response for Indigenous Peoples in Canada

Given the heightened risk for Indigenous Peoples to the SARS-CoV-2 virus, what has been the response in Canada? The response to the pandemic for Indigenous Peoples has been broad, including all levels of government, Indigenous organizations, and local communities. We will now provide a brief overview of some main elements of the pandemic response for Indigenous Peoples as of May 2020, although new developments occur daily. Initially, Canada's federal government dedicated $515.2 million to support the Indigenous population (Table 3; Government of Canada, 2020a). The funding was further bolstered by an additional $339.1 million for Indigenous businesses and transportation (Table 4; Government of Canada, 2020a). Members of Indigenous communities are also able to access funds that are universally available to all Canadians, such as the $157.5 million in funding used for the Reaching Home Initiative (RHI; Government of Canada, 2020a). The majority of dedicated funds for Indigenous Peoples have been allocated to service providers and organizations directly providing support and aid for Indigenous communities, both on- and off-reserve. Indigenous Services Canada developed a COVID-19 model to guide its funding process, with the underlying principles of preparedness, health human resources, infrastructure, infection prevention and control, medical transport, governance, communications, and surveillance (Indigenous Services Canada, 2020).

Table 3. Federal Government Funding for Indigenous Health and Social Services, as of May 2020

Program	Funding amount (million CDN$)
Community Support Fund	$305.0
Public health preparedness and support	$100.0
Nutrition North Canada	$25.0
Family Violence Prevention Program	$10.0
Indigenous Post-Secondary Students	$75.2

Table 4. Federal Government Funding for Indigenous Businesses and Infrastructure, as of May 2020

Program	Funding amount (million CDN$)
Small and medium-sized Indigenous businesses and Aboriginal financial institutions that finance them	$306.8
Air transportation	$17.3
Support for Northern businesses	$15.0
Total	$339.1

The Community Support Fund (CSF) is the largest of these funds and contributes $305 million for grassroots plans within Indigenous communities (Government of Canada, 2020e). The CSF's design provides Indigenous leadership with the resources and autonomy to design and implement culturally appropriate solutions to combat and prevent COVID-19 within their communities. Of the total, $215 million dollars of this fund was dedicated to on-reserve and self-governing First Nations communities, based on a funding formula that takes into account population size (2016 Census), remoteness, and socio-economic conditions, with each community receiving a base amount of $50,000. An additional $45 million dollars from the CSF was designated to each land claims organization and allocated by the Inuit Tapiriit Kanatami and regional Inuit land claims organizations. A further $30 million was directed to needs within Métis communities through governing members. The final $15 million was used for groups and organizations operating in off-reserve and urban centers.

The $100 million for Canada's public health response for Indigenous communities is dedicated to federal responsibilities. This fund is intended to address any immediate short-term needs regarding primary health capacity and managing pandemic plans (Government of Canada, 2020c). Communities are also encouraged to access support through the First Nation and Inuit Health Branch (FNIHB), which provides both funding and expertise for pandemic planning. However, the FNIHB may not be the first point of contact for communities, such as those in BC, Yukon, and the Northwest Territories. In

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these communities, the FNIHB will be supporting local health authorities in their provision for these communities (Government of Canada, 2020c).

Indigenous Services Canada is also ensuring the continuity of essential services (e.g., Non-Insured Health Benefits, Jordan's Principle, the Inuit Child First Initiative, emergency management measures, income assistance, operations to maintain safety at any environmental remediation site, working collaboratively with First Nations to ensure continued access to mental health and addictions resources) and an additional $10 million will be provided to the existing Family Violence Prevention Program as part of Indigenous Services Canada's network of 46 emergency shelters that support Indigenous women and children fleeing violence (serving approximately 329 First Nations communities), which are located on reserve and in the Yukon (Government of Canada, 2020b). Indigenous Services Minister Marc Miller indicated that the $305 million fund was just the beginning of the federal government's financial commitment to the Indigenous COVID-19 response (Stefanovich, 2020).

