Exploring the Impacts of COVID-19 on Indigenous Peoples in the Northwest Territories

by

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Abstract

Background

COVID-19 has impacted health and well-being globally; some populations have been disproportionately impacted. The experience of Indigenous peoples living in Northern Canada during the COVID-19 pandemic is influenced by their cultural and geographical context. Indigenous peoples in Canada have experienced high disease burden from previous pandemics and epidemics, as a result of colonial practices and adverse social determinants of health. Northern communities in Canada are more vulnerable to COVID-19, due to limited healthcare access, geographic isolation, and lack of infrastructure, such as housing. Thus, COVID-19 may pose a greater health risk to Indigenous peoples in Northern Canada. This thesis explores the experiences of Indigenous peoples living in Northern Canada during the COVID-19 pandemic, and aims to provide high-level policy recommendations for future pandemic response.

Methods

This research used a mixed methods research (MMR) study design. Components of the study design included: (1) a secondary data analysis of a GNWT COVID-19 dataset, (2) individual interviews with Indigenous Elders, using a descriptive qualitative approach; and (3) a literature review to identify unintended consequences of COVID-19 public health measures in the NWT. MMR was chosen as it allowed the research area to be studied from different perspectives, and provided appropriate contextualization (Regnault, 2018).

(1) GNWT COVID-19 Dataset

Secondary analysis of a COVID-19 case dataset maintained by the Government of Northwest Territories was performed. The age, sex, and regional distributions of COVID-19 cases and severe outcomes for Indigenous and non-Indigenous populations were described. COVID-19 case and severe outcome cumulative incidences for Indigenous and non-Indigenous populations were compared using Fisher's Exact test.

(2) Interviews with Indigenous Elders

A descriptive qualitative approach was used to explore the experience of Indigenous people during COVID-19 in the Northwest Territories. Purposive sampling was used to identify and select Indigenous individuals who had rich knowledge and understanding of COVID-19 in the Northern context. Semi-structured individual interviews were conducted with Indigenous Elders and Knowledge Holders. Interviews were recorded by audio and handwritten notes, and analyzed using inductive thematic analysis.

(3) Social Harms of COVID-19

A review of published and gray literature was conducted to identify social harms and unintended consequences of COVID-19 public health measures in the NWT.

Results

(1) GNWT COVID-19 Dataset

There were 9,294 cases of COVID-19 cases in the NWT between March 1, 2020 and March 31, 2022; 6,206 (67%) were Indigenous and 3,086 (33%) were non-Indigenous. Indigenous peoples had a higher cumulative incidence of COVID-19 than the non-Indigenous population overall (RR 2.12, 95% CI 2.04, 2.20, $p<0.001$), and for all sex, age-group and regional strata, except for the 0-4 age group strata.

180 cases between March 2020 and March 2023 experienced a severe outcome associated with COVID-19; 146 (81%) were Indigenous and 34 (19%) were non-Indigenous. There were 34 deaths associated with COVID-19 cases, 27 (79%) were Indigenous and 7 (21%) were non-Indigenous. Indigenous peoples experienced cumulative incidences of severe outcomes and deaths that were over four times higher than those of non-Indigenous people (Severe Outcomes CIR 4.89, 95% CI 3.51, 6.83, $p<0.001$; Mortality CIR 4.07, 95% CI 1.77, 9.33, $p<0.001$).

(2) Interviews with Indigenous Elders

Four interviews were conducted, and four themes and thirteen sub-themes were identified after thematic analysis. The four overarching themes were (i) Social & Health Inequities due to colonization have been exacerbated by COVID-19 (ii) COVID-19 has adversely impacted relationships and community, and resulted in social harms (iii) Effective communication, planning and preparedness are crucial and (iv) Indigenous peoples are sovereign.

(3) Social Harms of COVID-19

Five sources of gray literature were identified in the literature review. Social harms identified in this review were categorized into three categories: education, substance use, and mental health.

Discussion

Available data shows disproportionately outcomes from the COVID-19 pandemic for Indigenous peoples. Limitations include lack of COVID-19 testing and medical comorbidities data. Moving forward, we need an intersectoral approach to address the harms from the COVID-19 pandemic and to address these inequities. This approach must be co-created with Indigenous communities, respecting Indigenous sovereignty and knowledge systems. This approach should incorporate considerations around, but not limited to: Indigenous research capacity, Indigenous sovereignty, health, and emergency preparedness.

Preface

This thesis is an original work by Ali Humayun Qadri. The research project, of which this thesis is a part, received research ethics approval from the University of Alberta Research Ethics Board, Project Name “Exploring health impacts of COVID-19 on Indigenous Peoples in the Northwest Territories”, ID. Pro00123973, October 14, 2022 (Appendix 1).

This research project also received ethics approval from the Aurora College Research Ethics Committee, Project ID 22-15, December 9, 2022 (Appendix 2). The Aurora Research Institute issued a research license for this project, Research Licence No. 17217, February 23, 2023 (Appendix 3). A research agreement was signed between the Department of Health and Social Services, Government of Northwest Territories and Mr. Qadri on April 13, 2023 (Appendix 4).

No portion of this thesis has been previously published.

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I would like to acknowledge that I am a settler situated on Treaty 6 territory, the traditional lands of the First Nations and Métis peoples. Much of my research work was done in the Northwest Territories; I am deeply grateful for the opportunity to learn and work in the Northwest Territories on Treaty 8 territory, home of the Dene, Métis, Inuvialuit and Cree peoples.

I would like to express my gratitude to the many people who have supported me throughout my Masters. First and foremost, I would like to thank my research supervisor, Dr. Susan Chatwood, who has been a constant source of advice and encouragement throughout my Masters. She has helped me develop my research skills and take ownership of my own learning. Her constant support and connections in the Northwest Territories were invaluable.

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Finally, I would like to thank my parents, my wife Aaliyah, my siblings and my friends for their ongoing support and encouragement.

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List of Abbreviations

ARI	Aurora Research Institute
CADTH	Canadian Agency for Drugs and Technologies in Health
CIHI	Canadian Institute of Health Information
CPHO	Chief Public Health Officer
COVID-19	Coronavirus disease 2019
DHSS	Department of Health and Social Services
GNWT	Government of Northwest Territories
H1N1	Influenza A virus, subtype H1N1
HIV	Human Immunodeficiency Virus
HMIS	Health Management Information System
HRHSSA	Hay River Health and Social Services Authority
ICHR	Institute for Circumpolar Health Research
ICU	Intensive Care Unit
MDRx	Most responsible diagnosis
MMR	Mixed-methods Research
NTHSSA	Northwest Territories Health and Social Services Authority
NWT	Northwest Territories
OCAP®	Ownership, Control Access and Possession
OCPHO	Office of the Chief Public Health Officer
PCR	Polymerase Chain Reaction
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
TB	Tuberculosis
TCSA	Tłı̨chǫ Community Services Agency

TRC	Truth and Reconciliation Commission
UNDRIP	United Nations Declaration on the Rights of Indigenous Peoples
WHO	World Health Organization

Chapter 1: Background and Introduction

COVID-19

Coronavirus disease 2019 (COVID-19) is a highly transmissible infectious disease caused by the coronavirus strain Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) (Lotfi et al., 2020). The primary mode of human-human COVID-19 transmission is via large respiratory droplets; transmission may also occur via airborne and fomite routes (Lotfi et al., 2020). COVID-19 was declared a pandemic by the World Health Organization (WHO) in March 2020 (WHO, 2020). COVID-19 has a variable symptom burden; cases with mild disease may present with fever, cough and shortness of breath, or even no symptoms, whereas cases with more severe disease can present with respiratory distress or sepsis, leading to ICU admission or death (Tang et al., 2020). As of August 16, 2023, there have been over 769 million cases of COVID-19 and over 6.9 million deaths due to COVID-19 globally (WHO, 2023).

Risk factors for COVID-19 infection or severe disease are factors that are correlated with these measures; this does not imply a causal relationship (Rashedi et al., 2020). A commonly used epidemiologic framework that can be used to categorize risk factors is the epidemiologic triad, which consists of three components: the host, the agent, and the environment (Tsui et al., 2020). For COVID-19, the host refers to uninfected, susceptible humans, the agent is the SARS CoV-2 virus, and the environment refers to conditions that affect SARS CoV-2 and the risk of to humans (Tsui et al., 2020). Host risk factors for COVID-19 infection and severe disease include older age, male sex, pre-existing comorbidities such as diabetes, unvaccinated status, and race or ethnicity (Rod et al., 2020; Rashedi et al., 2020; Zhang et al., 2023; Meister et al., 2022). Increased age, in particular, is one of the most important and consistent risk factors for severe COVID-19 disease (Rod et al., 2020, Wingert et al., 2021). Viral risk factors include viral load, transmissibility, and viral evolution (Rashedi et al., 2020). Environmental risk factors include crowding, occupational risks (such as healthcare workers), poor ventilation and animal contact (Rashedi et al., 2020; Zhang et al., 2023).

Some studies list Indigenous identity as a risk factor for severe disease from COVID-19 (Carethers, 2021; Dahal, 2022). However, it is important to note that the characterization of Indigeneity as a “risk factor” is imprecise, lacks contextualization, and risks pathologizing Indigeneity by incorrectly imply that Indigenous people are simply predisposed to severe disease (Thurber et al., 2021; Donohue & McDowall, 2021; Mosby & Swidrovich, 2021). Indigenous peoples are not biologically or genetically predisposed to severe illness from COVID-19, or from H1N1 previously (Thurber et al., 2021; Mosby & Swidrovich, 2021).

Considering the wider context of health inequities and considering risk attributes individually, rather than simply characterizing the as a risk factor, has been suggested (Thurber et al., 2021; Mosby & Swidrovich, 2021).

Indigenous Peoples and Previous Infectious Diseases

Indigenous have suffered greatly from waves of infectious diseases since colonization and invasion by Europeans (Power et al., 2020; Richardson & Crawford, 2020). European settlers to North America introduced many novel diseases to Indigenous populations (Ehrenpreis & Ehrenpreis, 2022). While settlers had herd immunity or were asymptomatic carriers of disease, Indigenous populations were immunologically susceptible (Ehrenpreis & Ehrenpreis, 2022). This resulted in epidemics termed “virgin soil” epidemics, epidemics that sweep through populations without prior exposure and immunity, and have devastating impacts (Ehrenpreis & Ehrenpreis, 2022; National Institutes of Health, n.d.) Infectious diseases in the years after European colonization have resulted in the deaths of around 20 million Indigenous peoples in the Americas, or 95% of the Indigenous population at the time (Ehrenpreis & Ehrenpreis, 2022). The infectious diseases introduced by European settlers during colonization are numerous and include smallpox, influenza, tuberculosis, measles, mumps and diphtheria (Collen et al., 2022; Ehrenpreis & Ehrenpreis, 2022).

Smallpox is an aerosol-transmitted viral disease that has recently been eradicated (Meyer et al., 2020). The Spaniards brought smallpox to Mexico in 1520 (Houston & Houston, 2000). Smallpox continued to spread throughout the following centuries and resulted in an epidemic among Cree Indians on the Western Plains in 1781 and 1782 (Houston & Houston, 2000). The Cree Indians were immunologically unexposed to smallpox, and experienced high rates of mortality, with some tribes almost entirely wiped out (Houston & Houston, 2000).

Indigenous peoples in Canada continue to experience an increased burden of infectious disease, in part due to the lasting impacts of European contact (Power et al., 2020; Houston & Houston, 2000). This has been seen with recent epidemics and pandemics, including the Spanish and H1N1 influenza, as well as non-epidemic infectious diseases (Kelm, 1999; Houston & Houston, 2000; Boggild et al., 2011).

The Spanish influenza pandemic in 1918-1919 is estimated to have killed over 50 million people worldwide (Hobday & Cason, 2009). Among non-Indigenous Canadians, the rate of deaths was 6.2 for every 1,000; known death rates for Indigenous peoples on reserves ranged from 10.3 per 1,000 in Prince Edward Island to 61 per 1,000 in Alberta, which is almost ten times as high as the non-Indigenous rate (Jones, 2020). Another study found that the death rate

among First Nations people in British Columbia from the 1918 Spanish Influenza was over nine times higher than the rate for non-First Nations people (Kelm, 1999).

The 2009 H1N1 influenza pandemic disproportionately impacted Indigenous peoples living in Canada, particularly during the first wave of the pandemic (NCCAH, 2016). Indigenous peoples in Canada accounted for approximately 7-10% of hospitalizations, ICU admissions and deaths due to H1N1, despite constituting 3.8% of the population (Boggild et al., 2011). During the first wave of the H1N1 pandemic, First Nations people were hospitalized at a rate of 72 per 100,000, almost three times the crude hospitalization rate of 25.7 per 100,000 in the general population (Boggild et al., 2011).

European settlers to Canada carried strains of tuberculosis (TB); TB has been endemic in Canada since colonization (Hick, 2019). Today, TB is nearly eliminated in the Canadian-born non-Indigenous population, but several Indigenous populations continue to experience high rates of active TB (Hick, 2019; Jetty, 2020).

There are several other examples of infectious diseases which impact Indigenous peoples living in Canada inequitably, including HIV (Chelico et al., 2020). Indigenous peoples have experienced, and continue to experience, increased risk to many infectious diseases (Power et al., 2020; Huyser et al., 2022) This is a legacy of European invasion and colonialism, which has resulted in detrimental impacts on Indigenous peoples' social and cultural determinants of health (Huyser et al., 2022).

COVID-19 and Indigenous Health Determinants

Social and health disparities result in differential health outcomes for respiratory viruses due to differential exposure to virus, susceptibility to disease and access to healthcare (Quinn & Kumar, 2014). For Indigenous peoples, the legacy of colonization includes socioeconomic inequities that contribute to higher rates of infectious diseases (Power et al., 2020; Bratina, 2021; Lee et al., 2023). Risk factors that are common between many infectious diseases include underlying medical conditions and adverse social determinants of health (Lee et al., 2023). Examples of adverse determinants that influence how infectious diseases influence Indigenous peoples in North America include inadequate access to safe healthcare, insufficient access to drinking water, issues with overcrowded housing and limited transport, poor air quality, poorer physical and mental health, loss of coming-of-age traditional teachings and intergenerational poverty (Power et al., 2020; Lee et al., 2023). In addition to adverse social determinants, systemic racism in the healthcare system and society results in poor, insufficient healthcare

(Richardson & Crawford, 2021). These contribute to an overall high infectious disease burden for Indigenous populations (Lee et al., 2023).

The COVID-19 pandemic has itself exacerbated several Indigenous health determinants (Bautista & Wilson, 2021). The physical, social and mental health of Indigenous peoples with chronic health conditions in Canada was affected more compared to the non-Indigenous population throughout the pandemic (Bautista & Wilson, 2021). Indigenous peoples with pre-existing health conditions suffered from reduced personal and community resources and diminished social support (Bautista & Wilson, 2021). Disruptions to food, financial and social networks contribute to poor mental wellness and possible long-term impacts for Indigenous peoples (Bautista & Wilson, 2021). Prolonged public health measures during COVID-19 led to changes to people's work, lifestyle, and social interactions (Hosseinzadeh et al., 2022). Some public health measures, such as business closures and staff reductions, have had a considerable impact on Indigenous families living below the poverty line (Bautista & Wilson, 2021). Some measures may have also resulted in unintended social harms, including harms caused by substance use, self-harm and accidental falls (Canadian Institute for Health Information, 2021).

Several studies have discussed the need for an intersectional approach to understand how multiple interrelating inequalities result in higher risk and impacts from COVID-19 for some individuals (Maestripieri, 2021; Brakefield et al., 2022). The intersections of marginalized gender, age, class, occupation, income, rurality, and other determinants of health change an individual's COVID-19 experience (Maestripieri, 2021). The Native Women's Association of Canada discusses how COVID-19 has multiplied the vulnerabilities for Indigenous women. Indigenous women are marginalized due to discriminatory policies, gaps in healthcare, and the legacy of colonization (Native Women's Association of Canada, n.d.) Limited internet, combined with physical distancing and lockdown measures, further exacerbates social and mental health challenges for Indigenous women and gender-diverse people (Native Women's Association of Canada, n.d.). Similarly, remote and Northern Indigenous communities may face challenges from their intersecting identities; Northern communities in Canada are more vulnerable to COVID-19, due to limited healthcare access, geographic isolation, and lack of infrastructure, such as housing (House of Commons, 2021).

In summary, current and historical colonial practices, and social conditions, are fundamental underlying causes of disease and illness (Huyser et al., 2022). These factors, as well as intersectionality, need to be considered when looking at Indigenous health and well-being.

The Northwest Territories and Indigenous Health

NWT Demographic and Geographical Distributions

NWT is one of three territories in Canada, alongside Nunavut and Yukon. NWT has a population of 45,605, and is the third-largest province or territory by land mass (Northwest Territories Municipal and Community Affairs, 2014; NWT Bureau of Statistics, 2022). Roughly half of NWT's population lives in the Yellowknife region, with the rest of the population living in the Beaufort-Delta (15%), Hay River (9%), Dehcho (7%), Tłı̨chǫ (7%) and Fort Smith (6%) regions (NWT Bureau of Statistics, 2023a). The sex distribution of the NWT population is 51.6% male and 48.4% female (NWT Bureau of Statistics, 2023b). Data on gender from the 2021 Canadian census shows a distribution of 50.6% as male+ and 49.4% as female+; categories outside of the gender binary were randomly collated into the male and female categories due to small sample sizes (NWT Bureau of Statistics, 2022; Statistics Canada, 2022a).

The demographic profile of NWT differs in several ways from Canada's. 50% of the NWT population is Indigenous, compared to 5% for Canada (NWT Bureau of Statistics, 2022; Statistics Canada, 2022b). The proportion of immigrants in NWT, 10.3%, is less than Canada's, which is 23% (Statistics Canada, 2023a). The mean age of NWT is 5 years younger -- 36 years compared to Canada's 41 years (Statistics Canada, 2022a).

NWT has 33 communities of many different sizes and with different levels of access (Government of Northwest Territories, n.d.c). As mentioned, Yellowknife has a population of over 22,000. It is the capital city and only city in the NWT; it is well connected and has many amenities similar to larger cities in Southern Canada (Government of Northwest Territories, n.d.g). Regional centers, such as Inuvik, Hay River, and Fort Smith, generally have between 1,000 and 5,000 residents; these centres have year-round road access and serve as a hub for more remote communities (Government of Northwest Territories, n.d.d). Smaller communities accessible by road have less than 1,000 residents; the GNWT provides a Northern Living Allowance due to the high costs of living (Government of Northwest Territories, n.d.e). Several communities are fly-in communities, only accessible by flight for most of the year; these communities generally range from 100 to 500 residents. These communities receive groceries and supplies by air shipment or winter ice roads when available; access to other communities is more limited (Government of Northwest Territories, n.d.e).

Indigenous Peoples in the Northwest Territories

Indigenous peoples in the NWT are diverse. Of the 50% of the NWT population that is Indigenous, 31% are First Nations, 10% are Inuit and 7% are Métis (Statistics Canada, 2023b). There are 9 official Indigenous languages: Dëne Sųłıné Yatıé (Chipewyan), nēhiyawēwin (Cree), Dinjii Zhu' Ginjik (Gwich'in), Inuinnaqtun, Inuktitut, Inuvialuktun, Dene Kədə́ (North Slavey), Dene Zhatıé (South Slavey), and Tłı̨chǫ Yatıì (Tłı̨chǫ) (Government of Northwest Territories, 2023). Of note, Indigenous peoples are not defined by the NWT territorial borders ; the Inuvialuit, for example, live in communities across all three territories in the Canadian North (Inuit Tapiriit Kanatami, 2023).

Two numbered Treaties, Treaty 8 and Treaty 11, were signed within (what is presently) the NWT (Government of Northwest Territories, n.d.f). These were signed between the Crown and many First Nations. The Dene understood these Treaties as a way to establish peace and friendship between the Dene and the Crown's subjects (Government of Northwest Territories, n.d.f). However, the Government of Canada understood these Treaties as the Dene giving up Aboriginal rights and title. The Dene brought forth a landmark case in 1973, heard by the Supreme Court of the NWT; the presiding judge noted that there was "sufficient doubt on the facts that Aboriginal title was extinguished" (Government of Northwest Territories, n.d.f).

Since then, several Indigenous peoples have negotiated rights agreements with the Government of Canada and GNWT, including the Inuvialuit, Tłı̨chǫ, Gwich'in, Sahtu Dene and Métis (Government of Northwest Territories, n.d.f). These rights agreements include land claim agreements, self-government agreements and treaty settlement agreements (Government of Northwest Territories, n.d.f).

Indigenous Peoples' Health in the Northwest Territories

Health care delivery in the NWT is a territorial responsibility; the NWT government provides insured health services to all citizens, including Indigenous peoples (Indigenous Services Canada, 2020). There are three health and social services authorities in NWT. Each authority is responsible for the planning and delivery of healthcare for different regions in NWT (Table 1) (Health and Social Services Authority, n.d.).

Table 1 Health Authorities in the NWT

Health Authority	**Regions Covered**
Northwest Territories Health and Social Services Authority (NTHSSA)	Beaufort Delta, Sahtu, Dehcho, Fort Smith, Yellowknife (including Stanton Territorial Hospital), Hay River Reserve.

Hay River Health and Social Services Authority (HRHSSA)	Hay River (except Hay River Reserve)
Tłı̨chǫ Community Services Agency (TCSA)	Behchokǫ̀, Gamètì, Whatì, Wekweètì

There are several gaps in social determinants between Indigenous people living in NWT and Canadians nationally (T.K. Young et al., 2020). Indigenous people in NWT have higher rates of unemployment and lower educational attainment compared to non-Indigenous people (Government of Northwest Territories, 2019). The unemployment rate for Indigenous peoples in the NWT was 14% in 2019, compared to 3% for the non-Indigenous population. 90.1% of non-Indigenous people in the NWT had a high school diploma or higher, compared to 56.1% of Indigenous peoples in the NWT (NWT Bureau of Statistics, 2021).