Despite the funding and support for Indigenous Peoples, several issues have been outlined by key Indigenous groups and organizations. Assembly of First Nations National Chief Perry Bellegarde commented that Chiefs from across Canada have stated that when support is divided among 634 First Nations in Canada, including 96 remote fly-in communities and 51 Inuit communities in the North, Métis Nations in the West, and Indigenous Peoples living off reserve, the funding will not be sufficient to meet community needs (Wright, 2020). Similarly, Grand Chief Jerry Daniels, Southern Chiefs' Organization Inc., indicated during a House of Commons Standing Committee on Health meeting that less than 1% of the money allocated for Canada to combat the pandemic had been designated for Indigenous communities, despite Indigenous Peoples representing 4.9% of the population in Canada (Government of Canada, 2020d). Further, limited assistance was offered to off-reserve or urban Indigenous Peoples, even though 55.8% of Registered First Nations people live off reserve, with only $15 of $350 million allocated to the CSF permitted to support urban initiatives (Statistics Canada, 2017e). Restrictions included a proposal process for the CSF's urban and off-reserve initiatives, with the call for proposals launched on April 6 and a deadline just one week later (Government of Canada, 2020e). The rationale for this allocation of funds may be premised on the underlying assumption that off-reserve Indigenous Peoples may have greater access to urban resources and tend to fare better on social indicators of well-being than those on reserve (Royal Commission on Aboriginal Peoples, 1996; White et al., 2007, 2009).

These concerns were raised by the President of the National Association of Friendship Centers (NAFC), Christopher Sheppard-Buote, stating that an underfunded competitive program to procure funds in a limited timeframe by organizations with limited capacity who are trying get resources on the ground is problematic (Government of Canada, 2020d). The NAFC has indicated that more resources are needed despite receiving $3.75 million from the Indigenous Community Fund (Government of Canada, 2020d).

Valerie Gideon, senior assistant deputy minister of the First Nations and Inuit Health Branch, Department of Indigenous Services, outlined the complex policy framework surrounding jurisdiction, co-ordination, and collaboration issues between First Nations-, Inuit-, or Métis-led services and a cross-section of federal, provincial, and territorial governments, as well as public health authorities, which can have its challenges, but has also been a strength during COVID-19 (Government of Canada, 2020d).

Jocelyn Formsma, executive director of the NAFC, provided a concrete example of the problems with collaboration and varied responsibilities in practice (Government of Canada, 2020d): During the early phase of the pandemic, jurisdictional issues impeded their ability to respond, particularly as a result of the federal legal and policy framework that has been historically rooted in a restrictive model that focuses service provision on Registered First Nations on reserve and Inuit residing in their traditional territories (Indigenous and Northern Affairs Canada, 2017). As a national organization, the NAFC sought assistance from Indigenous Services Canada; however, they were instructed that the provinces and territories would be expected to provide requested support for Indigenous Peoples in urban centers. When regional Friendship Centres sought out assistance from provincial and territorial associations, they were told to go to the federal government for financial support. The deferral of responsibility led to agencies, such as the NAFC, being redirected from one level of government to another, resulting in a sub-optimal response. The NAFC is one example of a key organization with a longstanding focus on service delivery among off-reserve Indigenous populations, regardless of Status, with 107 local Friendship Centers across the country (National Association of Friendship Centres, 2020). They work closely with mainstream agencies and directly deliver a wide range of programs to support the local needs identified by urban Indigenous Peoples, addressing issues such as housing, family violence, food security, daycares, employment, education, and mental health. The provinces have dedicated a portion of their websites to providing information for members of Indigenous communities and their leaders, often referring them to local organizations such as the NAFC. As a result, these organizations have endured tremendous strain from an increase in service demand; for example, the British Columbia branches of NAFC have reported a 200% increase in service demand during the pandemic, while many Friendship Centers have been forced to physically close to reduce spread of the virus and come up with alternative modes of service provision ("Indigenous Friendship Centres," 2020). The Assembly of First Nations (AFN) created a National Task Force dedicated to assisting the AFN in providing and distributing information, updates, and recommendations to First Nations communities (Assembly of First Nations, 2020).

Inuit communities have also faced similar challenges. As of May 6, the Government of Nunavut had spent over $3.9 million towards developing and maintaining self-isolation hubs (Cable Public Affairs Channel, 2020). The isolation hubs act as a short-term substitute for home-isolation, through institutionally provided hotels with all essential living needs, with the goal of increasing self-isolation compliance, reducing strain on the healthcare system and its limited testing capacities, and mitigating potential household and community spread (Dickens et al., 2020; Government of Nunavut, 2020). The Government of Nunavut was promised $30.8 million in federal funding; however, during the May 8 press conference, Nunavut's Finance Minister George Hickes admitted that the funds have been inaccessible by his government (Cable Public Affairs Channel, 2020). Some provinces have stepped in to take on the pandemic's burden on Indigenous communities with varied responses. Ontario has dedicated $26 million to Indigenous initiatives for both remote and urban First Nations communities within the province (Phillips, 2020). In contrast, British Columbia announced the First Nations Emergency Program Act (BC Government, 2020b), and increased funding for Indigenous Students (BC Government, 2020a), as well as the First Nations Health Authority, which helps coordinate resources such as sanitizers, disinfectants, medical transportation, and mental health services (First Nations Health Authority, 2020).

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Additionally, many communities have exercised their own authority, mostly through prevention strategies (Yellowhead Institute, 2020). For example, many communities, such as Fort McKay, have imposed a strict curfew to limit the mobility of residents to reduce the risk of transmission (Malbeuf, 2020). Longpoint First Nation in Quebec had even requested RCMP and armed forces for border enforcement assistance for their area. Some communities, such as the Curve Lake First Nation, use a flag system to address resident needs and maintain physical distancing (Table 5). Color coded flags made of anything (e.g., T-shirts or paper) are placed in a visible location of a residence, such as a window. The flags are monitored by volunteers and meant to help the most vulnerable remain in self-isolation.

Table 5. Curve Lake First Nation's Flag Code Signals Volunteers for Needs within Households

Flag color	Meaning
White	"Everything is alright."
Blue	"We need water."
Yellow	"We need food."
Red	"We are sick."
Green	"Non-health related help request."

The Mohawk Council of Akwesasne and the Siksika First Nations were able to provide a mobile testing clinic for its community to address their geographical challenges and to ease the burden on local medical facilities (Mohawk Council of Akwesasne, 2020; Yellowhead Institute, 2020). Finally, in times of crisis, many communities would often turn to Sweat Lodges and other traditional ceremonies to support one another physically and emotionally. Such traditions have been paused due to the risk of physical contact under the advice of Indigenous doctors (Sterritt, 2020). Table 6 lists a sample of key Indigenous specific pandemic response activities by various institutions.

As things are developing at a rapid pace, an announcement from the federal government was released on May 29, 2020, outlining another $650.9 million in funding for Indigenous Peoples (Table 7) (Government of Canada, 2020f). The increase was in addition to the promised $75 million towards the Indigenous Community Fund, announced on May 21, dedicated to Indigenous organizations focused on urban centres and off-reserve communities (Government of Canada, 2020g).

This overview of the pandemic response in Canada for Indigenous Peoples has described the magnitude of resource allocation, coordination efforts, and the multisectoral approach that has been adopted. Moreover, we have outlined some of the issues that have arisen. These responses will continue to evolve and are critical to ensure the health and well-being of Indigenous Peoples throughout Canada.

Table 6. Key Pandemic Response Activities in Canada for Indigenous Peoples

Institution	Activities
Federal government	Funding commitments and allocations, information dissemination, PPE and staff supply, economic management
Provincial government	Coordination and mediation between government levels as well as external stakeholders
Indigenous organizations	Distribution and coordination of funds, traditional medicine management, emergency response, public health management, communication to all levels of government
Local communities	Food supply, communication

Table 7. Additional Federal Government Funding in Response to COVID-19 for Indigenous Peoples, as of May 29, 2020

Program	Funding amount (million, CDN$)
Community-led responses	$285.1
Supplement on-reserve income assistance program	$270.0
Spread over 5 years for constructing 12 new shelters	$44.8
Support operational costs for the 12 shelters	$40.8
Annual ongoing funding for operating costs for the 12 shelters	$10.2
Annual ongoing support for Métis leaders and service provider engagement related shelter provision and violence prevention	$1.0
Total	$651.9