Compared to all Canadians nationally, Indigenous people in the NWT have lower community well-being index scores, which comprises income, education, housing and labour force participation, higher incidence of tuberculosis and higher prevalence of daily smokers (T.K. Young et al., 2020). There are also notable disparities in healthcare access. 59% of Indigenous people in NWT have contact with a medical doctor, compared to 80% of all Canadians, and 24% of Indigenous people in NWT have a regular doctor, whereas 85% of all Canadians do (T.K. Young et al., 2020).

The NWT Health Status Chartbook 2019 provides information about the health status of NWT residents (Government of Northwest Territories, 2019). 50.9% of the Indigenous population were current smokers, compared to 16.5% of the non-Indigenous population. 18.1% of the Indigenous population had chronic obstructive pulmonary disease (COPD) compared to 10.6% of the non-Indigenous population. The prevalence of diabetes was 12.4% for the Indigenous population, compared to 11% for the non-Indigenous population.

Timeline of COVID-19 in NWT

In response to COVID-19, the GNWT declared a state of emergency on March 18, 2020 (Canadian Institute for Health Information, 2023). The first confirmed case of COVID-19 in the Northwest Territories was announced on March 21, 2020 (Government of Northwest Territories, 2020a). This individual had returned to Yellowknife after traveling to British Columbia and Alberta. A visual NWT COVID-19 dashboard with information on testing and confirmed cases was launched in July 2020 (Government of Northwest Territories, 2020b). COVID-19 vaccination rollout began in December 2020 in the NWT; this is discussed in more detail in the following section (Government of Northwest Territories, 2021a). The first COVID-19 related

death in the Northwest Territories occurred the following year, on August 24, 2021 (Government of Northwest Territories, 2021b). The Government of Northwest Territories ended COVID-19 public health emergency and related health orders on April 1, 2022 (Government of Northwest Territories, 2022b).

Over the course of the pandemic, the GNWT introduced several measures aimed at preventing and mitigating the spread of COVID-19. These included limiting the size of gatherings, travel restrictions, self-isolation protocols and suspending non-urgent medical services (Canadian Institute for Health Information, 2023).

Vaccinations

After COVID-19 vaccines were received in the NWT, vaccine rollout and administration were priorities. The GNWT announced their preliminary vaccination approach on December 11, 2020. They stated that this approach was based on five guiding principles: (1) equity, (2) cultural competency, (3) evidence-based decision making (4) flexibility and responsiveness and (5) trust (Government of Northwest Territories, 2021a). A brief overview of important milestones and vaccination-related interventions implemented in NWT is shown in Table 2 (Canadian Institute for Health Information, 2023).

Table 2 Vaccination Related Interventions in NWT

Date Implemented	**Intervention Summary**
18-Mar-20	GNWT announces Public State of Emergency
28-Dec-20	First shipment of Moderna COVID-19 vaccine doses received
31-Dec-20	Vaccination Strategy for NWT residents "Immunity for our Communities: The Northwest Territories COVID-19 Vaccine Strategy" released
31-Dec-20	COVID-19 Vaccination Priority groups outlined: Age>60 Existing chronic diseases and medical illnesses High likelihood of transmission to those at high risk Resident workers who live in NWT but regularly work outside Living in a remote community (including Indigenous communities) with limited health infrastructure

5-Mar-21	Vaccine eligibility expanded to Hay River and Inuvik residents 18 years and older, and Yellowknife residents 50 years and older
10-Mar-21	Vaccine eligibility expanded to Yellowknife residents 18 years and older
4-May-21	First shipment of Pfizer-BioNTech vaccine received
6-May-21	COVID-19 vaccine program expanded to include Pfizer-BioNTech Children aged 12-17 in Yellowknife eligible to receive Pfizer-BioNTech, rolled out to other regions
21-Sep-21	NTHSSA authorizes third vaccine dose for immunocompromised and essential frontline workers at high exposure risk
19-Nov-21	Children aged 5-11 eligible to receive Pfizer-BioNTech
1-Apr-22	GNWT lifts public state of Emergency

Purpose and Significance

Several studies have called for the need for Indigenous-specific COVID-19 data (Power et al., 2020; Mallard et al., 2021, Tripp, 2022). Data will help in understanding the impact of COVID-19 on Indigenous communities, as well as in preparing and responding to future pandemics (Power et al., 2020; Hayward et al., 2021). This need aligns with a key priority identified in The Chief Public Health Officer (CPHO) of Canada's 2021 Report: [to] "advance understanding of how to engage communities and populations in culturally safe and meaningful ways in the design and implementation of public health system solutions and transformations" (Public Health Agency of Canada, 2021).

This study aims to further understanding of COVID-19's impacts on Indigenous peoples in the NWT. This study will establish the incidence of COVID-19 infection and severe outcomes for Indigenous population in NWT. Research without appropriate contextualization has the potential to marginalize and stigmatize Indigenous populations; community-engaged health research and insights provided by Indigenous voices will contextualize the dataset analysis

(Hyett et al., 2019). These results may be used to help co-create high-level policy recommendations with Indigenous peoples for future pandemic preparedness and response.

Research Questions

The objective of this study is to assess the impact of COVID-19 on the Indigenous population in NWT. The specific research questions are:

1. What is the cumulative incidence of COVID-19 and severe outcomes from COVID-19 (hospitalizations, ICU admissions, mortality) among Indigenous peoples in the Northwest Territories, and do these differ from the non-Indigenous population?
2. What are the experiences of Indigenous peoples in the Northwest Territories during the COVID-19 pandemic?

Thesis Organization

This thesis is organized into 5 chapters. Chapter 1 is a background to the topic of COVID-19 and its impacts on Indigenous peoples in the Northwest Territories. Chapter 2 provides a narrative literature review on relevant topics. Chapter 3 describes the research methodology and methods used. Chapter 4 describes the results of the research study. Chapter 5 is a discussion of the results in relation to existing research and provides some suggestions for future direction.

Chapter 2: Literature Review

A narrative literature review was conducted in April 2022 for this thesis, with an additional search in August 2023. Various databases including Cochrane Reviews, PubMed, Google Scholar and Scopus were searched for relevant articles. Keywords used to search include: COVID-19, First Nations, Métis, Inuit, Native, Indigenous, Canada, North, health policy, healthcare access, risk factors vaccination, severe outcomes, hospitalization, ICU admissions and mortality.

The scope of this literature search was global, albeit with particular attention to articles focused on the Canadian context. Most of the articles found during the literature search were focused on the impacts of COVID-19 on Indigenous peoples in a small number of developed countries. A recent systematic scoping review on Indigenous peoples and the COVID-19 pandemic reported a similar experience; the authors found articles for only 19 different countries, with more than half of the articles focused on the United States, Canada and Brazil (Pickering et al., 2023).

The literature review focuses on three different themes:

(1) Indigenous COVID-19 Epidemiologic Measures
(2) Experiences of Indigenous communities in Canada during the COVID-19 pandemic
(3) Effective strategies for COVID-19 response in Canada for Indigenous populations

Indigenous-specific COVID-19 Epidemiologic Measures

Comparisons of COVID-19 epidemiologic measures across different jurisdictions are challenging due to differences in case definitions, testing criteria, individual-level factors affecting whether testing is sought, laboratory preparedness and capacity, and surveillance and reporting systems (Alvarez et al., 2023). These challenges may also arise when comparing COVID-19 measures in the same jurisdiction across different time periods (Stoto et al., 2022). Finally, several of the articles found in the literature review were published early in the pandemic and their analysis reflects COVID-19 data only from 2020; caution should be taken when considering when interpreting these results.

Incidence of COVID-19 Cases and Severe Outcomes for Indigenous peoples globally (excluding Canada)

Indigenous populations experienced disproportionately high burden of infection and mortality from COVID-19 in several countries. In the United States, age-adjusted case incidence, hospitalization incidence, and mortality due to COVID-19 were 2.23 (95% CI 2.18-2.28), 2.72 (95% CI 2.36-3.13) and 2.86 (95% CI 2.28-3.61) times higher, respectively, for American Indian/Alaska Natives compared with white persons, using data until December 31, 2021 (Ward et al., 2022). An earlier study looking at data until June 30, 2020 from 14 states found that American Indian/Alaska Natives had a mortality rate 1.8 times (95% CI 1.7-2.0) higher than rates in non-Hispanic whites (Arrazola et al., 2020). In Mexico, Indigenous peoples had a COVID-19 mortality rate almost twice as high that of the non-Indigenous population (OR 1.92, 95% CI 1.86-1.99), using data until February 28, 2022 (Little et al., 2023). Another study using data until July 30, 2020, found that Indigenous peoples in Mexico had a 64.8% higher case fatality rate compared to non-Indigenous people (Argoty-Pantoja et al., 2021). A COVID-19 modeling study in Brazil found a larger increase in the expected mortality for the Indigenous population compared to the non-Indigenous population (34.8 vs 18.1%) (Soares et al., 2022).

Some studies found that Indigenous populations experienced lower burden of illness from COVID-19, compared to non-Indigenous populations. A commentary by Mallard et al. (2021) found that COVID-19 case incidences were lower for Indigenous populations than non-Indigenous populations in Australia, Canada, Colombia, Ecuador, Mexico and New Zealand, and higher for Brazil, Peru and USA, using data until November 24, 2020 (Mallard et al., 2021). In a commentary published in July 2020, Eades (2020) found that First Nations in Australia constituted 0.7% of COVID-19 cases, despite making up 3% of the population (Eades, 2020).

Incidence of COVID-19 Cases and Severe Outcomes for Indigenous peoples living in Canada

Few studies have compared COVID-19 incidence and severe outcome measures between Indigenous and non-Indigenous populations in Canada. Banning (2020) noted that as of August 6, 2020, the case incidence of COVID-19 for First Nations on reserve was one-quarter that of the general Canadian population, and the mortality rate was one-fifth (Banning, 2020). Mallard et al. found that compared to the non-Indigenous population in Canada, the Indigenous population had 31% of the number of confirmed cases, 3% of the number of deaths and one-tenth of the case-fatality ratio (Mallard et al., 2021). However, in a response to the article by Mallard et al., Tripp (2022) highlighted concerns around incorrect population size estimates, case counts and lack of sourcing, noting that the case counts used by Mallard et al. referred to

First Nations on-reserve rather than the Indigenous population. Tripp conducted an analysis showing that COVID-19 case prevalence for First Nations exceeded non-First Nations by the end of December 2020 and that the COVID-19 mortality rate for First Nations exceeded non-First Nations by the end of April 2021 (Tripp, 2022).

Challenges with COVID-19 Data Availability for Indigenous Populations in Canada

Several studies commented on challenges with accessing and using Indigenous-specific COVID-19 data in Canada. In general, a lack of up-to-date, accurate, reliable, disaggregated and publicly available COVID-19 data for Indigenous populations in Canada was noted (Banning, 2020; Mallard et al., 2021; Tripp, 2022; Huyser et al., 2022; Mishra et al., 2023; Pickering et al., 2023). Federal government COVID-19 data on Indigenous populations excludes many Indigenous people living off-reserve (Tripp, 2022). Indigenous peoples living in Yukon, the Northwest Territories and Nunavut are also excluded, likely because most Indigenous peoples in the Territories do not live on reserves (Tripp, 2022). The lack of disaggregated data for First Nations, Metis and Inuit undermines understanding of how COVID-19 impacts diverse Indigenous communities (Huyser et al, 2022).

Summary

There is limited literature on COVID-19 incidence and severe outcomes for Indigenous populations, focusing largely on the United States, Brazil and Mexico. The literature overall suggests a trend of poorer outcomes from COVID-19 for Indigenous populations. Most studies show a higher incidence of COVID-19 and severe outcomes for Indigenous peoples, but a few using data from 2020 alone show lower incidence.

This literature search produced only a few articles analyzing COVID-19 data for Indigenous populations in Canada, with no articles found analyzing data beyond mid-2021. Issues identified included data quality issues, lack of disaggregated data and challenges with data access and availability.

Indigenous Experiences during the COVID-19 pandemic in Canada

In addition to published research studies on Indigenous experiences during COVID-19 in Canada, several journals published editorials, opinion pieces, stories and news articles from Public Health officials and community members. These add valuable insight into Indigenous experiences and are included in the literature review.

Experiences Around COVID-19 Vaccination

Sullivan et al. (2023) discuss that factors that influence Indigenous peoples' refusal or acceptance of the COVID-19 vaccination include culture, fear, community responses, government COVID-19 responses, and the information people were exposed to (Sullivan et al., 2023). For some Indigenous peoples, vaccine hesitancy may arise from historical legacies of medical experimentation in Indigenous communities (Mosby & Swidrovich, 2021). Additionally, abuse and racist treatment in the healthcare system has weakened trust in the healthcare system (Mosby & Swidrovich, 2021). Recent examples include the racist mistreatment and deaths of Brian Sinclair and Joyce Echaquan and forced medical sterilizations of Indigenous women (Mosby & Swidrovich, 2021; Goldhawke, 2021).

One study looking at racialized and Indigenous peoples in Canada found that vaccine-accepting participants experienced multiple social and structural barriers to COVID-19 vaccination (Aylsworth et al., 2022). These included barriers around accessing COVID-19 disease and vaccination information, booking COVID-19 vaccinations, and travel and security at COVID-19 sites (Aylsworth et al., 2022).

Education

Post-secondary Indigenous students were affected by the loss of traditional cultural supports and physical spaces in their post-secondary institutions (Blaskovits et al., 2023). Blaskovitz et al. (2023) called for these impacts to be addressed, to prevent exacerbating inequities in post-secondary education (Blaskovits et al., 2023). Some Indigenous students may have had to make the difficult decision of staying near school, or returning to their home communities, where they risked inadvertently introducing COVID-19 (Jenei et al., 2020). Indigenous health scholars noted the need for clear and open communication to students, in a way that prioritizes relationship building, as well as the need for scholars to use their privilege to support communities (Galloway et al., 2020).

K-12 school closures affected not only the formal schooling of Indigenous youth, but may have had more significant impacts on some youth, such as those who relied on school programs for breakfast and lunch (Brant-Birioukov, 2021). On the other hand, school closures may have promoted the opportunity for intergenerational learning at home, from siblings, parents and other family members (Brant-Birioukov, 2021). Some on-the-land educators saw school closures as an opportunity to re-introduce land-based education for youth (Brant-Birioukov, 2021).

Mental Health

A strong sense of community belonging was noted to be associated with positive mental health outcomes for Indigenous peoples during the COVID-19 pandemic (Burnett et al., 2022). Indigenous peoples with a weak sense of community belonging had twice the odds of reporting symptoms of anxiety and over four times the odds of reporting symptoms of depression compared to those with a strong sense of community belonging (Burnett et al., 2022).

Studies conducted in Alberta found that Indigenous peoples experienced a higher burden of mental illness than other groups in Alberta (Lawal et al., 2021; Lee et al., 2022). Symptoms of depression and anxiety, and overall poor mental health, may have been exacerbated for Indigenous peoples due to COVID-19 (Lawal et al., 2021; Lee et al., 2022). One study found that Indigenous peoples and visible minority groups more frequently reported stress related to emotional or physical intimate partner violence during the first wave of the COVID-19 pandemic, compared to non-visible minority groups (Jenkins et al., 2021). Indigenous peoples and visible minority groups were also more likely to report challenges with coping (Jenkins et al., 2021).

Effective COVID-19-related Strategies for Indigenous Populations

The final theme of this literature review is effective strategies pertaining to COVID-19 for Indigenous populations in Canada. These strategies have been broken down into those that are applicable at the individual and community level, and higher-level strategies.

Effective Strategies at the Individual and Community Levels

A number of strategies were identified as contributing to effective coping and response for Indigenous peoples. At the individual and community level, these included: returning to the land and using land-based skills and teachings, supporting people who were staying at home, proactive leadership, community unity and using traditional arts (Banning, 2020; Rondeau et al., 2023). Strategies and resources developed by the Inuit to combat tuberculosis were used to support the COVID-19 response (Banning, 2020).

Effective Strategies at the Policy Level

Strategies that were employed by or recommended to policymakers, public health officials, and clinicians included: delivery of pandemic messaging by trusted Elders, leaders and community members, educating health professionals about the historical and current impacts of colonialism, and recognizing the strengths and sacrifices of Indigenous peoples (Banning, 2020;

Howard-Bobiwash et al., 2021; Mosby & Swidrovich, 2021). In Manitoba, high vaccine uptake (90.2%) among First Nations was attributed to a First Nations-led approach, collaborative approaches, and honoring Indigenous leadership and self-determination (Anderson & McKinnon., 2023).

A study looking at COVID-19 impacts on urban Indigenous populations in the USA and Canada made several recommendations for public health policymakers: first, engagement with urban Indigenous leaders, second, increased federal assistance for healthcare delivery, and finally, safeguarding of rights to cultural and spiritual practices (Howard-Bobiwash et al., 2021).

Chapter 3: Methodology

Research Paradigm and Positionality

Research Paradigm

A mixed-methods approach was used for this thesis. Mixed-methods was chosen as it COVID-19 impacts to be studied from different perspectives (Regnault, 2018). Both quantitative and qualitative methods are used; they are described in detail further in this chapter. The methods complement each other, as Regnault aptly describes, MMR allows for the combination of “rich, subjective insights on complex realities from qualitative inquiry” with “standardized, generalizable data generated through quantitative research” (Regnault, 2018). For this research, qualitative interviews provide rich contextualization for quantitative COVID-19 dataset analysis.

Positionality

I am a cis-gender male and first-generation immigrant from Karachi, Pakistan. I settled with my family in Canada 15 years ago. Since then, I have lived in Edmonton, Alberta, on Treaty 6 territory, the traditional lands of the First Nations and Métis, as well as Winnipeg, Manitoba, on Treaty 1 Territory, heartland of the Métis people and original lands of the Anishinaabe, Cree, Oji-Cree, Dene and Dakota peoples.

I am currently completing a residency in Public Health and Preventive Medicine at the University of Manitoba, concurrently with my Master degree. I previously received my Doctor of Medicine (MD) degree in 2020 from the University of Manitoba and completed my Family Medicine residency training from July 2020 to June 2022. My interest in Indigenous health research stems from several clinical rotations I completed as a medical student and resident in urban and remote settings in Manitoba with significant Indigenous populations. I have only stayed in the NWT for a few months over the summer of 2023. I was in Yellowknife, NWT from May to July 2023. I stayed in Fort Smith for a week to attend the Dene National Assembly in July 2023. A planned trip to Inuvik and Aklavik in August 2023 was canceled due to wildfire conditions.

My experiences with COVID-19 shape the questions I ask and the viewpoints I hold. I was a frontline healthcare worker (family medicine resident) living alone in Winnipeg for most of the COVID-19 pandemic. I worked in both family medicine clinics and hospital settings. I was privileged to have steady employment and be in good health during the pandemic. A challenge I experienced during the pandemic was being unable to visit my family in Edmonton for over a

year due to travel restrictions and isolation requirements. I contracted COVID-19 in November 2022 and had mild symptoms. I have received 5 doses of the COVID-19 vaccine as of August 2023.

My positionality - particularly as a non-Indigenous settler, as an outsider to the Northwest Territories and as a medical resident - cannot be removed from my research. It affects, for example, the decisions I make when I analyze data or interpret results. the way I interact with interview participants and the way they perceive me.

Ethics

Ethics approval was obtained from the University of Alberta Research Ethics Board and the Aurora College Research Ethics Board. A research license was obtained from the Aurora Research Institute. For the COVID-19 case dataset, data custodians removed all identifying information prior to the investigator accessing and analyzing the data. I completed OCAP® training in August 2023; the course was not available earlier in the year.

Quantitative Methods

Quantitative Methodologies

Statistics are sometimes seen as a neutral and objective method to arrive at a "truth". However, as Walter and Andersen (2013) state, "...the statistical depictions used to summarize the social complexity of Indigenous communities … are neither natural nor normal" (p.9). Statistics cannot be removed from their cultural context; the way in which statistics about Indigenous peoples are collected, analyzed and interpreted reflects the dominant cultural framework (Walter & Andersen, 2013). Thus, in addition to an overview of the data categories, details on data sources and data collection have been provided. Reporting guidelines from the Canadian Agency for Drugs and Technologies in Health (CADTH) were followed, where applicable (CADTH, 2023). Further discussion around contextualization with respect to data collection, analysis and interpretation is included in Chapter 4.

Data Source

The NWT COVID-19 Case Dataset is a dataset maintained by the Epidemiology and Surveillance Unit in the Population Health Division of the Department of Health, GNWT. The COVID-19 case dataset links person, episode, demographic, laboratory, testing, vaccination and severe outcome information for every recorded COVID-19 case in the Northwest Territories.

The NWT COVID-19 Case Dataset (source dataset) includes both confirmed and probable COVID-19 cases. Confirmed COVID-19 cases are individuals with a positive COVID-19 PCR test result and individuals with positive Health Canada-approved COVID-19 point-of-care test results administered by a healthcare professional. Probable COVID-19 cases comprise individuals with a self-reported positive rapid antigen test.

The COVID-19 case dataset draws from multiple sources, including:

1. COVID-19 PCR test results;
2. Electronic Medical Record Point-of-Care COVID-19 test results;
3. COVID-19 variant data from Alberta Precision Lab;
4. Respiratory Virus Severe Outcome Surveillance Report Forms;
5. A Severe Outcome Liaison;
6. Death Certificates; and
7. Electronic Medical Record Vaccination Administration Data.

Data Access

After receiving a research license, the investigator submitted a data request to the Department of Health and Social Services (DHSS) for COVID-19 data from January 1, 2020 to March 31, 2023. A data custodian provided the investigator with de-identified data on October 19, 2023.

Data Quality

Data custodians reviewed the data thoroughly for completeness and accuracy. Fewer than 0.1% of cases had unknown Indigenous Identity Status. Fewer than 0.1% of cases had unknown sex Identity Status. 71 NWT cases, or 0.6% of the total cases, had unknown age group status.

Data Dictionary

The COVID-19 case dataset accessed by the investigator included 9 variables. A data dictionary with information on data sources, definitions, and validation methods for each variable is provided in this section. Variables in the dictionary include:

1. Person ID
2. Episode ID
3. Ethnic Group

4. Age Group
5. Sex
6. Residency
7. Region
8. Severe Outcomes (Hospitalization, ICU admission, death)
9. Vaccination Status

1. Person ID

Each individual in the COVID-19 dataset has a unique alphanumeric Person identifier. Person identifiers were randomly generated by the data custodians for each personal health number in the COVID-19 case dataset.