Moving Beyond Clinical Factors and Individual Risk

Rapid changes in the policy environment have implications for the COVID-19 pandemic response for Indigenous Peoples in Canada. This comes as no surprise as a hallmark of a novel virus is the associated

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scientific uncertainty, making it extremely difficult for policymakers to make high impact decisions that carry significant consequences. The severity of COVID-19 has already been observed in many regions, such as Italy, the United States, Brazil, the UK, Spain, and France, and it appears that significant heterogeneity, both inter- and intra-nationally will characterize this pandemic. History would indicate that the social determinants of health are extremely useful in navigating uncharted territory, given the powerful role of these factors across many health outcomes (Raphael, 2016). Further, important social determinants of health, such as socioeconomic status and racialized identity have been associated with pandemic outcomes, both in the past and present (Abedi et al., 2020; Chen & Krieger, 2020; Dee et al., 2011; Quinn et al., 2011; Vahidy et al., 2020). The disproportionate impact of pandemic H1N1/09 on Indigenous Peoples in particular has been documented (Centers for Disease Control and Prevention, 2009; Groom et al., 2009; Kumar et al., 2009; National Collaborating Centre for Aboriginal Health, 2013).

Along these lines, the landscape has disproportionately focused on risk factors at the individual level, such as the Public Health Agency of Canada's *Vulnerable Populations and COVID-19* (Public Health Agency of Canada, 2020a). The document indicates that some Canadians are more at risk of getting an infection and developing severe complications due to their underlying health, social, and economic circumstances (Public Health Agency of Canada, 2020a). The Agency states that vulnerable populations may include anyone who is: an older adult, at risk due to certain underlying medical conditions, and/or at risk due to certain medical treatments. Further, anyone who: has difficulty with any reading, speaking, understanding or communicating; has difficulty accessing medical care or health advice; has difficulty doing preventive activities such as frequent hand washing; requires ongoing specialized medical care or specific medical supplies; requires ongoing supervision or support for maintaining independence; or has difficulty accessing transportation. Individuals experiencing economic barriers, unstable employment or inflexible working conditions, social or geographical isolation, and/or insecure, inadequate, or non-existent housing conditions are also at risk. The Agency's focus in this document is on identifying vulnerability at the individual level; however, consistent with the ecological framework (McLeroy et al., 1988), we advocate for a renewed focus on the social causation of disease, consistent with an emphasis on the physical and social environment, and other levels of analysis and intervention, particularly communities.

The international community has identified Indigenous Peoples as particularly vulnerable to COVID-19, given the lower social determinants of health of this group globally (United Nations Expert Mechanism on the Rights of Indigenous Peoples, 2020). Within Canada, the Chief Public Health Officer, Dr. Theresa Tam, indicated, "First Nation, Inuit and Métis communities face a higher risk of 'severe outcomes' given health inequities, higher rates of underlying medical conditions and challenges of remote and fly-in communities" (cited in Kirkup & McLeod, 2020, para. 6). With hundreds of Indigenous communities scattered across the country, the geographic and socioeconomic conditions are diverse, which influences the proximity and degree of access to highly resourced urban health care centers as well as local community capacity and service provision; this begs the question, which communities are most vulnerable? How do we prioritize, manage, and allocate resources for the duration of the pandemic in the most impactful way?

Undoubtedly, a major shortcoming of research and policy approaches to understanding Indigenous inequity is that intra-group differences are often overlooked. As a result, the wide range of social,