2. Episode ID

Each episode of COVID-19 in the COVID-19 dataset has a unique alphanumeric Episode identifier. Episode identifiers were randomly generated by the data custodians for each distinct COVID-19 episode. An individual has one PersonID, but may have multiple EpisodeIDs (multiple COVID-19 episodes).

3. Ethnic Group

The source dataset includes the ethnic group of each COVID-19 case. In the source dataset, ethnic groups were classified as First Nations, Métis, Inuit, Non-Indigenous or Unknown. The data custodians classified values of ethnicity as First Nations, Métis, or Inuit as “Indigenous” for the data accessed and used for analysis by the investigator.

Indigenous identity in the case dataset was determined using health management information system (HMIS) data or provider-reported data. These two data sources are further described below:

(i) HMIS data

NWT residents complete a healthcare coverage application to receive an NWT health care card. Health care coverage applications include a section where applicants can self-declare Indigenous status. Applicants must also provide a letter or card as supporting documentation of status. Health care coverage application information is included in the HMIS.

(ii) Provider-reported data on surveillance reporting forms

If health insurance registry information cannot be obtained, ethnic group data from COVID-19 surveillance reporting forms is used if available. Surveillance report forms are completed by health care providers and include a section on client ethnicity.

4. Health Region

The source dataset includes each COVID-19 cases' city of residence at the time of infection, based on the HMIS. Data custodians classified cities, towns, villages and hamlets into seven health regions, for data accessed and used for analysis by the investigator. The classifications into health regions are described in Table 3:

Table 3 Health Regions in NWT

Cities, Towns, Villages, Hamlets	**Health Region**
Tuktoyaktuk, Aklavik, Tsiigehtchic, Fort McPherson, Paulatuk, Inuvik, Ulukhaktok, Sachs Harbour	Beaufort-Delta
Colville Lake, Fort Good Hope, Norman Wells, Tulita, Délįnę	Sahtu
Behchokǫ̀, Gamètì, Whatì, Wekweètì	Tłı̨chǫ
Yellowknife, Dettah, Łutsel K'e, Fort Resolution, Ndilo	Yellowknife
Hay River, Kakisa, Enterprise, K'atl'odeeche First Nation	Hay River
Wrigley, Fort Simpson, Jean Marie River, Hay River Reserve, Nahanni Butte, Fort Lard, Sambaa Ke, Fort Providence, Trout Lake	Dehcho
Fort Smith	Fort Smith

5. Territorial Residency

The COVID-19 source dataset classifies territorial residency based on HMIS data. Cases who had a valid NWT health card at the time of infection were classified as NWT residents. Cases without a valid NWT health card were classified as non-NWT residents. For this analysis, non-NWT residents were excluded.

6. Age

The COVID-19 source dataset includes the age of the case for each COVID-19 episode, based on HMIS data. The ages were categorized into eight age categories by the data custodians. The data accessed and used for analysis by the investigator included the following age categories for each episode: under 5 years, 5-11 years, 12-18 years, 19-29 years, 30-49 years, 50-64 years, 65-79 years and over 80 years.

7. Sex

The COVID-19 source dataset includes the sex of the case for each COVID-19 episode, based on HMIS data. Cases were classified using the following categories: male, female, or unknown. Data on gender was not collected in the COVID-19 source dataset.

8. Severe Outcomes

Severe outcome from COVID-19 was defined as COVID-19 episodes resulting in (i) hospitalization, (ii) ICU admission or (iii) death.

Hospitalization & ICU Admissions

Hospitalizations and ICU admission information was compiled from surveillance report form data and severe outcome liaison data. Under the Northwest Territories Public Health Act, healthcare professionals have a duty to report notifiable diseases to the Chief Public Health Officer (Government of Northwest Territories, 2007). Healthcare professionals were required by legislation to complete a Respiratory Virus Severe Outcome Surveillance Report Form for every severe outcome experienced by a COVID-19 case (Government of Northwest Territories, 2022). Complementing this data, a severe outcome liaison working in Stanton Territorial Hospital provided information about COVID-19 cases experiencing severe outcomes.

Hospitalizations and ICU admission were validated using discharge abstract data and Canadian Institute of Health Information (CIHI) data. COVID-19 hospital and ICU admissions are in-patient admissions for which the most responsible diagnosis (MDRx) is confirmed COVID-19. The MDRx is an International Classification of Diseases and Related Health Problems, 10th edition, Canada (ICD-10-CA) code describing the patient diagnosis or circumstance most responsible for their hospital stay.

Deaths

Deaths due to COVID-19 were determined using death certificates and the listed cause of death. Deaths due to COVID-19 included all deaths for which COVID-19 was listed as an immediate cause or as an antecedent cause for a contributing factor for death. Causes of death and contributing factors are determined by the clinician or the coroner, if a coroner investigation was required.

9. Vaccination Status at time of Infection

COVID-19 vaccine administration data is stored in Northwest Territories electronic medical records. This data was linked to the COVID-19 case dataset by data custodians. The investigator used this data to classify the vaccination status of cases. Cases were classified based on the number of vaccines they had received at least 14 days prior at the time of their infection using the following criteria:

(a) Unvaccinated
(b) Partially vaccinated (received one dose of a two-dose COVID-19 vaccine series)
(c) Primary series completed (received two doses of a two-dose vaccine series, or received one dose of a one-dose COVID-19 vaccine)
(d) One booster dose received (”Primary Series + 1”)
(e) Two booster doses received (”Primary Series + 2”)
(f) Three booster doses received (”Primary Series + 3”)
(g) Four booster doses received (”Primary Series + 4”)

Statistical Analysis

COVID-19 case dataset analysis was completed using R 4.2.1 and RStudio, and additional packages from the Comprehensive R Archive Network (CRAN). Appendix 5 and 6 show the code from the data custodians and the investigator. Codes are partially redacted to protect confidentiality. Fisher’s Exact test was used to test the hypotheses that the cumulative incidence of COVID-19 cases and severe outcomes between Indigenous and non-Indigenous populations were equal. A p-value of less than 0.05 was used as a benchmark for statistical significance.

Qualitative Methods

Methodology and Sampling

A descriptive qualitative methodology was used to guide this research study. This approach was used as it closely aligned with the aim of obtaining rich, detailed descriptions of COVID-19 experiences (Neergaard et al., 2009).

The target population for this research is all Indigenous adults residing in the Northwest Territories. A sample was selected using purposive sampling. Purposive sampling is a sampling technique used to identify and select individuals who have knowledge, experience and a deep understanding of the topic of interest; individuals should also be available, willing, and express themselves articulately (Palinkas et al., 2015). Indigenous Elders and knowledge-holders were selected using purposive sampling for this research. The ICHR facilitated introductions between the investigator and Indigenous Elders and knowledge-holders; these individuals are well-respected leaders with a wealth of knowledge and experience. Participants were selected and interviewed between June and August 2023. There was variability in the gender, region of residence, and area of employment for the selected participants.

Data Generating Strategies

The investigator identified participants interested in participating in the research study through in-person discussions, phone calls and email correspondence. Semi-structured, individual interviews were scheduled and conducted with willing participants. Interviews were conducted in-person, over Zoom, or by telephone. Participants were advised that interviews would take approximately 45 to 90 minutes, but that there was no specified minimum or maximum time. Participants who requested interview questions were sent this information by email 1-2 weeks prior to the interview. A copy of the interview guide is included and located in Appendix 7.

Interview questions focused on five key themes: (1) Resilience and Community, (2) Communication, (3) Healthcare, (4) Areas of Change and (5) Youth. Some themes and questions were inspired by the CPHO Supplementary Report “What we heard: Indigenous Peoples and COVID-19” (Mashford-Pringle et al., 2021).

Hunt & Young’s (2021) systematic review on blending Western Focus Group and Indigenous Sharing Circle Methodologies provided some helpful recommendations. Although different from the methodology used for this thesis, recommendations were followed where applicable. This included making an offering of tobacco to First Nations participants prior to the

interview, the use of open-ended questions where possible, and providing space for unstructured discussion.

Analysis and Interpretation

A combination of audio recording and handwritten notes was used for interview analysis. Audio-recorded interviews were recorded using a phone recording app and transcribed manually. Analysis was guided by a data-driven ("bottom-up") approach. Inductive approaches highly value participants' voices (Proudfoot, 2023). Themes were generated from a thematic analysis, guided by the six-step framework by Braun and Clarke, as well as the practical applications of the framework described by Maguire and Delahunt (Braun & Clarke, 2006; Maguire & Delahunt, 2017).

An inductive thematic analysis approach was used to analyze interview data. The original analysis planned was a deductive thematic analysis, as the initial design included focus groups with community members. This was revised once the decision to conduct interviews was made. The rich discussion in the semi-structured interviews resulted in insights that were better captured using an inductive approach.

The application of the six-step framework by the investigator is described below. Of note, this was a non-linear process, with steps 1 through 4 being returned to many times throughout the process.

Step 1: Become familiar with the data

After each interview, the investigator read the interview transcript and handwritten notes at least twice. Initial thoughts and codes were written down on hardcopies of the transcript and copies of any additional notes. Once all interviews were completed in August 2023, the interviewer also re-read the entire body of data twice to ensure familiarity with the data.

Step 2: *Generate Initial Codes*

The investigator completed all coding by hand. Codes were not pre-set but developed throughout the coding process for the inductive thematic analysis. Line-by-line coding was used. Transcripts were re-read several times after the completion of all the interviews, and codes were modified to ensure clarity and consistency.

Step 3: Searching for themes

After the completion of the coding process, codes were written down and organized by the investigator into preliminary themes.

Step 4: Review Themes

The investigator created a table with text, codes and themes to ensure that themes were supported by data, clear, and distinct. Themes that were unclear or unsupported were removed or modified.

Step 5: Defining and Naming Themes

Themes were refined and a thematic map was created to show relationships between different themes and between themes and sub-themes.

Step 6: Reporting Findings

Findings from the analysis are discussed in Chapter 4 (Results)

Rigour

The four principles outlined by Milne & Oberle, 2005 will be used to help ensure rigour. These principles are authenticity, credibility, criticality and integrity (Milne & Oberle, 2005).

Authenticity considers how accurately participant voices are represented (Milne & Oberle, 2005). Participant checks were used to ensure authenticity. An in-person follow-up or phone call was conducted with participants within two weeks to review if the ideas generated were an authentic reflection of the data they had provided. Findings were sent to all participants once all interviews were completed and thematic analysis had been completed, to ensure authenticity.

The second principle, credibility, considers how believable study findings are. This was accomplished through the use of purposive sampling. Interview participants were respected Indigenous Elders and knowledge holders who held rich knowledge about the subject matter and who were engaged in their communities.

The third principle, criticality, considers if decisions made throughout the research process are critically appraised (Milne & Oberle, 2005). One way to ensure criticality was the concurrent collection and analysis of data. After each interview, an initial analysis was conducted within 3 days of the interview. Audio-recorded interviews were transcribed. The investigator read through the interview transcript and any hand written notes at least twice, and

wrote initial ideas and preliminary codes. The investigator then reviewed if the data generated from the interview was useful in answering one or more research questions. The interview guide was reviewed after each interview for revisions to structure and questions based on that interview experience.

The final principle is integrity, which considers the investigator's self-reflection (Milne & Oberle, 2005). I used both voice memos and hand-written journals starting from around March 2023 to document my personal reflections, thoughts and feelings throughout the research process. This has helped me identify my own strengths and gaps in knowledge, and reflect on my own growth and the research process as a whole.

Consent

Written and verbal consent was obtained from participants. Participants were informed that they did not need to answer questions if they did not wish to and could terminate the interview at any point. Participants were asked if they wanted to make their identities known and if specific quotes from their interviews could be used. Participants were informed that they could withdraw their data after the interview. Participants were paid an honorarium for their time.

Knowledge Translation and Exchange

Knowledge translation and exchange is ongoing and will continue beyond the completion of this thesis. An infographic was developed to share study results with Elders (Appendix 8). The 2023 NWT wildfire crisis has delayed some knowledge-exchange events. I intend to participate in the ARI Speaker Series and Student Presentations, as well as other available opportunities.

Literature Search

A review of published and grey literature was conducted in June 2023 to identify unintended consequences of COVID-19 public health measures in the NWT. This included search queries on Google Scholar and PubMed. This also involved a review of the GNWT's Open Data Portal, as well as GNWT reports on COVID-19, social indicators, health and wellness, education and employment.

Chapter 4: Results

Demographic Characteristics of NWT Health-Insured Population

Demographic characteristics for the NWT Health-Insured Population in 2020 are presented in Table 4. The total health-insured population of the NWT was 45,513. Around half of the residents were male (n=23,065; 50.7%). One quarter of the population was aged 18 or younger (n=11,494; 25.3%) and just under 10% was aged over 65 (n=4236; 9.3%). Over three-quarters of the NWT population resided in one of the regions served by the NTHSSA (n=36,607; 80.4%)

Just under half of health-insured residents were Indigenous (n=22,157; 48.7%). The proportion of male residents was similar between Indigenous and non-Indigenous residents (Indigenous n=11,013; 49.7%, non-Indigenous n=12,052; 51.6%). 28.6% of Indigenous residents (n=6338) and 22.1% (n=5156) of non-Indigenous residents were under the age of 18, and 9.1% of Indigenous residents (n=2037) and 9.4% of non-Indigenous residents (n=2199) were over the age of 65.

Table 4 Demographic Data for NWT Health-Insured Residents

Characteristic		NWT Residents Total n = 45,513 n (%)	NWT Indigenous n = 22,157 n (%)	NWT Non-Indigenous n = 23,356 n (%)
Sex	Male	23065 (50.7)	11013 (49.7)	12052 (51.6)
	Female	22427 (49.3)	11136 (50.3)	11291 (48.3)
	Unknown	21 (<0.1)	8 (<0.1)	13 (<0.1)
Age	0-4	3106 (6.8)	1387 (6.3)	1719 (7.4)
	5-11	4353 (9.6)	2440 (11.0)	1913 (8.2)
	12-18	4035 (8.9)	2511 (11.3)	1524 (6.5)
	19-29	7209 (15.8)	4033 (18.2)	3176 (13.6)
	30-49	13622 (29.9)	5849 (26.4)	7773 (33.3)
	50-64	8952 (19.7)	3900 (17.6)	5052 (21.6)
	65-79	3637 (8.0)	1672 (7.5)	1965 (8.4)
	>80	599 (1.3)	365 (1.6)	234 (1.0)
Health Region	NTHSSA	36607 (80.4)	16995 (76.7)	19612 (84.0)
	HRHSSA	3925 (8.6)	1814 (8.2)	2111 (9.0)
	TCSA	2997 (6.6)	2825 (12.7)	172 (0.7)
	Unknown	1984 (4.4)	523 (2.4)	1461 (6.3)

COVID-19 Case Dataset

Case Counts

NWT COVID-19 case counts between March 1, 2020 and March 31, 2022 are presented in Table 5. There was a total of 9,294 confirmed and probable COVID-19 cases in the NWT between March 1, 2020 and March 31, 2022. Just over a half of the cases were female (n = 4801; 57%) and around a third of cases were aged 30-49 (n = 3012; 32.4%). 80.0% (n = 7432) resided in regions served by the NTHSSA; 13% (n = 1206) in TCSA and 6.4% (n = 597) in HRHSSA.

Around two-thirds of COVID-19 cases were Indigenous (n = 6206; 66.8%). Of these, 6.9% (n=430) were over the age of 65 and around a quarter (n = 1678; 27.0%) were under the age of 18. 90.1% (n = 2781) resided in regions served by the NTHSSA; 1.3% (n = 40) in TCSA and 6.2% (n=597) in HRHSSA.

Of non-Indigenous cases (n = 3086; 33.2% of all COVID-19 cases), 3.8% (n=118) were over the age of 65 and 28.8% (n = 919) were under the age of 18. 74.9% (n = 4651) resided in regions served by the NTHSSA; 18.8% (n = 1206) in TCSA and 6.9% (n=213) in HRHSSA.

Table 5 Characteristics of COVID-19 Cases (March 1, 2020-March 31, 2022)

Characteristic		NWT Residents Total[a] n = 9294 n (%)	NWT Indigenous n = 6206 n (%)	NWT Non-Indigenous n = 3086 n (%)
Sex	Male	4490 (48.3)	2901 (46.7)	1588 (51.5)
	Female	4801 (51.7)	3304 (53.2)	1497 (48.5)
	Unknown	3 (<0.1)	1 (<0.1)	1 (<0.1)
Age	0-4	628 (6.8)	279 (4.5)	349 (11.3)
	5-11	1004 (10.8)	665 (10.7)	339 (11.0)
	12-18	965 (10.4)	734 (11.8)	231 (7.5)
	19-29	1631 (17.5)	1189 (19.2)	441 (14.3)
	30-49	3012 (32.4)	1834 (29.6)	1178 (38.2)
	50-64	1505 (16.2)	1075 (17.3)	430 (13.9)
	65-79	451 (4.9)	349 (5.6)	102 (3.3)
	>80	98 (1.1)	81 (1.3)	16 (0.5)
Health Region	NTHSSA	7432 (80.0)	4651 (74.9)	2781 (90.1)
	Beaufort Delta	*1810 (19.5)*	*1581 (25.5)*	*229 (7.4)*
	Dehcho	*678 (7.3)*	*616 (9.9)*	*62 (2.0)*
	Fort Smith	*490 (5.3)*	*375 (6.0)*	*115 (3.7)*
	Sahtu	*646 (7.0)*	*574 (9.2)*	*72 (2.3)*
	Yellowknife	*3808 (41.0)*	*1505 (24.3)*	*2303 (74.6)*
	HRHSSA	597 (6.4)	383 (6.2)	213 (6.9)
	TCSA	1206 (13.0)	1166 (18.8)	40 (1.3)
	Unknown	59 (6.3)	6 (0.1)	52 (1.7)

[a] Includes two Individuals whose Indigenous Identity status is unknown

Cumulative Incidence of COVID-19 cases between March 1, 2020 and March 31, 2022

Cumulative incidences for COVID-19 cases from March 1, 2020 and March 31, 2022, including sex-stratified, age-standardized, and region-stratified cumulative incidences, are presented in Table 6. Cumulative incidences per 1,000 people were calculated using health-insured population denominators.

The cumulative incidence of COVID-19 cases during this time period was 204.2 per 1,000 for all NWT residents, 280.1 per 1,000 for Indigenous residents, and 132.1 per 1,000 for non-Indigenous residents. The cumulative incidence of COVID-19 cases from March 1, 2020 and March 31, 2022 for Indigenous peoples' is over twice as high as the rate for non-Indigenous peoples (CIR 2.12; 95% CI 2.04, 2.20; $p<0.001$). Stratified by sex, the cumulative incidence is twice as high for Indigenous males as for non-Indigenous males (CIR 2.00; 95% CI 1.89, 2.11; $p<0.001$) and over twice as high for Indigenous females as for non-Indigenous females (CIR 2.24; 95% CI 2.12, 2.36; $p<0.001$). Age group stratified cumulative incidence ratios showed no difference between Indigenous and non-Indigenous populations for the 0-4 age category (CIR 0.99; 95% CI 0.86, 1.14, $p = 0.93$), but higher rates for Indigenous populations for the remaining age categories. The greatest ratio was for the 65-79 age category (CIR 4.02; 95% CI 3.06, 4.96; $p<0.001$).

Stratified by health authority, the cumulative incidence ratios are 1.93 for NTHSSA (95% CI 1.85, 2.01; $p<0.001$), 2.09 for HRHSSA (95% CI 1.79, 2.44; $p<0.001$) and 1.77 for TCSA (95% CI 1.35, 2.34).

Table 6 Cumulative Incidence of COVID-19 Cases (March 1, 2020-March 31, 2022)

		NWT Residents Total n = 9294	NWT Indigenous n = 6206	NWT Non-Indigenous n = 3086	Cumulative Incidence Ratio[a] CIR (95% CI)	p-value[b]
Cumulative Incidence per 1,000 persons		204.2	280.1	132.1	2.12 (2.04, 2.20)	<0.001
Cumulative Incidence per 1,000 persons (sex-stratified)	Male	194.7	263.4	131.8	2.00 (1.89, 2.11)	<0.001
	Female	214.1	296.7	132.6	2.24 (2.12, 2.36)	<0.001
Cumulative Incidence per 1,000 (age-group stratified)	0-4	202.2	201.2	203.0	0.99 (0.86, 1.14)	0.93
	5-11	230.6	272.5	177.2	1.54 (1.37, 1.73)	<0.001
	12-18	239.2	292.3	151.6	1.93 (1.69, 2.20)	<0.001
	19-29	226.2	294.8	138.9	2.12 (1.92, 2.34)	<0.001
	30-49	221.1	313.6	151.6	2.07 (1.94, 2.21)	<0.001
	50-64	168.1	275.6	85.1	3.24 (2.92, 3.59)	<0.001
	65-79	124.0	208.7	51.9	4.02 (3.06, 4.96)	<0.001
	>80	163.6	221.9	68.4	3.25 (1.95, 5.41)	<0.001
Cumulative Incidence per 1,000 (stratified by region)	NTHSSA	203.0	273.7	141.8	1.93 (1.85, 2.01)	<0.001
	HRHSSA	152.1	211.1	100.9	2.09 (1.79, 2.44)	<0.001
	TCSA	402.4	412.7	232.6	1.77 (1.35, 2.34)	<0.001

[a] NWT non-Indigenous population is used as a reference for Cumulative Incidence Ratios
[b] Fisher's Exact Test p-value

Severe Outcome Counts

Demographic characteristics of cases with COVID-19 episodes associated with severe outcomes between March 1, 2020 and March 31, 2023 are presented in Table 7.

There was a total of 180 COVID-19 episodes associated with one or more severe outcomes in the NWT between March 1, 2020 and March 31, 2023. 52.8% (n = 95) were male, 55% (n = 99) were over the age of 65, and 73.3% (n =132), 10.6% (n = 19), 15.6% (n = 28) resided in NTHSSA, HRHSSA and TCSA regions respectively. Indigenous peoples represented 81.1% (n = 146) of COVID-19 episodes associated with one or more severe outcomes. Of these, 52.7% were male (n = 77) and over half were aged 65 or older (n = 82; 56.1%).

There were 238 severe outcome episodes; a single COVID-19 episode may be associated with more than one severe outcome episode. Of the total number of severe outcome episodes, 68.5% (n = 163) were hospitalizations, 17.2% (n = 41) were ICU admissions and 14.3% were deaths (n = 34). Indigenous peoples represented 81.9% (n = 195) of the severe outcome episodes. By severe outcome type, Indigenous peoples accounted for 81.6% (n = 133) of hospitalization episodes, 85.4% of ICU admissions (n=35) of ICU admissions and 79.4% (n = 27) of deaths.

Table 7 Demographic Characteristics for COVID-19 Episodes associated with Severe Outcomes (March 1, 2020-March 31, 2023)

Characteristic		NWT Total n = 180 n (%)	NWT Indigenous n = 146 n (%)	NWT Non-Indigenous n = 33 n (%)
Sex	Male	95 (52.8)	77 (52.7)	18 (54.5)
	Female	84 (46.7)	69 (47.2)	15 (45.5)
	Unknown	1 (0.6)	0 (0)	(0)
Age	0-4	*	*	*
	5-11	*	*	*
	12-18	0 (0)	0 (0)	0 (0)
	19-29	8 (4.4)	*	*
	30-49	26 (14.4)	*	*
	50-64	38 (21.1)	27 (18.5)	11 (33.3)
	65-79	59 (32.8)	50 (34.2)	9 (27.3)
	>80	40 (22.2)	32 (21.9)	7 (21.2)
Health Region	NTHSSA	132 (73.3)	105 (71.9)	27 (81.8)
	Beaufort Delta	*19 (10.6)*	*	*
	Dehcho	*13 (7.2)*	*	*
	Fort Smith	*9 (5.0)*	*	*
	Sahtu	*17 (9.4)*	*	*
	Yellowknife	*74 (41.1)*	*53 (36.3)*	*21 (63.6)*
	HRHSSA	19 (10.6)	*	*
	TCSA	28 (15.6)	*	*
	Unknown	1 (0.6)	0 (0)	0 (0)

(continued)

Table 7 Demographic Characteristics for COVID-19 Episodes associated with Severe Outcomes (March 1, 2020-March 31, 2023) (cont.)

Characteristic		NWT Total n = 180 n	NWT Indigenous n = 146 n	NWT Non-Indigenous n = 33 n
Total Number of Severe Outcomes[c]		238	195	42
Type of Severe Outcome	Hospitalization	163	133	29
	ICU Admission	41	35	6
	Mortality	34	27	7

[a] Includes on individual whose Indigenous identity status is unknown

[b] Non-zero case counts under 5 are suppressed, except for unknown categories. Secondary suppression is also used if indicated. Suppressed values are indicated with a *

[c] COVID-19 episodes may be associated with one or more severe outcomes; therefore, the total number of severe outcomes is greater than the number of COVID-19 episodes

Mortality Data

Demographic characteristics of mortality episodes due to COVID-19 between March 1, 2020 and March 31, 2023 are presented in Table 8.

There was a total of 34 COVID-19 episodes associated with mortality. Around two-thirds of these were male (n=23, 67.6%). Half of the deaths occurred in people over 80 (n=17, 50%) and 79% (n = 27) occurred in people aged 65 or older.

27 (79%) of deaths were Indigenous and 7 (19%) were non-Indigenous. Of Indigenous deaths, 19 (70%) were male and 21 (78%) occurred in people aged 65 or older.

Table 8 Demographic Characteristics for COVID-19 Mortality Episodes

Characteristic		NWT Total n = 34 n (%)	NWT Indigenous n = 27 n (%)	NWT Non-Indigenous n = 7 n (%)
Sex	Male	23 (67.6)	*	*[a]
	Female	11 (32.4)	*	*
Age	0-4	0 (0)	0 (0)	0 (0)
	5-11	0 (0)	0 (0)	0 (0)
	12-18	0 (0)	0 (0)	0 (0)
	19-29	0 (0)	0 (0)	0 (0)
	30-49	*	*	0 (0)
	50-64	6 (17.6)	*	*
	65-79	10 (29.4)	*	*
	>80	17 (50.0)	*	*
Health Region	NTHSSA	23 (67.6)	*	*
	Beaufort Delta	*	*	*
	Dehcho	*	*	0 (0)
	Fort Smith	*	*	*
	Sahtu	*	*	0 (0)
	Yellowknife	*13 (38.2)*	*	*
	HRHSSA	*	*	*
	TCSA	7 (20.6)	*	*

[a]Non-zero case counts under 5 are suppressed, except for unknown categories. Secondary suppression is also used if indicated. Suppressed values are indicated with a *

Cumulative Incidences of COVID-19 severe outcomes and mortality between March 1, 2020 and March 31, 2023

Cumulative incidences of COVID-19 episodes with severe outcome and mortality episodes between March 1, 2020 and March 31, 2023 are presented in Table 9. The cumulative incidence of COVID-19 Episodes associated with one or more severe outcomes was 39.5 per 10,000 for all NWT residents, 65.9 per 10,000 for Indigenous peoples and 14.1 per 10,000 for non-Indigenous residents. The cumulative incidence of episodes associated with one or more severe outcomes for Indigenous peoples was over four times higher than that of non-Indigenous peoples (CIR 4.68; 95% CI 3.21, 6.83; p<0.001); the cumulative incidence of severe outcome episodes themselves was almost five times higher for Indigenous compared to non-Indigenous people (CIR 4.89; 95% CI 3.51, 6.83; p<0.001).

Indigenous peoples had a higher cumulative incidence of severe outcomes for both male (CIR 4.68; 95% CI 2.80, 7.62; p<0.001) and female strata, when stratified by sex. When stratified by age group, Indigenous peoples had a higher cumulative incidence of severe outcomes than non-Indigenous people for the 30-49 (CIR 33.22; 95% CI 4.50, 245.12; p<0.001), 50-64 (CIR 3.18; 95% CI 1.58, 6.40; p<0.001), 65-79 (CIR 6.53; 95% CI 3.22, 13.24; p<0.001) and older than 80 (CIR 2.93; 95% CI 1.32, 6.53; p=0.006) age groups.

The cumulative incidence of COVID-19 episodes associated with mortality was 7.5 per 10,000 for all NWT residents, 12.2 per 10,000 for Indigenous peoples and 3.0 per 10,000 for the non-Indigenous population. The cumulative incidence for Indigenous peoples was four times higher than that of non-Indigenous people (CIR 4.07; 95% CI 1.77, 9.33; p<0.001).

Table 9 Cumulative Incidence for COVID-19 Episodes associated with Severe Outcomes, Severe Outcomes and Mortality (March 1, 2020-March 31, 2023)

		NWT Total	NWT Indigenous	NWT Non-Indigenous	Cumulative Incidence Ratio CIR (95% CI)	p-value
COVID-19 Episodes Associated with one or more Severe Outcomes						
Cumulative Incidence of COVID-19 Episodes associated with Severe Outcomes per 10,000		39.5	65.9	14.1	4.68 (3.21, 6.83)	<0.001
Cumulative Incidence of COVID-19 Episodes associated with Severe Outcomes per 10,000 (sex-stratified)	Male	41.2	69.9	14.9	4.68 (2.80, 7.62)	<0.001
	Female	37.5	62.0	13.3	4.66 (2.67, 8.15)	<0.001
Cumulative Incidence of COVID-19 Episodes associated with Severe Outcomes per 10,000 (age group-stratified)	0-4	*	*	*	*	*
	5-11	*	*	*	*	*
	12-18	0.0	0.0	0.0		
	19-29	11.1	*	*	*	*
	30-49	19.1	*	*	*	*
	50-64	42.4	69.2	21.8	3.18 (1.58, 6.40)	<0.001
	65-79	162.2	299.0	45.8	6.53 (3.22, 13.24)	<0.001
	>80	667.8	876.7	299.1	2.93 (1.32, 6.53)	0.006
Cumulative Incidence of COVID-19 Episodes associated with Severe Outcomes per 10,000 (region- stratified)	NTHSSA	36.1	61.8	13.8	4.49 (2.94, 6.85)	<0.001
	HRHSSA	48.4	82.7	18.9	4.36 (1.45, 13.13)	0.005
	TCSA	93.4	*	*	*	*

Table 9 Cumulative Incidences for COVID-19 Episodes associated with Severe Outcomes, Severe Outcomes and Mortality (March 1, 2020-March 31, 2023) (cont.)

		NWT Residents	NWT Indigenous	NWT Non-Indigenous	Cumulative Incidence Ratio[a] CIR (95% CI)	p-value[b]
Severe Outcomes						
Cumulative Incidence of Severe Outcomes per 10,000	All Severe Outcomes	52.3	88.0	18.0	4.89 (3.51, 6.83)	<0.001
	ICU Admission	9.0	15.8	2.6	6.15 (2.59, 14.62)	<0.001
	Mortality	7.5	12.2	3.0	4.07 (1.77, 9.33)	<0.001
	Hospitalization	35.8	60.0	12.4	4.83 (3.24, 7.22)	<0.001
Mortality						
Case Fatality Ratio per 10,000		29.0	40.3	18.9		
Incidence Rate of Mortality Episodes per 10,000 (sex-stratified)	Male	10.0	*[c]	*	*	*
	Female	4.9	*	*	*	*
Cumulative Incidence of Mortality Episodes per 10,000 (age group-stratified)	0-4	0	0	0		
	5-11	0	0	0		
	12-18	0	0	0		
	19-29	0	0	0		
	30-49	*	*	0		
	50-64	6.7	*	*	*	*
	65-79	27.5	*	*	*	*
	>80	283.8	*	*	*	*
Cumulative Incidence of Mortality Episodes per 10,000 (region-stratified)	NTHSSA	6.3	*	*	*	*
	HRHSSA	10.2	*	*	*	*
	TCSA	23.4	*	*	*	*

[a] NWT non-Indigenous population is used as a reference for Cumulative Incidence Ratios
[b] Fisher's Exact Test p-value
[c] Non-zero case counts under 5 are suppressed, except for unknown categories. Secondary suppression is also used if indicated. Suppressed values are indicated with a *

Counts and Cumulative Incidence of COVID-19 episodes between April 1, 2022 and March 31, 2023

Counts of COVID-19 episodes between April 1, 2022 and March 31, 2023 are presented in Table 10, and cumulative incidences are presented in Table 11. There were 1,123 reported COVID-19 cases between April 1, 2022 and March 31, 2023. Of these cases, 502 (45%) were Indigenous and 621 (55%) were non-Indigenous. 272 cases (24.2%) were aged 65 or older. The cumulative incidence of COVID-19 during this time period was 24.9 cases per 1,000 for all NWT residents, 23.3 per 1,000 for Indigenous residents and 26.3 per 1,000 for non-Indigenous residents. The cumulative incidence of reported COVID-19 episodes during this time period was slightly lower for Indigenous residents than non-Indigenous residents (CIR 0.88, 95% CI 0.79, 0.99, p=0.037).

Cumulative incidences for March 1, 2020-March 31, 2022 are also presented in Table 11; rates here are presented per 1,000 residents per year. The cumulative incidences during March 1, 2020-March 31, 2022 were 98.1 per 1,000 per year for all NWT residents, 134.5 per 1,000 per year for Indigenous residents and 63.5 per 1,000 per year for non-Indigenous residents.

Table 10 Demographic Characteristics of COVID-19 Cases (April 1, 2022-March 31, 2023)

Characteristic		NWT Total n = 1123 n (%)	NWT Indigenous n = 502 n (%)	NWT Non-Indigenous n = 621 n (%)
Sex	Male	454 (40.4)	215 (42.8)	239 (38.5)
	Female	669 (59.6)	287 (57.2)	382 (61.5)
Age	0-4	70 (6.2)	22 (4.4)	48 (7.7)
	5-11	33 (2.9)	10 (2.0)	23 (3.7)
	12-18	42 (3.7)	14 (2.8)	28 (4.5)
	19-29	107 (9.5)	47 (9.4)	60 (9.7)
	30-49	355 (31.6)	126 (25.1)	229 (36.9)
	50-64	244 (21.7)	105 (20.9)	139 (22.4)
	65-79	193 (17.2)	115 (22.9)	78 (12.6)
	>80	79 (7.0)	63 (12.5)	16 (2.6)
Health Region	NTHSSA	901 (80.2)	368 (73.3)	533 (85.8)
	Beaufort Delta	*145 (12.9)*	*120 (23.9)*	*25 (4.0)*
	Dehcho	*67 (6.0)*	*62 (12.4)*	*5 (<0.1)*
	Fort Smith	*32 (2.8)*	*24 (4.8)*	*8 (1.3)*
	Sahtu	*44 (3.9)*	*37 (7.4)*	*7 (1.1)*
	Yellowknife	*613 (54.6)*	*125 (24.9)*	*488 (78.6)*
	HRHSSA	126 (11.2)	59 (11.8)	67 (10.8)
	TCSA	84 (7.5)	75 (14.9)	9 (1.4)
	Unknown	12 (1.1)	0 (0)	12 (1.9)

Table 11 Cumulative incidences of COVID-19 Cases for April 1, 2022-March 31, 2023, compared with cumulative incidences (March 1, 2020-March 31, 2022)

Characteristic		All Cases	NWT Indigenous	NWT Non-Indigenous	Cumulative Incidence Ratio[a] CIR (95% CI)	p-value[b]
Cumulative Incidences for Cases from Apr 1 2022-Mar 31, 2023						
Cumulative Incidence per 1,000 per year (2022-2023 episodes)		24.9	23.3	26.3	0.88 (0.79, 0.99)	0.037
Cumulative Incidence per 1,000 per year (2022-2023 episodes; sex-stratified)	Male	19.9	20.1	19.8	1.01 (0.84, 1.22)	0.887
	Female	29.9	26.4	33.2	0.79 (0.68, 0.92)	0.003
Cumulative Incidence per 1,000 per year (2022-2023 episodes; age group-stratified)	0-4	23.9	21.0	25.6	0.82 (0.50, 1.35)	0.528
	5-11	7.7	4.4	11.6	0.38 (0.18, 0.79)	0.008
	12-18	10.2	5.6	17.8	0.31 (0.17, 0.59)	<0.001
	19-29	15.6	12.5	19.2	0.65 (0.45, 0.95)	0.061
	30-49	26.1	21.6	29.5	0.73 (0.59, 0.91)	0.005
	50-64	27.5	26.3	28.6	0.92 (0.72, 1.18)	0.557
	65-79	49.3	64.9	36.5	1.78 (1.34, 2.35)	<0.001
	>80	123.8	164.9	62.5	2.64 (1.56, 4.46)	<0.001
Cumulative Incidence per 1,000 per year (2022-2023 episodes; region-stratified)	NTHSSA	24.9	22.3	27.1	0.82 (0.72, 0.94)	0.004
	HRHSSA	38.4	70.3	12.1	1.06 (0.76, 1.50)	0.717
	TCSA	23.1	23.1	22.3	0.70 (0.35, 1.37)	0.296

Table 11 Cumulative Incidences of COVID-19 Cases for April 1, 2022-March 31, 2023, compared with Cumulative Incidences (March 1, 2020-March 31, 2022) (cont.)

Characteristic		All Cases	NWT Indigenous	NWT Non-Indigenous	Cumulative Incidence Ratio[a] CIR (95% CI)	p-value[b]
Cumulative Incidences per year for COVID-19 episodes from Mar 1 2020-Mar 31, 2022						
Cumulative Incidence per 1,000 per year (2020-2022 episodes)		98.1	134.5	63.5		
Cumulative Incidence per 1,000 per year (2020-2022 episodes; sex-stratified)	Male	93.5	126.5	63.3		
	Female	102.8	142.5	63.7		
Cumulative Incidence per 1,000 per year (2020-2022 episodes; age group-stratified)	0-4	97.1	96.6	97.5		
	5-11	110.8	130.9	85.1		
	12-18	114.9	140.4	72.8		
	19-29	108.7	141.6	66.7		
	30-49	106.2	150.6	72.8		
	50-64	80.7	132.4	40.9		
	65-79	59.6	100.3	24.9		
	>80	78.6	106.6	32.8		
Cumulative Incidence per 1,000 per year (2020-2022 episodes; region-stratified)	NTHSSA	97.5	131.4	68.1		
	HRHSSA	73.1	101.4	48.5		
	TCSA	193.3	198.2	111.7		

[a] NWT non-Indigenous population is used as a reference for Cumulative Incidence Ratios

[b] Fisher's Exact Test p-value

Vaccination Data for COVID-19 cases, including those associated with severe outcomes and mortality

COVID-19 Vaccination counts are presented in Table 12, and cumulative incidences are presented in Table 13.

Between March 1, 2020 and March 31, 2023, 10,417 COVID-19 cases were recorded. 23.2% (n=2,421) were unvaccinated at the time of infection, 36.9% (n=3,842) were partially vaccinated, 29.5% (n=3.077) had received their primary series and 9.4% (n=971) had received their primary series and one booster.

Vaccination Data was reported separately for five different time periods (termed “waves”) to account for differences in vaccine eligibility at different points in time during the pandemic.

(i) first wave: March 1, 2020 - March 31, 2021

(ii) second wave: April 1, 2021 - July 31, 2021

(iii) third wave: August 1, 2021- December 31, 2021

(iv) fourth wave: January 1, 2022 - March 31, 2022

(v) fifth wave: April 1, 2022- March 31, 2023

88% of cases (n=9,164) occurred during the third and fourth waves, with the majority of cases occurring in the fourth wave (68.6% of all cases, n = 7,141). Of the 7,141 COVID-19 episodes during the fourth wave; 17.3% (n = 1,232) were unvaccinated, 39.4% (n = 2,812) were partially vaccinated and 43.4% (n = 3,097) had received at least their primary dose. The proportion of Indigenous (n = 781, 17.2%) and non-Indigenous (n = 450, 17.3%) fourth wave cases who were unvaccinated was similar. The cumulative incidence of fourth wave COVID-19 cases for unvaccinated individuals was 4,681 per 10,000 per year; 35,953 per 10,000 per year for partially vaccinated individuals and 3,966 per 10,000 per year for individuals who had received at least their primary series. (Cumulative incidences are presented per year for clarity, as the duration of each wave is different).

180 cases were associated with severe outcomes; these mostly occurred during the third (n = 64; 35.6%), fourth (n = 49; 27.2%) and fifth (n = 61; 33.8%) waves. Cumulative incidences for COVID-19 episodes associated with severe outcomes were 54.6 per 10,000 per year, 64.6 per 10,000 per year and 11.8 per 10,000 per year for unvaccinated residents during the third, fourth and fifth waves, respectively. For individuals who had received their primary dose series or greater, rates for the third, fourth and fifth wave were 25.6 per 10,000 per year, 17.9 per 10,000 per year and 8.0 per 10,000 per year.

34 cases were associated with death; deaths occurred during the third (n= 15, 44.1%) fourth (n = 10, 29.4%) and fifth (n = 9, 26.5%) waves. 21 deaths occurred in individuals who were unvaccinated. Cumulative incidences for COVID-19 episodes associated with mortality were 18.2 per 10,000 per year and 22.8 per 10,000 per year for unvaccinated residents during the third and fourth waves respectively.