cultural, and health characteristics of Indigenous Peoples are homogenized, with profound implications for scientific understanding of social and health issues, as well as hampering the development of tailored policy and interventions, as discussed in detail elsewhere (Spence, 2016; Wilson & Young, 2008). Relatedly, about 25 years ago, the Royal Commission on Aboriginal Peoples (1996) problematized the predominant focus on the individual level of analysis, with an appreciation for the role of community characteristics and broader social conditions fundamental to address the pressing social issues in the Indigenous population. For example, Indigenous communities or reserves are meaningful places in which a significant number of Indigenous Peoples in Canada live (predominantly Registered Indians); they are unique physical and social environments given their geographical, historical, cultural, political, and socioeconomic features. Moreover, within Indigenous communities, a variety of programs and policies, as well as social norms and networks, govern and impact the day-to-day lives of constituents (Mignone, 2003; White et al., 2013). Empirical evidence has supported the variation between Indigenous communities: For example, despite the higher rate of youth suicide among Indigenous youth over a 5-year period, among First Nations communities in British Columbia, some had youth suicide rates 800 times the national average while more than half did not experience a single youth suicide (Chandler & Lalonde, 1998). Similarly, a study on injuries in British Columbia found vast differences in on-reserve injuries across Indigenous communities: Out of about 500 reserves, two accounted for one-quarter of all on-reserve injuries, and less than 30% reported injury rates surpassing surrounding non-reserve areas (Bell et al., 2011). In fact, the varying contextual environment of these communities may considerably affect health and well-being (Spence, 2016; Spence et al., 2007; White et al., 2003, 2007, 2009), as well as indicate vulnerability to any disaster.

A Social Diagnostic Tool to Predict Community Vulnerability to the COVID-19 Pandemic

There is growing evidence linking community characteristics (e.g., socioeconomic position and race) and outcomes for the COVID-19 pandemic (Chen & Krieger, 2020). In this regard, we propose that a social diagnostic tool to predict vulnerability of communities to COVID-19 would be of potentially high value to decision makers in policy planning, by identifying relative risk and allocating finite resources in an optimal manner. The Canadian context has one such social diagnostic tool rooted in work from researchers affiliated with the Aboriginal Policy Research Consortium (International) at the University of Western Ontario (Canada), and the Strategic Research and Data Innovation Branch, Indigenous Affairs Canada, formerly the Strategic Research and Analysis Directorate, Indian and Northern Affairs Canada, who produced and refined the Community-Well Being (CWB) Index (O'Sullivan, 2011; O'Sullivan & McHardy, 2007). The CWB Index measures the socioeconomic well-being of Indigenous and non-Indigenous communities at the community level over time, using the geographic unit of a Census Subdivision (CSD), with each First Nations or Inuit community designated by 1 or more CSDs (Indigenous Services Canada, 2019). There is no score for Métis communities because there are only 8 Métis designated settlement areas in Alberta that are a smaller level of geography than CSDs. The data are from the Census of Canada (1981-2006, 2016) and the National Household Survey (2011). The CWB Index is composed of four variables, which are important social determinants of health: income (per capita), housing (homes in an adequate state of repair and are not overcrowded), education (attainment of high school and university degree), and labor force status (labor force participation and employment; Indigenous Services Canada, 2019). The individual scores on income, housing, education, and labor force status are combined to form a single CWB Index score for every community, ranging

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from 0 to 100. The most recent data from 2016 is based on CWB scores for 623 First Nations, 50 Inuit, and 3,781 non-Indigenous communities (Indigenous Services Canada, 2019).

Program and Policy Applications of the CWB Index

The CWB Index provides an assessment of the gap between Indigenous and non-Indigenous communities over time. Based on the most recent data from 2016, the pattern of inequity between Indigenous and non-Indigenous communities is striking (Figure 2): First Nations communities (N= 623, M= 58.4, range = 39); Inuit communities (N= 50, M= 61.2, range = 30); non-Indigenous communities (N= 3,781, M= 77.5, range = 20; Indigenous Services Canada, 2019).