Table 12 Vaccination Status by Time Period for COVID-19 Cases, Severe Outcomes and Mortality

	NWT Total[a]	NWT Indigenous	NWT Non-Indigenous
COVID-19 CASES			
COVID-19 Cases - all waves (Mar 1, 2020-Mar 31, 2023)			
Total	10417	6708	3707
Unvaccinated	2421 (23.2)	1673 (24.9)	746 (20.1)
Partially Vaccinated	3842 (36.9)	2527 (37.7)	1315 (35.5)
Primary Series	3077 (29.5)	2027 (30.2)	1050 (28.3)
Primary Series + 1 or more	977 (9.4)	481 (7.2)	496 (13.4)
COVID-19 Cases in first wave (Mar 1, 2020-Mar 31, 2021)			
Total	48	20	27
Unvaccinated	*	*	27 (100)
Partially Vaccinated	0 (0)	0 (0)	0 (0)
Primary Series	*	*	0 (0)
COVID-19 Cases in second wave (Apr 1, 2021-Jul 31, 2021)			
Total	82	16	66
Unvaccinated	70 (85.4)	15 (93.8)	55 (83.3)
Partially Vaccinated	*	*	*
Primary Series	*	*	*
COVID-19 Cases in third wave (Aug 1, 2021-Dec 31, 2021)			
Total	2023	1636	387
Unvaccinated	923 (45.6)	795 (48.6)	128 (33.1)
Partially Vaccinated	647 (32.0)	508 (31.1)	139 (35.9)
Primary Series	333 (16.5)	322 (19.7)	11 (2.8)
Primary Series + 1	20 (1.0)	11 (0.7)	9 (2.3)

Table 12 Vaccination Status by Time Period for COVID-19 Cases, Severe Outcomes and Mortality (2/5)

	NWT Total[a]	NWT Indigenous	NWT Non-Indigenous
COVID-19 Cases in fourth wave (Jan 1, 2022-Mar 31, 2022)			
Total	7141	4534	2606
Unvaccinated	1232 (17.3)	781 (17.2)	450 (17.3)
Partially Vaccinated	2812 (39.4)	1845 (40.7)	967 (37.1)
Primary Series	2365 (33.1)	1524 (33.6)	841 (32.2)
Primary Series + 1	732 (10.3)	384 (8.5)	348 (13.4)
COVID-19 Cases in five wave (Apr 1, 2022-Mar 31, 2023)			
Total	1123	502	621
Unvaccinated	149 (13.3)	63 (12.5)	86 (13.8)
Partially Vaccinated	375 (33.4)	173 (34.5)	202 (32.5)
Primary Series	374 (33.3)	180 (35.9)	194 (31.2)
Primary Series + 1 or more	225 (20.0)	86 (17.1)	139 (22.4)
COVID-19 CASES ASSOCIATED WITH SEVERE EPISODES			
COVID-19 Cases associated with Severe Outcomes- all waves (Mar 1, 2020-Mar 31, 2023)			
Total	180	146	33
Unvaccinated	74 (41.1)	62 (42.5)	11 (33.3)
Partially Vaccinated	51 (28.3)	42 (28.8)	9 (27.3)
Primary Series	41 (22.8)	33 (22.6)	8 (24.2)
Primary Series + 1	14 (7.8)	9 (6.2)	5 (15.2)
COVID-19 Cases associated with Severe Outcomes in first wave (Mar 1, 2020-Mar 31, 2021)			
Total	*	*	*

Table 12 Vaccination Status by Time Period for COVID-19 Cases, Severe Outcomes and Mortality (3/5)

	NWT Total[a]	NWT Indigenous	NWT Non-Indigenous
COVID-19 Cases associated with Severe Outcomes in second wave (Apr 1, 2021-Jul 31, 2021)			
Total	*	*	*
COVID-19 Cases associated with Severe Outcomes in third wave (Aug 1, 2021-Dec 31, 2021)			
Total	64	56	8
Unvaccinated	39 (60.4)	36 (64.3)	*
Partially Vaccinated	*	*	*
Primary Series	13 (20.3)	11 (19.6)	*
Primary Series + 1	*	*	*
COVID-19 Cases associated with Severe Outcomes in fourth wave (Jan 1, 2022-Mar 31, 2022)			
Total	49	43	5
Unvaccinated	17 (34.7)	14 (32.6)	*
Partially Vaccinated	18 (36.7)	16 (37.2)	*
Primary Series	10 (20.4)	9 (20.9)	*
Primary Series + 1	*	*	*
COVID-19 Cases associated with Severe Outcomes in fifth wave (Apr 1, 2022-Mar 31, 2023)			
Total	61	43	18
Unvaccinated	12 (19.7)	*	*
Partially Vaccinated	22 (36.1)	17 (39.5)	5 (27.8)
Primary Series	18 (29.5)	13 (30.2)	5 (27.8)
Primary Series + 1	9 (14.8)	*	*

Table 12 Vaccination Status by Time Period for COVID-19 Cases, Severe Outcomes and Mortality (4/5)

	NWT Total[a]	NWT Indigenous	NWT Non-Indigenous
COVID-19 CASES ASSOCIATED WITH MORTALITY			
COVID-19 Cases associated with Mortality- all waves (Mar 1, 2020-Mar 31, 2023)			
Total	34	27	7
Unvaccinated	21 (61.8)	*	*
Partially Vaccinated	7 (20.6)	7 (25.9)	0 (0)
Primary Series	*	*	*
Primary Series + 1	*	*	0 (0)
COVID-19 Cases associated with Mortality in first wave (Mar 1, 2020-Mar 31, 2021)			
Total	0	0	0
COVID-19 Cases associated with Mortality in second wave (Apr 1, 2021-Jul 31, 2021)			
Total	0	0	0
COVID-19 Cases associated with Mortality in third wave (Aug 1, 2021-Dec 31, 2021)			
Total	15	*	*
Unvaccinated	13 (86.7)	*	*
Partially Vaccinated	*	*	0 (0)
Primary Series	*	*	*
COVID-19 Cases associated with Mortality in fourth wave (Jan 1, 2022-Mar 31, 2022)			
Total	10	*	*
Unvaccinated	6 (60)	*	*
Partially Vaccinated	*	*	0 (0)
Primary Series	*	*	0 (0)

Table 12 Vaccination Status by Time Period for COVID-19 Cases, Severe Outcomes and Mortality (5/5)

	NWT Total[a]	NWT Indigenous	NWT Non-Indigenous
COVID-19 Cases associated with Mortality in fifth wave (Apr 1, 2022-Mar 31, 2023)			
Total	9	*	*
Unvaccinated	*	*	*
Partially Vaccinated	*	*	*
Primary Series	*	*	*
Primary Series + 1	*	*	0 (0)

[a] NWT Total for Cases and Severe Outcomes includes individuals with unknown Indigenous identity status

[b] Non-zero case counts under 5 are suppressed, except for unknown categories. Secondary suppression is also used if indicated. Suppressed values are indicated with a *

Table 13 Cumulative incidences per 10,000 per year for COVID-19 Cases, Severe Outcomes and Mortality by Vaccination Status

	NWT Total[a]	NWT Indigenous	NWT Non-Indigenous	Cumulative Incidence Ratio (95% CI)	p-value[b]
Cumulative Incidences per 10,000 per year for COVID-19 Cases					
First wave (Mar 2020-Mar 2021)					
Unvaccinated	*	*	10.7	*	*
Partially Vaccinated	0	0	0		
Primary Series	*	*	0		
Second wave (Apr 2021-Jul 2021)					
Unvaccinated	85.5	32.6	153.4	0.21 (0.12, 0.38)	<0.001
Partially Vaccinated	*	*	*		
Primary Series	*	0.0	*		
Third wave (Aug 2021-Dec 2021)					
Overall	1067.4	863.2	204.2	4.46 (3.99, 4.97)	<0.001
Unvaccinated	1293.3	1945.0	419.7	4.63 (3.85, 5.57)	<0.001
Partially Vaccinated	*	*	*		<0.001
Primary Series or more	322.7	740.0	31.1	23.8 (15.2, 37.4)	<0.001
Fourth wave (Jan 2022-Mar 2022)					
Overall	6363.2	8298.9	4525.1	1.76 (1.68, 1.84)	<0.001
Unvaccinated	4680.5	5325.1	3861.6	1.38 (1.24, 1.54)	<0.001
Partially Vaccinated	35952.8	41045.0	29071.3		
Primary Series or more	3966.3	5378.8	2790.4	1.93 (1.80, 2.07)	<0.001
Fifth wave (Apr 2022-Mar 2023)					
Unvaccinated	145.9	117.0	178.2	0.72 (0.65, 0.81)	<0.001
Partially Vaccinated	2204.6	1451.3	3968.6		
Primary Series or More	178.3	170.7	184.8	0.79 (0.66, 0.93)	0.005

Table 13 Cumulative Incidence per 10,000 per year for COVID-19 Cases, Severe Outcomes and Mortality by Vaccination Status (cont.)

	NWT Total[a]	NWT Indigenous	NWT Non-Indigenous	Cumulative Incidences Ratio (95% CI)	p-value[b]
Cumulative Incidences per 10,000 per year for COVID-19 Cases associated with Severe Outcomes					
First wave (Apr 2021-Jul 2021)					
Unvaccinated	*	*	*	*	*
Second wave (Apr 2021-Jul 2021)					
Unvaccinated	*	*	*	*	*
Third wave (Aug 2021-Dec 2021)					
Unvaccinated	54.6	88.1	9.8	8.95 (2.76, 29.06)	<0.001
Partially Vaccinated	*	*	*		
Primary Series or More	25.6	48.9	9.3	5.25 (1.46, 18.80)	0.005
Fourth wave (Jan 2022-Mar 2022)					
Unvaccinated	64.6	95.5	17.2	5.56 (1.26, 24.46)	0.011
Partially Vaccinated	230.1	355.9	60.1		
Primary Series or More	17.9	36.6	2.3	8.41 (1.91, 37.00)	<0.001
Fifth wave (Apr 2022-Mar 2023)					
Unvaccinated	11.8	14.9	8.3	1.79 (0.54, 5.95)	0.396
Partially Vaccinated	129.3	142.6	98.2		
Primary Series or More	8.0	11.6	5.0	2.31 (1.04, 5.15)	0.051

Table 13 Cumulative Incidences per 10,000 per year for COVID-19 Cases, Severe Outcomes and Mortality by Vaccination Status (cont.)

	NWT Total	NWT Indigenous	NWT Non-Indigenous	Cumulative Incidence Ratio (95% CI)	p-value
Cumulative Incidences per 10,000 per year for COVID-19 cases associated with mortality					
First wave (Jan 2021-Mar 2021)	0	0	0		
Second wave (Apr 2021-Jul 2021)	0	0	0		
Third wave (Aug 2021-Dec 2021)					
Unvaccinated	18.2	* [c]	*	*	*
Partially Vaccinated	*	*	*		
Primary Series or More	*	0.0	*		
Fourth wave (Jan 2022-Mar 2022)					
Unvaccinated	22.8	*	*	*	*
Partially Vaccinated	*	*	0.0		
Primary Series or More	*	*	0.0		
Fifth wave (Apr 2022-Mar 2023)					
Unvaccinated	2.0	*	*	*	*
Partially Vaccinated	*	*	*		
Primary Series or More	*	*	*	*	*

[a] NWT non-Indigenous population is used as a reference for Cumulative Incidence Ratios
[b] Fisher's Exact Test p-value

[c] Non-zero case counts under 5 are suppressed, except for unknown categories. Secondary suppression is also used if indicated. Suppressed values are indicated with a *

Interviews

The qualitative component of this study was conducted to understand the health and policy impacts of COVID-19 and further contextualize the dataset findings.

Description of Participants

Interviews were conducted with four Indigenous Elders and knowledge holders from different communities in the NWT. Interview participants are not identified by name to protect their identities. Interview participants included Inuit and First Nations based in different regions including the Yellowknife region, Beaufort-Delta Region and Fort Smith region.

Analysis of results

79 excerpts from four participant interviews were coded during the thematic analysis process. Codes were organized into four broad themes and 11 subthemes. Quotes are used frequently to ensure that participant voices are heard and valued in this thesis. Quotes may be lightly edited for clarity; for example, the removal of filler sounds or words (such as, “um”, “so like”). Four themes and 11 sub-themes were identified. Themes and subthemes are presented in Table 15. The results are discussed in Chapter 5.

Table 15 Themes and Sub-themes

Social and Health Inequities	Emotional Aspects of COVID-19	COVID-19 Policies	Indigenous Sovereignty
- Racism and Colonization *- Exacerbation of Existing Health Inequities*	*-Mental Health Impacts* *-Social Harms* *-Relationships and Community*	*- Communication* *- Isolation Policies and Supports* *- Pandemic & Emergency Preparedness* *- Healthcare Access*	*-Self-government* *-Traditional Medicine*

Theme 1: Social and Health Inequities
Social & health inequities due to colonization are exacerbated by COVID-19

Participants described social and health inequities for Indigenous peoples and discussed underlying factors, including colonization, racism and residential schools.

"When we look at the determinants of health, up here, there is treated water, natural clean water. But housing is starting to deteriorate, we still have overcrowded housing. Our public health is not the greatest public health." (Participant 3)

"There is inequality in healthcare: segregation, racism and discrimination, and colonization…There was an intentional mandate from the federal government to kill our culture and language, our way of life, land medicine, our nurturing relationships to our parents, and the environment." (Participant 3)

Some participants highlighted that COVID-19 exacerbated existing social and health inequities. For example, one participant reflected on the widening of the education gap in their community during the COVID-19 pandemic:

"I did a study for the Education Board here looking at absenteeism in the [region in Northwest Territories] schools … everyone I spoke to -- and I spoke to everybody in every community -- everyone agreed that they had not recovered from COVID…some of the students did not come back to the school to this day, and everyone else agreed that online learning did not work for most students. So where in this region we might have had a gap in education overall by a couple of years, I think that gap has widened since COVID-19. Some of our students are even further behind than they were before." (Participant 4)

Theme 2: Emotional Aspects of COVID-19

COVID-19 had emotional and social impacts, and adverse impacts on community and relationships

Participants all discussed social and emotional impacts from COVID-19 and related policies. Several participants described the impact of fear of COVID-19 on themselves and others around them:

"I was told to sanitize, my husband was too [...] we overreacted and got scared, we sanitized everything we touched, even though it was me and my husband alone." (Participant 2)

"I was aware though, that there were people who were very afraid, they were just overall afraid and um, not understanding, um, I don't know if it was the amount of information, but not understanding some of it, you know they were living by themselves and they were overcleaning and using lots of um cleaning supplies, you know with heavy chemicals and stuff like that. Cleaning their walls, and their floors and their kitchen and everything, daily." (Participant 4)

"My best friend and I, we couldn't go for a walk together. When we could go out, we had to walk six feet apart, things are so funny now, but terrifying then." (Participant 2)

Participants also described divisions in their community that arose from differing opinions on COVID-19 and COVID-19 vaccines, and the emotional impacts of these divisions.

"We had a sweat lodge…The unvaccinated were not allowed in. Some of those people were CIRitated" (Participant 1)

"Antivaxxers made it hard, they have every right [to have an opinion], but they shouldn't be going against people who got vaccines [...] There was a lot of anger, [antivaxxers] said their body wouldn't get contaminated, and they won't wear a mask." (Participant 2)

"We *had major arguments. Within family, some people wanted [the COVID-19 vaccine], and some people didn't want anything to do with it at all, and it felt like, some people were talking about conspiracies [...]"* (Participant 4)

Some participants also reported a sense of loss and sadness due to disruptions to cultural traditions and practices and isolation from friends and family. Excerpts from participant interviews are provided below:

"There was loss from dying alone. There were no cultural activities when we died, buried alone, sent from hospital, no farewell, no service, our spirits have left our bodies, no community send-off as we had always done. We know that we die, our spirits live on. This compounded our grieving." (Participant 3)

"Both my son and daughter-in-law work for the hospital, they could not be around people with the sniffles, or the elderly. I had few friends in my bubble, it was hard to have

family members in my bubble as they were essential workers, working in the hospital" (Participant 2)

"You know, [COVID-19] also brought up a lot of feelings for some of our real true Elders, whose parents and relatives had lived through epidemics of the past, like so many. There was a lot of information and stories on those as well; that would be an interesting study." (Participant 4)

In addition to emotional impacts, participants described social consequences and harms from COVID-19 and related policies. Participants noted that the pandemic seemed to adversely affect other aspects of life, including family relationships, education, mental health and substance use issues.

"Some of the things that seem to be on an increase, one of the things is mental health issues among students, increased anxiety, in one community, you know a lot of suicides, um, you know I don't if it's directly related to COVID, but it seemed to happen after. Some students did not want to go to school because they were anxious and for some people, they said they did not want their children to go to school because they were afraid of COVID, afraid of COVID. And then, probably an increase after COVID, in addictions, not only amongst the young people, of course there's an increase in drug use, but in all people, for alcohol and drug use, there seems to be an increase. And then with that comes all kinds of implications to family, children." (Participant 4)

"The issues are dormant. They are like an alcoholic, passive-aggressive. People keep things inside, then explode. And in the immediate family, aggression." (Participant 1)

Finally, participants reflected on the importance of community support and relationships during the COVID-19 pandemic. One participant described what they felt was an important gap in community support -- lack of meal support for Elders who were isolating due to COVID-19. Some excerpts are listed below:

"We need to reflect on what's important and our relationship to each other." (Participant 3)

"Our Indigenous organizations were very helpful in distributing food, giving groceries, food vouchers to buy groceries. They distributed country foods, like caribou and fish, to families and elders and I think that the positive messages that went out, you know, for people that needed help and such, and then, [there weren't] only the organizations, also the individuals. I tried to make extra meals and drop them off to certain people I knew were alone, because there were, you know, no longer any community functions, and a lot of people rely on those to socialize, to eat, that kind of thing, with other people, and that was impossible" (Participant 4)

"Well, I think the community could have been more helpful towards Elders. For example, my wife and I, we contracted COVID, I came down with it and I couldn't go anywhere, my wife couldn't go anywhere, so we stayed home, and we're lucky we had some food, but it could have been organized in the community that uh, that food, could have brought here, hot food, you know what I mean." (Participant 1)

Theme 3: COVID-19 Communication & Policies

Effective communication, planning and preparedness are crucial

Participants generally said that there was enough information available about COVID-19 and COVID-19 vaccines, and that this information was easy to access. Participants described a variety of sources for COVID-19 information, including word-of-mouth, radio and social media.

Some participants stressed the importance of a trusted messenger for COVID-19 communications.

"There were too many "wanna-be" doctors. The health minister and Premier are not doctors, only Dr. Kandola should give information, sick of wanna-be doctors. There should be one spokesperson, just trying to protect us." (Participant 2)

"I was not confident in our own Health Minister from the NWT at [a particular] time, I didn't feel that she was qualified" (Participant 4)

Some participants identified aspects of government engagement, policies or programs around COVID-19 isolation that they felt worked well or were inappropriate. Participant excerpts

discussing engagement, Canada Emergency Response Benefit (CERB) and COVID-19 isolation centres are provided below:

> *"The engagement was good [...] there was direct bilateral consultation. When they were hiring toll people [to monitor entry into the community], the government [was] paying Chief and Council. This is better than giving money to each individual."* (Participant 1)

> *"[Requesting recipients to return CERB funds] is wrong. If the government is going to give out money, give it out. Don't take it back. Some of these people are on welfare, how are they going to pay it back? Simple as that."* (Participant 1)

> *"[COVID-19 isolation centers] were like residential schools or jail, 'Where are you going?' When [people] were looking for cigarettes, signing in and signing out, there were lots of triggers for residential schools."* (Participant 2)

Several participants highlighted the need for planning and preparedness, and discussed similarities between COVID-19 and other crises.

> *"COVID-19 is similar to forest fires, floods, people being displaced. Forest fires are threatening [Fort] St. John. People are fighting over gas and toilet paper, similar to COVID-19. People are hoarding and buying all the steaks over there, which was also a factor in COVID-19"* (Participant 1)

> "*[There needs to be] preparation, and having more of a strategy in place, not only for schools, but various departments like health, the justice system [...] if it's not COVID it will be something else, something we have to deal [...] maybe [there should be] a list of vulnerable people in every community, people that are living alone, people that need explanations."* (Participant 4)

> *"There was a global pandemic, now climate change, our food security, food sovereignty is at stake"* (Participant 3)

> *"[I] would like more planning ahead, hope the federal and territorial government look back and say, 'We are going to fix this.'"* (Participant 2)

Participants generally reported that they were able to access in-person or virtual health care for COVID-19 and other health issues in a timely manner.

Theme 4: Sovereignty

Indigenous peoples are sovereign

Several First Nations participants emphasized First Nations sovereignty, and discussed the implications this has for policymaking and policy implementation.

> *"Our relationship with the Crown is sovereign and self-determining […] We need to be involved in climate change, public policy, we need to be right there, it's not about domesticating Treaties. It's an international relationship. UNDRIP is right there. All of the Supreme Court Cases are not to be taken away or watered down; they are related to our relationships with the land."* (Participant 3)

> *"[The] government need[s] to uphold the policy of what First Nations come up with."* (Participant 1)

> *"Forest fires have chaos, havoc, increase in suicides, increase in West Nile Virus, communicable diseases. They will spread across provinces. It is important to maintain control, access to data. [The] questions that we answer, within the present colonialistic system will keep us under radar. [They] will not be able to give us self-determination."* (Participant 1)

Some participants discussed the crucial role of traditional knowledge and practices in a First Nations approach to COVID-19 and other catastrophes.

> *"First Nations traditional healing knowledge and protocols: if a First Nations asks a question about COVID, they can turn to traditional knowledge healing and protocols now that we've been through this [...] [There is a need to] bring together women, elder, youth, land use, policy and protocols."* (Participant 1)

> *"Enough is enough, we will [reclaim] peacefully through ceremony and Dene Laws, our relationships with land, water and air [...]"* (Participant 3)

Unintended Consequences of COVID-19 Public Health Measures

Five key sources pertaining to unintended consequences were found following a review of the gray literature. These were: (i) GNWT Social Indicators: COVID-19 Pandemic Report, (ii) GNWT COVID-19 Impact Indicators Report: Northwest Territories JK-12 Education System, (iii) Office of the Chief Coroner Annual Reports, (iv) GNWT DHSS 2021-2022 Annual Report and (v) NWT Bureau of Statistics alcohol sales and volume data. Unintended impacts of COVID-19 measures were classified into three categories: education, substance use, and mental health and a total of ten subcategories.

(i) Education Impacts

School Closures

Early in the pandemic, during the 2019-2020 academic year, school closures were mostly driven by CPHO in the NWT (Government of Northwest Territories, 2023). For the 2020-2021 academic year, 27% of school closures were made without a CPHO recommendation, and for the 2021-2022 academic year, 32% of school closures were made without a CPHO recommendation (Government of Northwest Territories, 2023). Many of these school closures were in smaller communities outside of Yellowknife, Inuvik, Hay River and Fort Smith (Government of Northwest Territories, 2023).

Kindergarten Enrolment

The percentage of children aged 5 enrolled in kindergarten in 2020-2021 was 13% lower in regional centres (Hay River, Fort Smith, Inuvik) and 12% lower in small communities, compared to pre-pandemic percentages (Government of Northwest Territories, 2023).

Kindergarten Readiness

The overall developmental readiness of kindergarten students is tracked using surveys filled out by kindergarten teachers every February. Students are classified as being On-Track, In Flux, or Vulnerable based on survey results (Government of Northwest Territories, 2023). Compared to the pre-COVID period, small communities (communities outside of Yellowknife, Inuvik, Hay River and Fort Smith) saw a 1% decrease in on-track students and 2% increase in vulnerable students for kindergarten readiness (Government of Northwest Territories, 2023).

(ii) Substance Use Impacts

Alcohol Sales

Alcohol sales data in the NWT show an average increase of 12% from April 2020 to August 2021, compared to the same months in 2019 (Government of Northwest Territories, 2022). The sustained increase in alcohol sales was hypothesized to be partly due to the closure of the territorial border, as people who normally purchased alcohol from other provinces and territories had limited ability to do so (Government of Northwest Territories, 2022). Data from August 2021 until April 2023 show a return to pre-pandemic alcohol sales (NWT Bureau of Statistics, 2023).

Hospitalizations due to Harms Caused by Substance Use

There is an overall increasing long-term trend in hospitalizations due to harms caused by substance use (Government of Northwest Territories, 2023). There was a substantial increase in age-standardized discharges from hospital stays due to harms caused by substance use from 20.2 per 1,000 in 2019-2020, to 25.7 per 1,000 in 2020-2021 (Government of Northwest Territories, 2023). There was a decrease to 19.0 per 1,000 in 2021-2022; however, this is still over three times higher than the average in Canada (Government of Northwest Territories, 2023).

Opioid related hospitalizations

Opioid related hospitalizations due to opioid use or opioid poisoning increased significantly during the first year of the pandemic (Government of Northwest Territories, 2023). In 2019-2020, there were 4.9 discharges per 10,000 for opioid related hospitalizations; this number almost doubled to 9.4 discharges per 10,000 in 2020-2021, before decreasing to 5.3 discharges per 10,000 in 2021-2022 (Government of Northwest Territories, 2023). Of note, the incidences may vary considerably from year to year due to the small number of opioid-related hospitalizations in NWT (Government of Northwest Territories, 2023). The average opioid related hospitalization incidence over these three time periods (2019-2020, 2020-2021, 2021-2022) did not differ from the Western Canadian average.

(iii) Mental Health

Data from several alcohol and substance use health-related indicators showed concerning changes in 2020-2021 (Government of Northwest Territories, 2023). Some of these indicators showed a return to pre-pandemic levels in 2021-2022 (Government of Northwest

Territories, 2023). For some indicators, it may be challenging to differentiate between pandemic-related impacts and overall long-term trends (Government of Northwest Territories, 2023).

Mental Health Hospitalization

Mental health hospitalization incidence peaked in 2020-2021 (Government of Northwest Territories, 2023). Age-standardized mental health hospital discharges per 1,000 were 15.1, 18.4, and 15.1 for 2019-2020, 2020-2021 and 2021-2022, respectively Government of Northwest Territories, 2023). These incidences are more than double those in Western Canada Government of Northwest Territories, 2023).

Mental Health Hospitalizations due to Alcohol or Drug Use

The percentage of mental health hospitalizations due to alcohol or drug use increased from 53% in 2019-2020 to 62% in 2020-2021, and decreased to 52% in 2021-2022 (Government of Northwest Territories, 2023). These percentages are around four times higher than the average in Western Canada (Government of Northwest Territories, 2023).

Repeat Mental Health Hospitalizations

The percentage of repeat mental health hospitalizations (three or more stays within a year) increased from 14.4% in 2019-2020 to 18% in 2020-2021, and decreased slightly to 16.9% in 2021-2022 (Government of Northwest Territories, 2023). These percentages, with the exception of 2020-2021 are comparable to the rest of Canada (Government of Northwest Territories, 2023).

Suicides

In NWT, there were nine, ten and eleven suicide deaths in 2019, 2020 and 2021 respectively (Office of the Chief Coroner, 2020, 2022a, 2023). Data for suicide deaths in 2022 was released early due to an increase in suicide deaths (Office of the Chief Coroner, 2022b). As of the end of the third quarter of 2022, there were 18 suicide deaths (Office of the Chief Coroner, 2022b). The Beaufort-Delta region had the largest increase in suicide deaths, from one in 2021 to seven in 2022 (Office of the Chief Coroner, 2022b).

Chapter 5: Discussion

COVID-19 has disproportionately impacted certain population subgroups. Indigenous peoples' may be at higher risk of disease burden from infectious diseases like COVID-19, due to legacies of colonization including systemic racism and adverse social determinants of health. This research aimed to understand the impacts of COVID-19 for Indigenous peoples in the NWT. Specifically, this research looked at: (i) comparing COVID-19 infections and severe outcomes between Indigenous and non-Indigenous populations, and (ii) understanding the experience of Indigenous peoples during COVID-19, especially in regards to COVID-19-related policies.

Key Findings

The Indigenous population in NWT has been disproportionately impacted by COVID-19. Between March 2020 and March 2023, 146 Indigenous people experienced a COVID-19 related severe outcome and 27 Indigenous people died from COVID-19. The cumulative incidence of severe outcomes and mortality over this time period were over four times as high for Indigenous peoples as the non-Indigenous population. Disproportionate impacts were observed even when results were stratified by age, sex, and vaccine status, suggesting these were not confounders. It is important to note that comorbidity data and test positivity data were not available.

Interview participants discussed that COVID-19 has resulted in exacerbation of health and social inequities for Indigenous peoples, and resulted in social and emotional harms to their families and communities. Participants also reflected on the need for clear communication and preparedness on the government's part, and for Indigenous sovereignty to be reflected in policies.

COVID-19 policies had unintended adverse impacts on education, substance use, and mental health. Although disaggregated data for Indigenous populations was not available, smaller communities, which have a higher proportion of Indigenous peoples experienced greater educational impacts (such as school closures and kindergarten readiness). There were adverse impacts of several substance use and mental health indicators during the 2020/2021 calendar year.

COVID-19 Outcomes in Context

COVID-19 outcomes throughout the pandemic can be better understood in context of the territorial policies and the predominant COVID-19 strain during that time period. NWT COVID-19 before August 2021 were few in number and generally travel-related (Eye on the Arctic, 2021). Community transmission in NWT is thought to have begun in Yellowknife in August 2021, corresponding with increased circulation of the delta variant of COVID-19 (Eye on the Arctic, 2021).

The delta wave in particular had severe impacts for Indigenous peoples in NWT. COVID-19 infection rates were 4.5 times as high for Indigenous peoples during the August-December 2021 time period, when the delta variant was predominant. 56 Indigenous cases experienced severe outcomes, accounting for 3.4% for all cases. These findings are consistent with other regions in the Arctic, where the delta variant resulted in large increases in case and death rates, including in remote and rural regions that were previously largely spared from COVID-19 impacts (Tiwari et al., 2022). Impacts in NWT during the delta wave occurred in spite of COVID-19 interventions to limit disease spread. In August 2021, the GNWT had launched a “drive to 75” campaign, encouraging residents to get fully vaccinated against COVID-19 (Canadian Institute for Health Information, 2022). Masks in indoor spaces were mandated, as well as in school buildings (except classrooms) and school buses (Canadian Institute for Health Information, 2022). COVID-19 vaccines were mandated for health workers in September 2021(Canadian Institute for Health Information, 2022).

Modelling the hypothetical impacts of COVID-19 in the NWT without public health measures or vaccinations has been a challenge for researchers. One Canadian study using counterfactual modelling found that there could have been up to 34 million COVID-19 cases, 2 million hospitalizations, and 800,000 deaths in Canada until April 2022 without any interventions; these are 10-20 times higher than the outcomes observed until April 2022 (Ogden et al., 2022).

All public health restrictions were lifted in April 1, 2022. COVID-19 case counts are less accurate after this date, as surveillance relied largely on self-report. Rates of cases and severe outcomes for both Indigenous and non-Indigenous populations are lower than in previous time periods. Indigenous peoples were not found to have more severe disease burden than non-Indigenous people from the available data after April 2022; in fact, data suggests that there is a very modest trend In the opposite direction. Experts note that as COVID-19 transitions to an endemic disease, challenges to consider include co-occurrences of COVID-19 and influenza/RSV waves and the potential emergence of new COVID-19 variants (Duong, 2022).

This transition has also raised interest around the effectiveness of additional vaccine boosters and vaccine acceptance, especially among high-risk populations (Reifferscheid et al., 2022).

Health Inequities

Health inequities are differences in health that are unnecessary, avoidable and unjust (Braveman, 2014). The COVID-19 pandemic has brought structural drivers of health inequities to the forefront; the health impacts of both COVID-19 and COVID-19 related restrictions are not equitable (Paremoer et al., 2021; McGrail et al., 2022). In the NWT, Indigenous populations were inequitably impacted, with higher cumulative incidences of COVID-19 infections, severe outcomes, and deaths.

As one participant states, “Our public health is not the greatest public health.” The question then arises of how Indigenous health inequities can be addressed. Interview participants offer insights into next steps, which are categorized below. Several of the suggestions by interview participants align with the Truth and Reconciliation Commission Calls to Action, which outline some key, actionable ways to address healthcare inequities, health inequities and social inequities.

(1) Identifying Health Inequities; Data Collection and Access

Interview participants discuss the need for data to understand health disparities and inequities for Indigenous peoples. As one participant discusses, “*It is important to maintain control, [have] access to data.”* Another participant discusses their own study on educational impacts during COVID-19, and the importance of their data on monitoring trends in health inequities.

This aligns with the Truth and Reconciliation Commission (TRC) Call to Action 19, which calls for the federal government to monitor health indicators for “infant mortality, maternal health, suicide, mental health, addictions, life expectancy, birth rates, infant and child health issues, chronic diseases, illness and injury incidence, and the availability of appropriate health services” for Indigenous and non-Indigenous populations (National Centre for Truth and Reconciliation, 2015). The TRC also calls for data collection relating to education, justice and children in care for Indigenous peoples (National Centre for Truth and Reconciliation, 2015). Although these Calls to Action are directed to the federal government, territorial and provincial governments can also contribute to this. While some health and social indicator data are available in the GNWT Health and Social Services Annual reports, the GNWT may consider working further with Indigenous partners to include additional indicator data.

In addition to improving access to data, there is a need to support Indigenous researchers and strengthen Indigenous research capacity for health research. One participant notes, "*[The] questions that we answer, within the present colonialistic system, will keep us under radar."* Several researches notes the importance for governments, researchers and non-profit organizations to collaborate with Indigenous peoples on their own terms for data access and use effective public health responses (Carroll et al., 2021; Aylsworth et al., 2022; Tripp, 2022) . Institutional research ethics boards and organizations research licensing bodies should work with Indigenous leadership to support indigenous research capacity and reduce barriers for Indigenous researchers (Carrolee et al., 2021). Several research bodies have started to explore what decolonization and reconciliation means in the research context. For example, Strengthening Indigenous Research Capacity (SIRC) is a collaborative research initiative between the Canadian Institutes of Health Research (CIHR), the Natural Sciences and Engineering Research Council (NSERC), and the Social Sciences and Humanities Research Council (SSHRC) that seeks to support Indigenous research priorities and self-determination, and build Indigenous research capacity (Government of Canada, 2022).

(2) Responding to Health and Social Inequities

Results from the COVID-19 dataset shows that Indigenous peoples in the NWT faced inequitable health outcomes due to COVID-19. These inequitable outcomes, and other health and social inequities have directly resulted from Canadian government policies. One participant mentions, *"there was an intentional mandate from the federal government to kill our culture and language, our way of life, land medicine, our nurturing relationships to our parents, and the environment."* Participants also discussed overcrowded housing and widening gaps in education for Indigenous peoples' as specific adverse social determinants of health. Participants also highlighted the need for Indigenous involvement in policy-making. One participant highlighted a positive experience of "*direct bilateral consultation*" between government and Council regarding setting up a community entry checkpoint during COVID-19. Other participants discussed the need for Indigenous involvement in policy-making, highlighting climate change and policies around the 2023 wildfires as examples

The question arises - how should healthy public policy to address these inequities be developed? One participant discusses that the starting point is from the recognition that Indigenous peoples' "*relationship[s] with the Crown [are] sovereign and self-determining".* This aligns with the approach of Justice Sinclair and his co-Commissioners on the Truth and Reconciliation Commission, who used the United Nations Declaration on the Rights of

Indigenous Peoples (UNDRIP) as a framework for reconciliation (Richmond & Cook, 2016). Some Indigenous peoples in the NWT have entered into self-government agreements with the GNWT to enhance their self-determination and authority to make laws (Government of Northwest Territories, n.d.a). Government should reflect on their responsibilities to, and relationships with, Indigenous peoples, and consider how UNDRIP and Treaty relationships may inform their approach to policymaking and reconciliation. In Manitoba, for example, federal government funding provided to the Manitoba Inuit Association was used to develop Inuit-centred programming and respond to community needs (Lavoie et al., 2023). This included Inuit-led COVID-19 clinics and the development of an algorithm to produce bi-weekly specific COVID-19 data (Lavoie et al., 2023). Sustained funding, including beyond COVID-19, was identified as a priority for the Manitoba Inuit Association to continue its work (Lavoie et al., 2023). Models of Indigenous health care sovereignty and self-determination in other regions during COVID-19 include Indigenous control of healthcare funding and delivery, Indigenous-led vaccination efforts, and culturally appropriate COVID-19 education programming (Petrov et al., 2023). Indigenous-led health leadership and health partnerships have been shown to be effective for access to care and holistic health outcomes for Indigenous peoples generally, and not solely in the context of COVID-19 (Allen et al., 2020).

Lessons Learned and Recovery after COVID-19

Participants highlighted social and emotional harms from COVID-19, including feelings of fear and isolation, and divisions within families and disruptions to social structures. Data from 2020 and 2021 shows an increase in hospitalizations due to substance use and mental health issues compared to 2019. Participants noted the compounding of trauma from COVID-19 and the 2023 NWT wildfire crisis, in which over half of the NWT was evacuated.

Going forward, participants discussed the need for preparedness for crises. Pandemics and other crises, such as climate change-related crises will continue to occur; in any given year, there is a 2% chance of a pandemic with similar impact to COVID-19 (Marani et al., 2021). Disaster recovery supports should incorporate an Indigenous healing approach, with a focus on socially and culturally safe care (Quinn et al., 2022). Supporting Indigenous mental health and wellness effectively may require a multi-sectoral approach with programs and policies at various settings (Montesanti et al., 2022). Participants particularly discussed the need for strategies to help populations most at-risk, including elderly and isolated residents. The CPHO supplementary report on Indigenous peoples and COVID-19 identifies a need for community-specific pandemic and emergency preparedness, including the need for funding for public health

planning (Mashford-Pringle et al., 2021). While the GNWT has engaged and collaborated with Indigenous partners, further developing collaborative approaches for service delivery and resources may strengthen future pandemic response (Anderson, 2023).

Strengths and Limitations of Research

This research study had several strengths. The COVID-19 case dataset used census sampling (all health-insured COVID-19 cases were included), which has increased accuracy and reliability compared to non-census sampling. Data on hospitalizations and ICU admissions was validated using other data sources. The proportion of missing variables was very low.

Rich data were obtained from interviews completed with Indigenous leaders, Elders and knowledge holders. Inductive thematic saturation refers to the extent of which new codes or themes emerge from the data (Saunders et al., 2018). At the completion of all the interviews, few new codes and themes were being generated, suggesting that saturation was reached or near being reached.

There were several limitations to this research. Some communities in NWT had limited capacity to engage in research, due to restricted community resources and existing research burden. For example, a different research project related to COVID-19 was underway in the Tłı̨chǫ region. The NWT also experienced a severe wildfire season in Summer 2023, requiring several communities to evacuate.

With regards to the COVID-19 case dataset, causality cannot be inferred from the data analyzed. Variables not included in the analysis that may affect the relationship between Indigenous identity and severe outcomes include medical co-morbidities, income and employment (Government of Northwest Territories, 2019; Huyser et al., 2021). Disaggregated data on Indigenous identity (Inuit, First Nations, Métis) was not used. COVID-19 test positivity and test volume information was not available.

COVID-19 vaccine data relies on information sources that track vaccines administered in NWT, COVID-19 vaccines administered outside of the NWT may not have been accounted for in the Electronic Medical Record. This may have contributed to misclassification of COVID-19 vaccine status.

Conclusion

The purpose of this work was to describe the impact of COVID-19 on Indigenous peoples. Indigenous peoples have experienced disproportionate disease burden and severe outcomes due to COVID-19, in spite of public health measures and interventions. Comorbdiity

data is not available for COVID-19 cases, but population level data suggests a higher burden of several comorbidities for Indigenous peoples. Interview participants and published literature describe that effective pandemic response for Indigenous populations needs to honour Indigenous self-determination, incorporate a collaborative approach for service delivery and support social and emotional healing. While COVID-19 is now largely considered to be endemic, it continues to have social and emotional impacts on populations. It is hoped that this work will support the co-creation of policy with Indigenous partners around emergency and pandemic response, including for future pandemics and for other crises, such as climate change.

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Appendices

Appendix 1: University of Alberta Research Ethics Board Approval

Approval Form

Date:	October 14, 2022
Study ID:	Pro00123973
Principal Investigator:	Susan Chatwood
Study Title:	Exploring health impacts of COVID-19 on Indigenous Peoples in the Northwest Territories
Approval Expiry Date:	October 13, 2023

Thank you for submitting the above study to the Health Research Ethics Board - Health Panel. Your application has been reviewed and approved on behalf of the committee.

Approved Documents:

Consent Forms

Information Sheet.pdf

Consent Form

Questionnaires, Cover Letters, Surveys, Tests, Interview Scripts, etc.

Focus Group Questions Template

Protocol/Research Proposal

Research Protocol v1.1.pdf

The Health Research Ethics Board assessed all matters required by section 50(1)(a) of the Health Information Act. Consent for access to identifiable health information is required for the research described in the ethics application, and appropriate procedures for such consent have been approved by the HREB Health Panel. In order to comply with the Health Information Act, a copy of the approval form is being sent to the Office of the Information and Privacy Commissioner.

Any proposed changes to the study must be submitted to the REB for approval prior to implementation. A renewal report must be submitted next year prior to the expiry of this approval if your study still requires ethics approval. If you do not renew on or before the renewal expiry date (October 13, 2023), you will have to re-submit an ethics application.

Approval by the REB does not constitute authorization to initiate the conduct of this research. The Principal Investigator is responsible for ensuring required approvals from other involved organizations (e.g., Alberta Health Services, Covenant Health, community organizations, school boards) are obtained, before the research begins.

Sincerely,

Anthony S. Joyce, PhD.
Chair, Health Research Ethics Board - Health Panel

Note: This correspondence includes an electronic signature (validation and approval via an online system).

Appendix 2: Aurora College Research Ethics Committee Approval

COLLÈGE AURORA COLLEGE

Aurora College Research Ethics Committee
PO Box 45, Fort Smith, NT X0E0P0
Tel: 867-872-7084
chairrec@auroracollege.nt.ca

09-DEC -2022
Dr. Ali Qadri
University of Alberta
2120 77 St SW Edmonton AB T6X0Z3
aqadri@ualberta.ca

AC-REC Project #: 22-15
Project Title: Exploring the health impacts of COVID-19 on Indigenous Peoples in the Northwest Territories
Date of Review: 09- DEC-22; 17-NOV-22(Full Board)
Review Type: Delegated Review
REC Decision: Approved

Dear Dr. Qadri,

Thank you for submitting revisions in response to REC letter dated 25-NOV-22 to the above-mentioned research project application for Aurora College REC review. The REC found the project to be acceptable in accordance with Aurora College Policy I.04 *Ethical Conduct for Research Involving Human Subjects* and the *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans.*

Please be informed that, following the receipt of this approval to proceed with the project, Principal Investigator(s) must:

- obtain an annual Certificate of Ethics Approval until the research is complete **(the approval is given for one year and will expire on 09-DEC-23);**
- seek re-approval from the REC for any amendment or modification of the approved research protocol or consent form;
- report immediately to the REC, any adverse or unexpected events resulting from the research on human subjects; and
- notify the REC upon termination or completion of the project.

To access these forms and instructions for their completion, please contact the REC.

Kindly confirm that the research will be carried out in accordance with the approved protocol, by signing the enclosed Certificate of Ethics Approval and sending a copy by email to the REC.

Please direct all correspondence to Dr. Sunila R. Kalkar, Manager Research Ethics & Regional Programs at chairrec@auroracollege.nt.ca or by phone at 867-872-7084.

Sincerely,

Chair, Aurora College Research Ethics Committee
chairrec@auroracollege.nt.ca

COLLÈGE AURORA COLLEGE

Aurora College Research Ethics Committee
CERTIFICATE OF ETHICS REVIEW

AC-REC Project #:22-15

Project Title: Exploring the health impacts of COVID-19 on Indigenous Peoples in the Northwest Territories

Principal Investigator:
Name: Dr. Ali Qadri
Branch/Institution: University of Alberta
Address: 2120 77 St SW Edmonton AB T6X0Z3
Email Address: aqadri@ualberta.ca

Type of Review: Follow Up

Date of Review: 09-DEC-22

Review Type: Delegated Review

List of approved documents submitted to the REC: **Document Name:**	**Date Submitted:**
• AC REC Ethics Form Version # 02	30-NOV-2022
• Information Sheet and Consent Form -Elders	30-NOV-2022
• Information Sheet and Consent Form –Community Members	30-NOV -2022
• Budget	30-NOV -2022
Documents acknowledged:	
• Changes to the REB proposal	30-NOV -2022
• Communication from DHSS Research Coordinator dated 28-NOV-22	30-NOV -2022

ETHICS REVIEW:
Your application to the Aurora College Research Ethics Committee (REC) regarding the above-referenced research project has been reviewed. The most recent versions of the documents listed above were found to meet ethical requirements for research involving humans.

Alexandra Hood 9 Dec 2022

Chair, Aurora College Research Ethics Committee — Date

Certificate Expiry Date: 09-DEC-2023

Principal Investigator's responsibilities:
I confirm that I will:

1. Carry out the research in accordance with the above-referenced protocol by the REC;
2. Obtain an annual ethical review renewal until the research is complete;
3. Seek ethics review of the REC for any amendment or modification of the research protocol or consent form;
4. Report immediately to the REC any adverse or unexpected events resulting from the research involving humans; and
5. Submit an end of project report to the REC, upon termination or completion of the project

Principal Investigator — Date

Once signed, please return a copy of the certificate to the REC by email at chairrec@auroracollege.nt.ca

COLLÈGE AURORA COLLEGE

Aurora College Research Ethics Committee
CERTIFICATE OF ETHICS REVIEW

AC-REC Project #:22-14

Project Title: Exploring the health impacts of COVID-19 on Indigenous Peoples in the Northwest Territories

Principal Investigator:
Name: Dr. Ali Qadri
Branch/Institution: University of Alberta
Address: 2120 77 St SW Edmonton AB T6X0Z3
Email Address: aqadri@ualberta.ca

Type of Review: Follow Up

Date of Review: 09-DEC-2022

Review Type: Delegated Review

Certificate Expiry Date: 09-DEC-2023

Study Summary:
Indigenous people have been significantly impacted by COVID-19, especially due to social factors like housing, access to clean water and impacts of colonialism. Northwest Territories has had over 10,000 cases of COVID-19. We hypothesize that Indigenous people in NWT have more severe outcomes from COVID-19 compared to non-Indigenous people.
This research has several parts.
(1) Data analysis:
A COVID-19 case dataset with aggregate (de-identified) data is already collected. The case data is stored on a shared drive on a secured GNWT server that is restricted to approved users. Sources of this data include: PCR laboratory testing results data, COVID-19 variant testing lab data, EMR point-of-care COVID-19 testing, Hospitalization and severe outcome, severe outcome Surveillance Report form, and EMR Vaccination administration data. We will compare rates of hospitalizations, deaths and intensive care unit admissions for COVID-19 cases between Indigenous and non-Indigenous people, matched for vaccination status. This data will be recorded in a password protected file.
(2) Focus groups:
Two or three with Indigenous people and elders in NWT to understand their experiences and perspectives on COVID-19, Kimberly Fairman (study team member) is Nunavummiut and the Director of the Institute for Circumpolar Health Research. She has developed connections with Indigenous communities throughout her career. She will contact organizations (e.g. Dene Council) to identify interested participants and elders for focus groups. Focus groups will be audio recorded and transcribed. Common themes in policies and focus groups will be analyzed, using a word cloud if appropriate, for qualitative analysis.
(3) Conducting a web literature review of national and local COVID-19 policies.
The research aims to produce high level recommendations about pandemic response for Indigenous people and in Indigenous communities in the NWT. We hope that this will guide the ongoing response to the COVID-19 pandemic response as well as future pandemics.