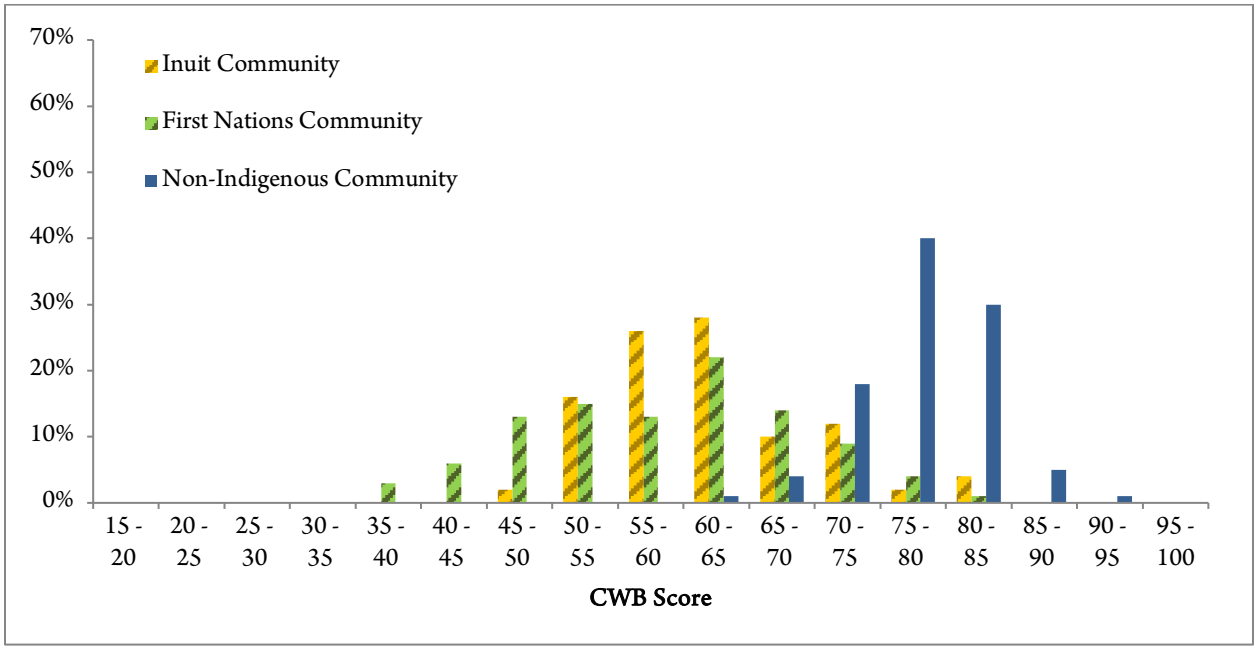

Figure 2. **Distribution of Community Well-Being scores in Canada by community type, 2016.**

As seen in Figure 2, 98 of the lowest 100 CWB Index scores were First Nations communities, while at the other end of the spectrum, only 2 First Nations communities had CWB Index scores that were in the top 100 in Canada (Indigenous Services Canada, 2019). Clearly, Indigenous versus non-Indigenous differences are striking and coincide with well-documented evidence of these social inequities (Public Health Agency of Canada, 2020b). On the other hand, there are important differences between Indigenous communities that are notable. For example, the range in CWB Index scores for First Nations communities is almost double that of non-Indigenous communities (Indigenous Services Canada, 2019). Indeed, this intra-Indigenous heterogeneity is often missed, but discussed earlier and in detail elsewhere (Chandler & Lalonde, 1998; Spence, 2016; Waldram et al., 2006; White et al., 2003). Beyond identifying Indigenous Peoples and communities as generally "at risk," this work has potential policy

implications for assessing the vulnerability among Indigenous communities during a pandemic. It is this intra-Indigenous community variation that is our focus in developing policy initiatives. We propose that the CWB index is a socioeconomically comprehensive tool that may be used to predict those Indigenous communities at greatest risk of being affected by the pandemic. This coincides with previous work, which documented the disproportionate burden of pandemic H1N1/2009 (Centers for Disease Control and Prevention, 2009; Groom et al., 2009; Kumar et al., 2009; National Collaborating Centre for Aboriginal Health, 2013), as some communities were hit much harder than others by the virus (Spence & White, 2010). Indeed, during pandemic H1N1/09, the sites of early and severe pandemic outbreaks included St. Theresa Point and Garden Hill. These communities had relatively low CWB Index scores: St. Theresa Point and Garden Hill were in the bottom 10% among First Nations communities.