Appendix 3: Aurora Research Institute: Northwest Territories Research Licence Approval

AURORA RESEARCH INSTITUTE
AURORA COLLEGE

Aurora Research Institute
PO Box 1450, Inuvik, NT X0E0T0
Tel: (867) 777-3298 Fax: (867) 777-4264

www.nwtresearch.com

February 23, 2023

Notification of Research

I would like to inform you that Northwest Territories Scientific Research Licence No. 17217 has been issued to:

Susan Chatwood
University of Alberta
3-279 Edmonton Clinic Health Academy 11405 - 87 Ave NW

Phone: (780) 492-9335
Email: chatwood@ualberta.ca

to conduct the following study:
Exploring health impacts of COVID-19 on Indigenous Peoples in the Northwest Territories (5254)

Please contact the researcher if you would like more information about this research project.

Summary of Research

Our objective is study the impact of COVID-19 on Indigenous people in the Northwest Territories. We hope this study will produce high level policy recommendations for future pandemic response. Furthermore, we hope the co-development of COVID 19 data and evidence will contribute to the development of national strategies with Indigenous communities.

Sincerely,

_____
Niccole Hammer
Manager, Scientific Services

Distribution
Health and Social Services and NTHSSA

Appendix 4: Research Agreement

RESEARCH AGREEMENT

Dated the 03 day of
April, 2023

BETWEEN:
Department of Health and Social Services, Government of Northwest Territories
as represented by the Deputy Minister
(hereinafter called "[DHSS/Disclosing Party])

AND:
Ali Qadri
(hereinafter called the "Researcher")

Whereas Covid-19 vaccination and hospitalization data is collected under the *Public Health Act*, S.N.W.T. 2007, c. 17;

Whereas the Covid-19 data is in the control of the DHSS; and

Whereas the purpose of this Agreement is to document the terms and conditions of the disclosure of personal health information to the Researcher, in compliance with the *Health Information Act* and other applicable legislation (if any).

THE PARTIES AGREE AS FOLLOWS:

1. DEFINITIONS

1.1 In this Agreement, unless expressly otherwise provided or where the context does not permit:

"**agreement**" means this Agreement, including all Schedules;

"***Health Information Act***" means the Northwest Territories *Health Information Act*, S.N.W.T. 2014, c. 2;

"**personal health information**" means information defined under Part 1 of the *Health Information Act*;

"**party**" means any party to this Agreement, as the context requires;

"**record**" means record defined under Part 1 of the *Health Information Act*;

"**research**" means research defined under Part 1 of the *Health Information Act;*

"**research ethics committee**" means a research ethics committee defined under Part 1 of the *Health Information Act*;

1.2 These definitions shall apply equally to both the singular and the plural forms of the terms

defined, and words of any gender shall include each other gender when appropriate.

2. PURPOSE OF THE RESEARCH

Project title: **Exploring health impacts of COVID-19 on Indigenous Peoples in the Northwest Territories**

This research is part one of the Researcher's Master's work at the University of Alberta.

This project aims to study the impact of COVID-19 on Indigenous people in the Northwest Territories. The researchers hope this study will produce high level policy recommendations for future pandemic response. Furthermore, the researchers hope the co-development of COVID 19 data and evidence will contribute to the development of national strategies with Indigenous communities.

2.2 The research requires the information as follows:

1) Aggregate Covid-19 case data, consisting of patient demographics, laboratory result test data, hospitalization and severe outcome results, and vaccination administrative data;
2) Two to three focus groups with Northwest Territories residents; and
3) Web (internet) literature review of local/national Covid-19 policies.

No research data with personal health information will be collected as part of the research objectives and related methodology.

3. AUTHORITY TO SHARE HEALTH INFORMATION FOR RESEARCH PURPOSES

3.1 The *Health Information Act* applies in respect of disclosure by the Chief Public Health Officer of personal health information for a research purpose in accordance with section 38(2) of the *Public Health Act*.

3.2 The Disclosing Party is authorized to enter into this Agreement and to disclose personal health information in accordance with section 77 of the *Health Information Act*.

3.3 In accordance with section 1(4) of the *Health Information Act,* as a health information custodian, the Disclosing Party is authorized to disclose non-identifying information.

3.4 The Researcher is required to comply with section 81 of the *Health Information Act* and this Agreement. In particular, the Researcher must comply with any conditions set out by the Research Ethics Committee as per Schedule A, must not publish information in a form that could reasonably be expected to identify an individual the information is about, and must not contact an individual the information is about unless the Disclosing Party obtains the individual's express consent.

4. HEALTH INFORMATION TO BE DISCLOSED

4.1 The Disclosing Party shall disclose the following information to the researcher:

An aggregate (non-identifying) Covid-19 case date data for the period January 1, 2020 to August31, 2022 will be disclosed to the Researcher.

4.2 The information will be collected during the following planned visits:

Visits to the Northwest Territories in May /June 2023 are planned. Focus groups will be conducted during this time.

The Disclosing Party is allowing the researcher to conduct research with DHSS staff persons and on site at DHSS facilities with Northwest Territories residents. By interviewing DHSS staff and/or being present at DHSS facilities, the researchers may inadvertently become privy to personal health information of those receiving services from the DHSS. Identifying information will be deleted from field notes and transcription of audio recording of focus groups.

5. SECURITY AND CONFIDENTIALITY OF HEALTH INFORMATION

5.1 The disclosed health information will be transferred in a secure manner using the following method:

The dataset file will be sent by GNWT Secure File Transfer to the Researcher.

5.2 The disclosed health information will be retained and stored by the researcher in a secure manner, using the following method(s):

Data collected in this study will be stored on a password protected file on a password protected laptop of the Researcher.

5.3 Any removal of individual identifiers will be done in a secure manner that protects against unauthorized data matching with other health information, which could lead to the identification of individuals the information is about.

5.4 The Researcher will not disclose or release information in a form that could reasonably be expected to identify an individual the disclosed health information is about.

5.5 The Researcher will as soon as reasonably possible return, dispose of, or destroy personal health information received from the Disclosing Party in such a way that unauthorized identification or re-identification is not possible.

5.6 The Researcher must comply with the Disclosing Party's standards, policies and procedures in respect of health information, privacy and confidentiality.

5.7 The Researcher is responsible for protecting the security, privacy and confidentiality of the disclosed health information against loss, theft, and unauthorized access, use, disclosure, and destruction, by maintaining safeguard measures proportionate to the threat to security and confidentiality, in accordance with the *Health Information Act*.

5.8 No other persons will have access to the disclosed personal health information, apart from the Researcher.

5.9 The Disclosing Party may determine it is necessary to carry out on-site visits and such other inspections that it deems necessary to ensure compliance with the conditions of this Agreement and applicable legislation. Such measures may include, but are not limited to:

a) on-site inspection of premises, databases, software and applications to confirm that stated safeguard measures are adequate and in effect;
b) receipt, upon request, of a copy of any written or published work based on research carried out under the terms of this Agreement;
c) written verification from the Researcher that the destruction of all information about identifiable individuals has been carried out according to this Agreement.

5.10 In the event the Disclosing Party suspects the Researcher may have failed to comply with a term or condition set out in this Agreement or may have failed to comply with section 81 of the *Health Information Act,* the Disclosing Party reserves the right to not disclose any further health information and/or demand the immediate return of previously disclosed health information, until such time as the Disclosing Party is satisfied the Researcher is in compliance with the above.

5.11 In the event of any privacy breach involving the loss, theft, or unauthorized access, use, disclosure, or destruction of the disclosed health information, the Researcher will immediately notify the Disclosing Party. The Disclosing Party is responsible for responding to the privacy breach.

5.12 The Researcher is familiar with section 192 of the *Health Information Act* and other applicable legislation setting out offences, and recognizes that upon being found guilty of an offence is liable upon summary conviction to punishment, including the possibility of fines and penalties.

5.13 The Researcher will ensure that all and any information related to the affairs of the Disclosing Party to which the Researcher becomes privy as a result of this Agreement, is confidential and will be treated as confidential during and after the term of this Agreement and shall not be divulged, released or published without prior written approval of the Disclosing Party.

6. LIMITATION OF LIABILITY AND INDEMNITY

6.2 The Disclosing Party, its servants and agents, shall not be liable to the Researcher, its officers, servants, or agents for any loss, damage or injury (including death) or for any loss or damages to the property of the Researcher, or property of others for which the Researcher is responsible, however arising or in any manner based upon, arising from or attributable to the performance of this Agreement; and the Researcher waives all rights and recourse against the Disclosing Party for any such loss, damage, or injury or lose or damage to the Researcher's property or property of others for which the Researcher s responsible.

6.3 The Researcher shall indemnify and hold harmless the Disclosing Party, officers, employees, servants and agents from and against all claims, actions, causes of action, demands, costs, losses, damages, expenses, suits or other proceedings brought or prosecuted in any manner based upon or related wholly or partially to the actions or omissions of the Researcher under this Agreement, provided that the claims, actions, causes of action, demands, costs, losses, damages, expenses, suits or other proceedings do not arise from the actions or omissions of the Disclosing Party or from the breach of any of the terms of this Agreement by the Disclosing Party.

7. TERM OF RESEARCH AGREEMENT

7.2 This Agreement shall come into effect on the day it is signed by the last Party to do so, and shall remain in effect for a period of 12 months.

8. TERMINATION

8.2 This Agreement may be terminated by the either Party by giving the other Party 30 days' notice in writing.

8.3 Upon termination of this Agreement by a Party, the Researcher shall immediately cease any activity specific to the disclosed health information and shall, as soon as reasonably possible and no later than ninety (90) days after termination, return, dispose of, or destroy the disclosed health information, including all copies.

9. NOTICE AND ADDRESS

9.2 In this Agreement, if any notice is required to be given by the Disclosing Party or the Researcher, it shall be in writing and deemed to have been received:

a) immediately, if delivered in person;
b) one day after transmittal, if sent by email or fax;
c) ten (10) days after mailing, if sent by registered mail;
to the following addresses:

To the Disclosing Party at:

Prerna Krishan
Research Coordinator
Corporate Planning, Reporting and Evaluation

Department of Health and Social Services
Government of the Northwest Territories
Box 1320
Yellowknife, NT X1A 2L9
Email: HSS_Research@gov.nt.ca
Telephone: 867-767-9053 Ext.49054
Fax: 867-873-0484

Sarah Jeffries
Senior Epidemiologist
Department of Health and Social Services
Government of the Northwest Territories
Email: Sarah_Jeffrey@gov.nt.ca
Telephone: 867) 767-9066 ext. 49285

To the Researcher at:

Ali Qadri
University of Alberta
2120 77 St SW
Edmonton, Alberta, Canada
Phone: 780-850-7556
Email: Ali.qadri@gmail.com

10. AMENDING PROCEDURES

10.2 This Agreement may be amended on written agreement by the Parties.

10.3 Written approval from the Disclosing Party must be obtained prior to the transfer of this Agreement to another person, or a change in the access, collection, use or disclosure of the personal health information is implemented.

11. ASSIGNMENT

11.2 This Agreement may be assigned by the Disclosing Party and the assignee shall have all the rights and be subject to all the obligations of this Agreement in favour of or against the Disclosing Party. Notice of the assignment will be given in writing to the Researcher.

12. COUNTERPARTS

12.2 This Agreement may be signed in counterparts and each counterpart shall constitute an original.

13. CHOICE OF LAW

14.1 This Agreement shall be interpreted and governed by the laws of the Northwest Territories and Canada, and enforced in the courts of the Northwest Territories.

IN WITNESS WHEREOF this Agreement has been signed on behalf of the Disclosing Party by:

Jo-Anne Cecchetto, DM

Witness

April 13, 2023

Date

IN WITNESS WHEREOF this Agreement has been signed on behalf of the Researcher by:

Ali Qadri

Witness

April 3, 2023

Date

SCHEDULE A

Provide a copy of the research proposal along with research ethics committee approval, interview guide and other relevant documents.

Research Proposal

1. Introduction

COVID-19 poses a serious risk to Indigenous peoples globally. Colonization and discrimination have resulted in high disease burden and inequitable health outcomes (Mallard et al, 2021). Public health measures such as handwashing and isolation cannot be implemented fully in First Nations Communities due to overcrowding, inadequate resources and lack of access to clean water (Public Health Agency of Canada, 2021).
Per Indigenous Services Canada (ISC), the rate of active cases in First Nations reserves is 572.8, or 1.3 times the rate in the respective general Canadian population as of April 4, 2022 (Indigenous Services Canada, 2022). The Northwest Territories are a federal territory in Northern Canada that has been significantly impacted by COVID-19. There have been 11, 832 confirmed cases of COVID-19, with 119 total hospitalizations, and 22 total deaths as of April 28, 2022. (Government of Northwest Territories, 2022). 52% of the Northwest Territories population identifies as one or more Aboriginal Identities in 2016 (Government of Canada, Statistics Canada 2016). Aboriginal people, especially First Nations people, are more likely to live in crowded homes and homes in need of repair in the Northwest Territories (Government of Canada, Statistics Canada 2016).
This study will use a parallel mixed methods approach to explore the impact of COVID-19 on Indigenous people in the Northwest Territories. A retrospective data analysis will be conducted using existing COVID-19 data. This study will compare hospitalization, ICU admission and mortality rates between Indigenous and non-Indigenous peoples. Focus groups will be conducted with Indigenous participants to better understand the effectiveness of COVID-19 public health measures.

There are gaps in our current COVID-19 data and analysis for Indigenous populations. The co-development of COVID 19 data and evidence will contribute to the development of national strategies with Indigenous communities. We hope that this will guide the ongoing response to the COVID-19 pandemic response as well as future pandemics.

2. Project Details

2.1 Objective

COVID-19 has had a significant impact on many communities. The Chief Public Health Officer (CPHO) of Canada's Report on the State of Public Health in Canada 2021 outlines four priority action areas for Public Health Renewal. This project aims to address the priority area of modernizing our models of governance. The lived experience of Indigenous community members and local COVID-19 data will be used to produce policy recommendations tailored to Indigenous communities.

2.2 Methodology

This study will use a parallel mixed methods approach. The mixed methods approach uses both qualitative and quantitative methods to help answer questions that cannot be answered by either method alone (Shorten and Smith, 2017).

A retrospective data analysis will be conducted using COVID-19 data from January 1, 2020 to August 31, 2022. COVID-19 data has already been collected in the Northwest Territories. Community engagement Qualitative data will be obtained from focus groups will be conducted with recruited participants from Indigenous communities in Yellowknife, Denae and Tłı̨chǫ regions. A policy review will also be undertaken to review COVID-19 related policies by local governments during the pandemic. This will involve a review of the literature and published COVID-19 related guidelines.

2.3 Timeline

The anticipated start date is November 1, 2022 and anticipated end date is Aug 31, 2023. The researchers intend to be on-site in Northwest Territories in February 2023, and May to June 2023 to conduct focus groups and access the data set.

2.4 Funding

The project will be self-funded.

2.5 Licencing and Ethics

An application for search licencing will be submitted to the Aurora Research Institute. Ethics approval will be obtained from the University of Alberta Research Ethics Board.

2.6 Endpoints

The primary co-endpoints for the dataset analysis are the rates of hospitalization, ICU admission and mortality for Indigenous and non-Indigenous COVID-19 cases in the Northwest Territories

2.7 Inclusion and Exclusion Criteria

Focus group participants must be residents of Northwest Territories, at least 19 years of age, and self-identify as Indigenous. Exclusion criteria includes those unable to provide informed consent.

2.8 Dataset Information

Information about COVID-19 cases in the Northwest Territories from January 1, 2020 to August 31, 2022 will be examined in this study. A COVID-19 case dataset with aggregate (de-identified) data already exists; this dataset draws from the following sources: PCR laboratory testing results data (NWT Stanton Hospital Lab, Alberta Precision Lab), COVID-19 variant testing lab data (Alberta Precision Lab), Electronic Medical Record point-of-care COVID-19 testing, Hospitalization and severe outcome data – provided by the severe outcome liaison, severe outcome Surveillance Report form, and electronic Medical Record Vaccination administration data.

The case data is stored on a shared drive on a secured GNWT server that is restricted to approved users. Aggregate numbers for COVID-19 infections, hospitalizations, ICU admissions and mortality, and vaccination status for each category will be recorded in a password protected file.

2.9 Focus Group Information

Indigenous boards and Councils will be contacted and sent information on the study and focus groups. Boards will be asked to identify if there is interest and to provide contact information for relevant participants. Participants will be contacted to obtain consent and review focus group

details.

2.9 Data Analysis including Statistical Analysis

As we are using data from all cases of COVID-19 in the Northwest Territories, a priori sample size calculation is not required. Hospitalization, ICU admission and mortality will be compared for Indigenous and non-Indigenous cases matched for vaccination status. Data outcomes will be analysed using non-parametric tests including Mann-Whitney tests.

Focus groups will be audio recorded and transcribed. After transcription, any identifying information including names will be removed. Focus group and policy review data will be analyzed for common themes and experiences relating to COVID-19 policies.

2.10 OCAP (Ownership, Control, Access and Possession) Principles

This work will be supported by the Chief Public Health office of the NWT in consultation with Indigenous leadership. This will ensure the statistical data is handled within the scope of the OCAP principles as implemented by Indigenous governments and communities in the Northwest Territories

3. References

1. "Covid-19 and Indigenous Peoples for Indigenous Peoples." *United Nations*, United Nations, https://www.un.org/development/desa/indigenouspeoples/covid-19.html.
2. Mallard, Alistair, et al. "An Urgent Call to Collect Data Related to Covid-19 and Indigenous Populations Globally." *BMJ Global Health*, vol. 6, no. 3, 2021, https://doi.org/10.1136/bmjgh-2020-004655.
3. Canada, Public Health Agency of. "Government of Canada." *Canada.ca*, / Gouvernement Du Canada, 16 Mar. 2021, https://www.canada.ca/en/public-health/corporate/publications/chief-public-health-officer-reports-state-public-health-canada/from-risk-resilience-equity-approach-covid-19/indigenous-peoples-covid-19-report.html.
4. "Population Estimates by Community." *NWT Bureau of Statistics | Population - Estimates by Community*, https://www.statsnwt.ca/population/population-estimates/bycommunity.php.
5. Government of Canada, Statistics Canada. "Focus on Geography Series, 2016 Census." *Northwest Territories*, 10 Apr. 2019, https://www12.statcan.gc.ca/census-recensement/2016/as-sa/fogs-spg/Facts-PR-Eng.cfm.
6. Government of Northwest Territories. (n.d.). NWT covid-19 dashboard. Retrieved March 24, 2022, from https://nwt-covid.shinyapps.io/Testing-and-Cases/?lang=1

AURORA RESEARCH INSTITUTE
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PO Box 1450, Inuvik, NT X0E0T0
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www.nwtresearch.com

February 23, 2023

Notification of Research

I would like to inform you that Northwest Territories Scientific Research Licence No. 17217 has been issued to:

Susan Chatwood
University of Alberta
3-279 Edmonton Clinic Health Academy 11405 - 87 Ave NW

Phone: (780) 492-9335
Email: chatwood@ualberta.ca

to conduct the following study:
Exploring health impacts of COVID-19 on Indigenous Peoples in the Northwest Territories (5254)

Please contact the researcher if you would like more information about this research project.

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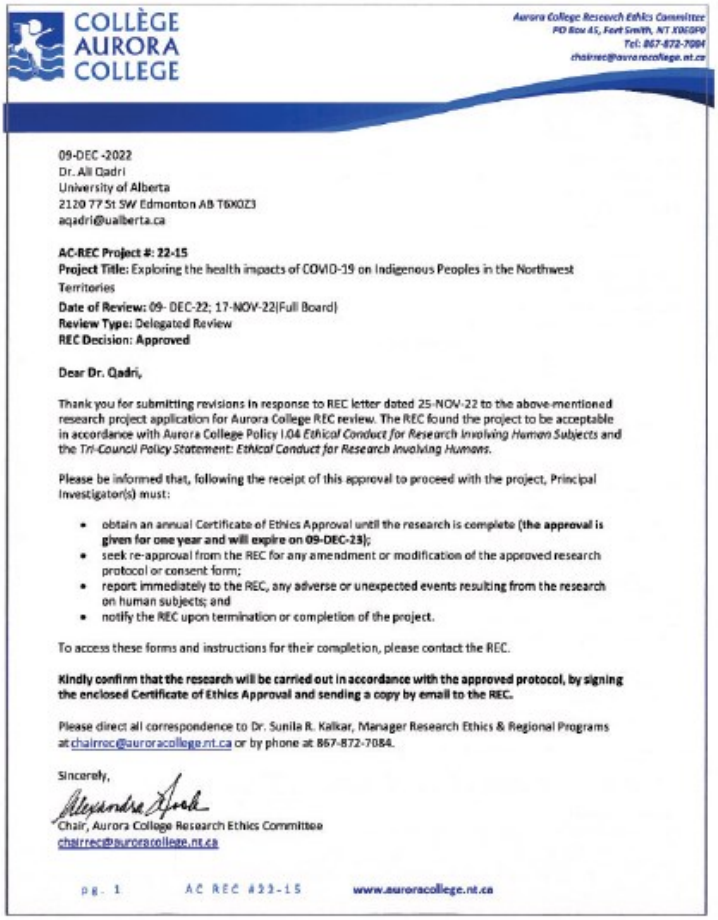
Our objective is study the impact of COVID-19 on Indigenous people in the Northwest Territories. We hope this study will produce high level policy recommendations for future pandemic response. Furthermore, we hope the co-development of COVID 19 data and evidence will contribute to the development of national strategies with Indigenous communities.