Why are these data important? On the ground, these data can provide stakeholders at all levels with the capacity to concretely move beyond identifying individuals at highest risk to identifying communities at highest risk. This can be integral to prioritizing the allocation of finite resources in the short-, medium-, and long-term, given the number and distribution of communities across the country. For example, personal protective equipment, scaled up surveillance, testing and contact tracing, food, safe water, temporary housing to self-quarantine, financial assistance, childcare, access to high speed internet and telephone services, health services, education, and mental health resources are some immediate needs. As new treatments and vaccines are discovered, the allocation of these biomedical resources will require a strategic plan to maximize impact, as there will likely be limited supply initially, as we outlined earlier. Prioritizing beyond individual level vulnerability and risk factors is an implication of this approach. Of course, all needs must be addressed in a collaborative and culturally appropriate manner, respecting the governance structures, decision-making powers, and expertise of local communities. First Nations leaders can use the CWB Index to both assert their sovereignty and lobby the government to address inequities. Thus far, limited use of the CWB Index illustrates its utility as a credible tool that could directly benefit Indigenous Peoples (e.g., BC Treaty Commission, 2016). More generally, the CWB Index may be used by local, provincial, and national policymakers to advocate for, prioritize, and guide, the flow of finite resources to communities at highest risk. This proactive approach would curb the spread of the virus and mitigate the short- and long-term consequences of the pandemic in these communities.

The social, health, and economic impacts of the COVID-19 pandemic will disproportionately affect disadvantaged populations, both in the short- and long-term. Let us examine two examples—mental health and education. There is significant concern over mental health issues associated with the COVID-19 pandemic (Angus Reid, 2020; Qiu et al., 2020; Rohr et al., 2020). An Angus Reid (2020) poll in Canada found that half of Canadians report a worsening of their mental health over the past six weeks related to the pandemic. This mounting evidence is consistent with well-documented research on the short- and long-term impacts of a variety of disasters on mental health (Mak et al., 2009; Norris et al., 2002a, 2002b; North, 2016; Rodriguez & Kohn, 2008). Ensuring adequate community capacity and the implementation of culturally appropriate services and resources will be especially important (Chandler & Lalonde, 1998; Spence et al., 2016), given the varying and unique needs of Indigenous communities (Bell et al., 2011; Chandler & Lalonde, 1998; Spence, 2016; White et al., 2003), rooted in a history of institutionalized inequity, colonialism, and social exclusion. Again, the CWB Index can be used in conjunction with other available community information to guide policy by identifying communities with the fewest resources that can be mobilized to cope with the mental health consequences associated

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with the pandemic, including post-pandemic when resilience resources (Ungar, 2012) and attention dedicated towards these issues may wane. Another example is the disruption of educational systems. The United Nations Educational, Scientific, and Cultural Organization (UNESCO, 2020) indicates that nationwide closures are impacting over 72% of the student population globally, with disadvantaged communities particularly vulnerable to the consequences of school closures. In the context of Indigenous Peoples, these concerns are well founded, given major connectivity gaps to the internet (Innovation, Science and Economic Development Canada, 2019), socioeconomic disparities in computer ownership (Canadian Radio-Television and Telecommunications Commission, 2018), historical issues related to underfunding of education (Drummond & Rosenbluth, 2013), and limited household and community capacity to facilitate learning (White et al., 2009). Indeed, the lower average educational attainment of Indigenous Peoples has been well documented (Battiste, 2013; Castellano et al., 2001; Gordon & White, 2014; White et al., 2009), which has been a major impediment to health and well-being (White et al., 2007, 2009). The potentially long duration of the COVID-19 pandemic, disrupting crucial educational processes and supports at the individual, familial, and community level (White et al., 2009), may exacerbate issues surrounding attainment, particularly in the most vulnerable Indigenous communities, as indicated by the CWB, especially the educational component. Thus, educational policy may benefit from use of the CWB Index to streamline resources, ensuring vulnerable communities are able to deliver education and ensure inequities in education are not exacerbated by the pandemic.

Overall, we believe that the CWB Index is an easy-to-use tool that may support the federal government's Indigenous Services Canada's Preparedness and Response to COVID-19, including preparedness, health human resources, infrastructure, infection prevention and control, medical transportation, governance, communications, and surveillance (Indigenous Services Canada, 2020). In fact, our review of the Indigenous pandemic policy response in Canada found one instance of the use of the CWB Index in the case of the Indigenous Community Support Fund, which is part of the COVID-19 Economic Response Plan, including $305 million to address immediate needs in Indigenous communities. First Nations communities are eligible for $215 million, with funding for each community based on a base amount of $50,000, the total population residing in the community, and an adjustment for remoteness and CWB Index scores. We advocated for the use of this tool in previous work during pandemic H1N1/09 (Spence & White, 2009, 2010) and, to our knowledge, this is the first instance of the CWB Index being explicitly used in pandemic policy and resource allocation. We hypothesize that among Indigenous communities, those in the bottom 10% of CWB Index scores would be at particularly high risk. In a world with limits on resources and the need to move fast, there needs to be predictive assessments, not only reactive assessments. When unforeseen things happen, such as a community that has a relatively high CWB Index score being disproportionately impacted, policy can be used to address these needs. The impact of the COVID-19 pandemic will be seen in coming months. The way the story of this pandemic will play out will be a product of decisions and actions of stakeholders. Moving forward, we advocate for a comprehensive review of the applicability of using the CWB Index across all levels of pandemic policy decision making.

Despite the potential merit of the CWB Index, without doubt, the CWB Index is far from a comprehensive measure of the well-being of Indigenous Peoples in Canada. Given that the measure is capturing Indigenous communities, Indigenous Peoples off reserve are not explicitly captured by the CWB Index, as they are lumped together with non-Indigenous individuals in non-Indigenous

communities. Further, indicators that are specifically relevant to Indigenous Peoples' experience of colonialism, including access to territories (water, resources, and land), social exclusion across social and cultural rights, discrimination, and governance and participation in decision-making are not captured by this measure, which are salient social determinants of health. These shortcomings of the CWB Index are mainly a result of data limitations: National level data with coverage of Indigenous and non-Indigenous communities over multiple years that allows us to track changes in well-being, beyond socioeconomic indicators in the Census, are not available.

Conclusion

Despite the significant challenges posed by the COVID-19 pandemic thus far, the story is far from fully written. Responses are best viewed in their totality when the balance of evidence has been accrued, put into its proper context, and the full impact of policy action is realized. This pandemic will be with us for the foreseeable future, in the absence of highly effective medical treatments or a vaccine. Moreover, post-pandemic challenges, including long term economic, social, and health challenges will require strict attention. In this environment, difficult decisions will have to be made across all realms of society. What we know is that historically, existing social inequities increase vulnerability to disasters for disadvantaged groups. Efforts to mitigate the potential impact of the COVID-19 pandemic are underway and will be essential to ensure the success of the pandemic response.

We believe that the proposed approach to assess the degree of vulnerability to the COVID-19 pandemic, using the CWB Index, a social diagnostic measure for predicting community risk in Canada, may be a valuable, evidence-based tool, for a cross-section of policy decision-makers, including Indigenous communities, health planners and tribal councils, public health departments, regional health authorities, and provincial and federal governments. The main strength of the CWB index is that it is a theoretically rooted measure, composed of the pivotal social determinants of health, measuring the degree of social inequity. Beyond the well-documented risk factors for the COVID-19 disease identified at the individual level, the CWB Index potentially provides actionable evidence for targeted interventions at the community level that address the heterogeneity in socioeconomic risk of Indigenous communities across the country. We advocate for a comprehensive review of the applicability of using the CWB Index across all levels of policy decision-making. Also, we believe that there may be an application to non-Indigenous communities in Canada as well as other countries where Indigenous Peoples live in their own communities and have measurable socioeconomic indicators.

The unpredictable nature of pandemics is unsettling but, given the longstanding evidence on the utility of the social determinants of health, we feel that this this social diagnostic tool may provide some scientific certainty in a time of scientific uncertainty to guide policy decision-making. Of course, this is a short-term "reactionary disparities approach" to deal with a contemporaneous issue and mitigate inequities in relation to this specific disaster. In the long term, the COVID-19 pandemic is yet another opportunity to highlight social inequities and the need for proactive measures to eradicate the socially unjust conditions which produce vulnerability, as we inevitably face new social, health, economic, and environmental challenges.

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