Sincerely,

Niccole Hammer
Manager, Scientific Services

Distribution
Health and Social Services and NTHSSA



COLLÈGE AURORA COLLEGE

Aurora College Research Ethics Committee
PO Box 41, Fort Smith, NT X0E0P0
Tel: 867-872-7084
chairrec@auroracollege.nt.ca

09-DEC -2022
Dr. Ali Qadri
University of Alberta
2120 77 St SW Edmonton AB T6X0Z3
aqadri@ualberta.ca

AC-REC Project #: 22-15
Project Title: Exploring the health impacts of COVID-19 on Indigenous Peoples in the Northwest Territories
Date of Review: 09- DEC-22; 17-NOV-22(Full Board)
Review Type: Delegated Review
REC Decision: Approved

Dear Dr. Qadri,

Thank you for submitting revisions in response to REC letter dated 25-NOV-22 to the above-mentioned research project application for Aurora College REC review. The REC found the project to be acceptable in accordance with Aurora College Policy I.04 *Ethical Conduct for Research Involving Human Subjects* and the *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans.*

Please be informed that, following the receipt of this approval to proceed with the project, Principal Investigator(s) must:

- obtain an annual Certificate of Ethics Approval until the research is complete **(the approval is given for one year and will expire on 09-DEC-23);**
- seek re-approval from the REC for any amendment or modification of the approved research protocol or consent form;
- report immediately to the REC, any adverse or unexpected events resulting from the research on human subjects; and
- notify the REC upon termination or completion of the project.

To access these forms and instructions for their completion, please contact the REC.

Kindly confirm that the research will be carried out in accordance with the approved protocol, by signing the enclosed Certificate of Ethics Approval and sending a copy by email to the REC.

Please direct all correspondence to Dr. Sunila R. Kalkar, Manager Research Ethics & Regional Programs at chairrec@auroracollege.nt.ca or by phone at 867-872-7084.

Sincerely,

Chair, Aurora College Research Ethics Committee
chairrec@auroracollege.nt.ca

COLLÈGE AURORA COLLEGE

Aurora College Research Ethics Committee
CERTIFICATE OF ETHICS REVIEW

AC-REC Project #:22-15

Project Title: Exploring the health impacts of COVID-19 on Indigenous Peoples in the Northwest Territories

Principal Investigator:
Name: Dr. Ali Qadri
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Type of Review: Follow Up

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• Communication from DHSS Research Coordinator dated 28-NOV-22	30-NOV -2022

ETHICS REVIEW:
Your application to the Aurora College Research Ethics Committee (REC) regarding the above-referenced research project has been reviewed. The most recent versions of the documents listed above were found to meet ethical requirements for research involving humans.

Alexandra Hood 9 Dec 2022

Chair/Aurora College Research Ethics Committee — Date

Certificate Expiry Date: 09-DEC-2023

Principal Investigator's responsibilities:
I confirm that I will:

1. Carry out the research in accordance with the above-referenced protocol by the REC;
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Principal Investigator — Date

Once signed, please return a copy of the certificate to the REC by email at chairrec@auroracollege.nt.ca

COLLÈGE AURORA COLLEGE

Aurora College Research Ethics Committee
CERTIFICATE OF ETHICS REVIEW

AC-REC Project #:22-14

Project Title: Exploring the health impacts of COVID-19 on Indigenous Peoples in the Northwest Territories

Principal Investigator:
Name: Dr. Ali Qadri
Branch/Institution: University of Alberta
Address: 2120 77 St SW Edmonton AB T6X0Z3
Email Address: aqadri@ualberta.ca

Type of Review: Follow Up

Date of Review: 09-DEC-2022

Review Type: Delegated Review

Certificate Expiry Date: 09-DEC-2023

Study Summary:
Indigenous people have been significantly impacted by COVID-19, especially due to social factors like housing, access to clean water and impacts of colonialism. Northwest Territories has had over 10,000 cases of COVID-19. We hypothesize that Indigenous people in NWT have more severe outcomes from COVID-19 compared to non-Indigenous people.
This research has several parts.
(1) Data analysis:
A COVID-19 case dataset with aggregate (de-identified) data is already collected. The case data is stored on a shared drive on a secured GNWT server that is restricted to approved users. Sources of this data include: PCR laboratory testing results data, COVID-19 variant testing lab data, EMR point-of-care COVID-19 testing, Hospitalization and severe outcome, severe outcome Surveillance Report form, and EMR Vaccination administration data. We will compare rates of hospitalizations, deaths and intensive care unit admissions for COVID-19 cases between Indigenous and non-Indigenous people, matched for vaccination status. This data will be recorded in a password protected file.
(2) Focus groups:
Two or three with Indigenous people and elders in NWT to understand their experiences and perspectives on COVID-19, Kimberly Fairman (study team member) is Nunavummiut and the Director of the Institute for Circumpolar Health Research. She has developed connections with Indigenous communities throughout her career. She will contact organizations (e.g. Dene Council) to identify interested participants and elders for focus groups. Focus groups will be audio recorded and transcribed. Common themes in policies and focus groups will be analyzed, using a word cloud if appropriate, for qualitative analysis.
(3) Conducting a web literature review of national and local COVID-19 policies.
The research aims to produce high level recommendations about pandemic response for Indigenous people and in Indigenous communities in the NWT. We hope that this will guide the ongoing response to the COVID-19 pandemic response as well as future pandemics.

Focus Group Questions

Preamble: Hello everyone. Thank you for your participation in this focus group. This work will help support my Masters of Science thesis. We hope this work will help improve Indigenous health policy.
To start off, I'd like to mention that participation in this focus group is completely voluntary. Participants can leave at any time and don't need to answer any questions. The focus group will be audio recorded. The audio will be transcribed and any information that identifies you like your name will be removed.

Theme: Resilience and Community

1. What has made you feel proud about your community's response to COVID-19?
2. What has kept your community strong when responding to COVID-19?

Theme: Communication

1. Where did you get your information for COVID-19 updates (e.g. Facebook, Instagram, Snapchat, websites, local newsletters)?
2. What do people in your community think about COVID-19 vaccinations?
3. Was there enough information about vaccinations available?
4. Were COVID-19 policies from the federal or territorial government difficult to follow?

Theme: Healthcare

1. Some doctor appointments were changed to virtual appointments (e.g. phone appointments). What did you think of this?
2. Travel restrictions made it more challenging to travel to Yellowknife or Edmonton for care. How was this experience for you or your community?
3. Has the pandemic changed your access to care for other health issues for yourself or your community?

Theme: Areas of Change

1. Is there anything you think the government (federal or territorial) could have done differently in responding to COVID-19?
2. Is there anything you think your community could have done differently in responding to COVID-19?

Theme: Youth

1. How has COVID-19 impacted youth in your community?

Some questions adapted from:
https://www.canada.ca/en/public-health/corporate/publications/chief-public-health-officer-reports-state-public-health-canada/from-risk-resilience-equity-approach-covid-19/indigenous-peoples-covid-19-report.html

Appendix 5: Code in R by Rob Warren (Data Analyst)

```
UofA Covid Data Request
#R.Warren
#2023-05-16

#Total Counts By Ethnicity
#Total counts by severe outcomes & ethnicity
#Total counts by vaccination status & ethnicity & severe outcome
#Date range 2020-01-01 to 2022-08-31

library(RODBC)
library(openxlsx)
library(tidyverse)
library(janitor)
library(DBI)
library(odbc)

##############################

#FILE PATH SOURCE REDACTED

##############################

NTHSSA <- c("BEAUFORT DELTA", "YELLOWKNIFE", "DEHCHO", "FORT SMITH", "SAHTU")
HRHSSA <- c("HAY RIVER")
TCSA <- c("TLICHO")

#insert file paths for severe outcomes and mortality data comps

person_tbl <- f.QID(person_tbl, person_tbl$LastName, person_tbl$FirstName, person_tbl$DOB)

#Total Counts
comp_list <- demo_tbl |>
  left_join(person_tbl |> select(PersonID,PHN, QID, DOB), by = "PersonID") |>
  mutate(broad_eth = case_when(
    tolower(Ethnicity) == "inuit" |
      tolower(Ethnicity) == "first nations" |
      tolower(Ethnicity) == "indigenous metis" |
      tolower(Ethnicity) == "indigenous not specified" |
      tolower(Ethnicity) == "metis" ~ "Indigenous",
    tolower(Ethnicity) == "non indigenous" ~ "Non Indigenous",
    is.na(Ethnicity) ~ "Unknown",
    TRUE ~ Ethnicity
  ))

sml_fc_epi <- epi_tbl |>
  select(EpisodeID, EpisodeDate, Episode_Num, Case_Type, Case_Source)

comp_list_epi <- sml_fc_epi |>
  left_join(comp_list, by = "EpisodeID") |>
```

```
  select(EpisodeID,
         PersonID,
         PHN,
         QID,
         DOB,
         Sex,
         broad_eth,
         Residency,
         EpisodeDate,
         Case_Type,
         Case_Source,
         Episode_Num) |>
  filter(EpisodeDate >= "2020-01-01" &
           EpisodeDate <= "2023-03-31") |>
  mutate(EpisodeDate = as.Date(EpisodeDate, format = "%Y-%m-%d"))

###################################

#FUNCTION PATH REDACTED

###################################

comp_res <- timeinplace(comp_list_epi, comp_list_epi$EpisodeDate, PK =
comp_list_epi$EpisodeID)

# comp_res <- PHN_res(comp_list_epi, comp_list_epi$EpisodeDate)
# comp_res <- PHN_mail(comp_res, comp_res$EpisodeDate) |>
#   mutate(COMMUNITY = coalesce(COMMUNITY_RES, COMMUNITY_MAIL),
#          Region = coalesce(health_authority_res, health_authority_mail))

rm(comp_list_epi, comp_list, demo_tbl, epi_tbl, hmis_qid, labs_tbl, person_tbl, sml_fc_epi)

sev_comp <- sev_tbl |>
  mutate(admin = case_when(
    !is.na(AdmissionDate) ~ 1
  ),
  icu = case_when(
    ICU == 1  ~ 1
  ),
  deceased = case_when(
    Deceased == 1 ~ 1
  )) |>
  select(c(
    EpisodeID,
    admin,
    icu,
    deceased
    )) |>
  group_by(EpisodeID) |>
  fill(admin, .direction = "updown") |>
  fill(icu, .direction = "updown") |>
```

```
  fill(deceased, .direction = "updown") |>
  ungroup() |>
  unique()

comp_list_res <- comp_res |>
  mutate(Region = health_authority,
         health_authority = case_when(
           Region  %in% NTHSSA ~ "NTHSSA",
           Region %in% HRHSSA ~ "HRHSSA",
           Region  %in% TCSA ~ "TCSA",
           is.na(Region) &
             !is.na(COMMUNITY) ~ "OOT",
           TRUE ~ "Unknown"),
         Region = case_when(
           is.na(Region) ~ health_authority,
           TRUE ~ Region
         ),
         age_infec = trunc((DOB %--% EpisodeDate)/ years(1)),
         age_group = case_when(
           age_infec >= 0 &
             age_infec <= 4  ~ "0 to 4",
           age_infec >= 5 &
             age_infec <= 11 ~ "5 to 11",
           age_infec >= 12 &
             age_infec <= 18 ~ "12 to 18",
           age_infec >= 19 &
             age_infec <= 29 ~ "19 to 29",
           age_infec >= 30 &
             age_infec <= 49 ~ "30 to 49",
           age_infec >= 50 &
             age_infec <= 64 ~ "50 to 64",
           age_infec >= 65 &
             age_infec <= 79 ~ "65 to 79",
           age_infec >= 80   ~ "80+"
         )) |>
  select(-(age_infec)) |>
  left_join(sev_comp, by = "EpisodeID") |>
  mutate(across(c(admin, icu, deceased),~ifelse(is.na(.),0,.))) |>
  # mutate(hosp_admission = case_when(
  #   EpisodeID %in% sev_comp$EpisodeID &
  #     sev_comp$admin == 1 ~ 1,
  #   TRUE ~ 0
  # ),
  # ICU_admission = case_when(
  #   EpisodeID %in% sev_comp$EpisodeID &
  #     !is.na(sev_comp$icu) ~ 1,
  #   TRUE ~ 0
  # ),
  # deceased = case_when(
#   EpisodeID %in% sev_comp$EpisodeID &
#     !is.na(sev_comp$deceased) ~ 1,
```

```
#   TRUE ~ 0
# )) |>
select(c(
  PersonID,
  EpisodeID,
  EpisodeDate,
  broad_eth,
  sex = Sex,
  health_authority,
  region = Region,
  age_group,
  residency = Residency,
  hosp_admission = admin,
  ICU_admission = icu,
  deceased,
  case_type = Case_Type,
  case_source = Case_Source
)) |>
  mutate(across(c("broad_eth", "sex", "region"),~str_to_title(.)),
         sex = case_when(
           is.na(sex) ~ "Unknown",
           TRUE ~ sex
         ),
         age_group = case_when(
           is.na(age_group) ~ "Unknown",
           TRUE ~ age_group
         ))

#####################################

#IMMUNIZATION DB PATH REDACTED

#####################################

vac_subset <- vac_tbl|>
  pivot_longer(cols = c(starts_with("Event")),
               values_to = "EventID") |>
  select(EpisodeID,
         EventID) |>
  filter(!is.na(EventID)) |>
  left_join(vac_repo, by = "EventID") |>
  filter(ImmunizationDate >= "2020-01-01" &
           ImmunizationDate <= "2022-03-31") |>
  select(EventID,
         EpisodeID,
         ImmunizationDate,
         ImmunizingAgentTradeName,
         Series)

sev_subset <- sev_tbl |>
  inner_join(comp_list_res, by = "EpisodeID") |>
```

```
  select(colnames(sev_tbl)) |>
  distinct()

########################################

#FUNCTION PATH REDACTED

########################################

bd.mnth <- seq(as.Date("2021-01-31"), by = "month", length.out = 24)

edates <- c(as.Date("2020-12-31", format = "%Y-%m-%d"), bd.mnth, as.Date("2023-12-31",
format = "%Y-%m-%d"))

########################################

#RAW IMZ DATA PATH REDACTED

########################################

imz_res <- PHN_check(imz_raw, imz_raw$v.date) |>
  filter(NTResident_PHN == 1) |>
  select(PHN,
    PatientID,
        immz_date,
        age_grp,
        ethnicity,
        sex,
        community,
        onedose:boost_four) |>
  mutate(fail.dose = case_when(
    if_all(.cols = c(onedose:boost_four),
          ~ . == 0) ~ 1,
    TRUE ~ 0
  )) |> filter(fail.dose != 1) |>
  select(-fail.dose)

imz_res <- PHN_res(imz_res, imz_res$immz_date)
imz_res <- PHN_mail(imz_res, imz_res$immz_date) |>
  mutate(Region = case_when(
    !is.na(health_authority_res)  ~ health_authority_res,
          is.na(health_authority_res) &
            !is.na(health_authority_mail) ~ health_authority_mail,
          TRUE ~ "UNKNOWN"),
    COMMUNITY = case_when(
      !is.na(COMMUNITY_RES) ~ COMMUNITY_RES,
      TRUE ~ COMMUNITY_MAIL
    ),
    health_authority = case_when(
      Region  %in% NTHSSA ~ "NTHSSA",
      Region %in% HRHSSA ~ "HRHSSA",
```

```
      Region  %in% TCSA ~ "TCSA",
      is.na(Region) &
        !is.na(COMMUNITY) ~ "OOT",
      TRUE ~ "Unknown"
    ),
    sex = case_when(
      sex == "M" ~ "MALE",
      sex == "F" ~ "FEMALE",
      TRUE ~ "UNKNOWN"
    ))|>
    select(
      PatientID,
      immz_date,
      ethnicity,
      age_grp,
      sex,
      health_authority,
      onedose:boost_four
      ) |>
    distinct()

filter_age <- function(df,e) {
    pop <- df |>
      filter(immz_date <= e) |>
      group_by(PatientID) |>
      slice_max(immz_date) |>
      mutate(status = case_when(
        boost_four == 1 ~ "Primary+4",
        boost_three == 1 ~ "Primary+3",
        boost_two == 1 ~ "Primary+2",
        boost_one == 1 ~ "Primary+1",
        prim == 1 ~ "Primary",
        onedose == 1 ~ "Partial Primary"
      ))

    pop.eth.age <- pop |>
      group_by(ethnicity,age_grp, status) |>
      summarise(total = n()) |>
      mutate(date = e)

    # pop.eth.gen <- pop |>
    #   group_by(ethnicity,sex, status) |>
    #   summarise(total = n())
    #
    # pop.eth.loc <- pop |>
    #   group_by(ethnicity,health_authority, status) |>
    #   summarise(total = n())

    # pop.list <- list(pop.eth.age, pop.eth.gen,pop.eth.loc)
    return(pop.eth.age)
}
```

```
filter_gen <- function(df,e) {
  pop <- df |>
    filter(immz_date <= e) |>
    group_by(PatientID) |>
    slice_max(immz_date) |>
    mutate(status = case_when(
      boost_four == 1 ~ "Primary+4",
      boost_three == 1 ~ "Primary+3",
      boost_two == 1 ~ "Primary+2",
      boost_one == 1 ~ "Primary+1",
      prim == 1 ~ "Primary",
      onedose == 1 ~ "Partial Primary"
    ))

  # pop.eth.age <- pop |>
  #   group_by(ethnicity,age_grp, status) |>
  #   summarise(total = n())

  pop.eth.gen <- pop |>
    group_by(ethnicity,sex, status) |>
    summarise(total = n()) |>
    mutate(date = e)

  # pop.eth.loc <- pop |>
  #   group_by(ethnicity,health_authority, status) |>
  #   summarise(total = n())

  # pop.list <- list(pop.eth.age, pop.eth.gen,pop.eth.loc)
  return(pop.eth.gen)
}

filter_loc <- function(df,e) {
  pop <- df |>
    filter(immz_date <= e) |>
    group_by(PatientID) |>
    slice_max(immz_date) |>
    mutate(status = case_when(
      boost_four == 1 ~ "Primary+4",
      boost_three == 1 ~ "Primary+3",
      boost_two == 1 ~ "Primary+2",
      boost_one == 1 ~ "Primary+1",
      prim == 1 ~ "Primary",
      onedose == 1 ~ "Partial Primary"
    ))
  #
  # pop.eth.age <- pop |>
  #   group_by(ethnicity,age_grp, status) |>
  #   summarise(total = n())
  #
  # pop.eth.gen <- pop |>
```

```
  #   group_by(ethnicity,sex, status) |>
  #   summarise(total = n())

  pop.eth.loc <- pop |>
    group_by(ethnicity,health_authority, status) |>
    summarise(total = n()) |>
    mutate(date = e)

  return(pop.eth.loc)
}

l.age <- lapply(edates, function(x) filter_age(imz_res, x))
l.gen <- lapply(edates, function(x) filter_gen(imz_res, x))
l.loc <- lapply(edates, function(x) filter_loc(imz_res, x))


names(l.age) <- edates
names(l.gen) <- edates
names(l.loc) <- edates

l.age <- rbindlist(l.age)

l.gen <- rbindlist(l.gen)

l.loc <- rbindlist(l.loc)

l <- list("Ethnicity.Age" = l.age, "Ethnicity.Sex" = l.gen, "Ethnicity.Location" = l.loc)

###################################

#WRITE PATH REDACTED

###################################




#1. Load required packages

library(openxlsx) #import/export excel files
library(tidyverse) #data wrangling
library(janitor) #data cleaning
library(DBI) #db connect
library(odbc) #db connect

#####################################

#FUNCTION SOURCE REDACTED
```

```
#####################################

#date to check residency status against (July 1, 2022)
residentdate <- ymd("2022-07-01")
#it.date <- seq(as.Date("2022-03-31"), by = "month", lenght.out = 12)

#2. Define directories and import data

#2a) NT VaccinationRecords Database

#####################################

#DB PATH REDACTED

#####################################


demo <- demo_tbl |>
  left_join(person_tbl |> select(PatientID, BirthDate), by = "PatientID") |>
  left_join(vac_tbl |> filter(abbr=="COVID-19" & ImmunizationRefused=="NO" &
                              Series != 0) |> select(EventID, ImmunizationDate, NTResident), by =
"EventID") |>
  filter(!is.na(ImmunizationDate) &
           NTResident == 1) |>
  mutate(across(where(is.POSIXct), ~ ymd(.)),
         PHN = na_if(PHN, ""))

demo <- PHN_check(demo, demo$ImmunizationDate)
demo <- QID_check(demo, demo$ImmunizationDate) |>
  mutate(PHN = coalesce(PHN, i.PHN)) |>
  select(-i.PHN, -NTResident_PHN, -NTResident_QID)

demo <- PHN_res(demo, demo$ImmunizationDate) |>
  select(
    EventID,
    PatientID,
    PHN,
    QID,
    BirthDate,

  )

person <- person_tbl |>
```

```
  mutate(BirthDate = ymd(BirthDate)) |>
  left_join(demo_tbl |> select(PatientID, EventID, )) 
  left_join(demo_phn |> select(PHN, ETHNICITY, GENDER), by = "PHN")
  # mutate(age_yr = trunc((BirthDate %--% residentdate / years(1)))) |> #age in years
  # mutate(AgeGroup = case_when(    #case when function to assign agegroups
  #   age_yr < 18               ~ "children",
  #   age_yr >= 18 & age_yr < 40 ~ "young adults",
  #   age_yr >= 40 & age_yr < 60 ~ "middle-age adults",
  #   age_yr >= 60              ~ "older adults",
  #   TRUE                      ~ "Unknown"
  # )) |>
  # mutate(AgeGroup = factor(AgeGroup, levels = c("children", "young adults", "middle-age
adults", "older adults", "Unknown"))) |>
  # select(PatientID, Gender, AgeGroup) |>
  # mutate(Sex = case_when( #recode sex to match report form
  #   Gender == "F" ~ "Female",
  #   Gender == "M" ~ "Male",
  #   Gender == ""  ~ "Unknown",
  #   TRUE          ~ "Unknown"
  # )) |>
  # select(-Gender)


#check residency status using hmis check function against residentdate (July 1, 2022)
demo <- PHN_check(demo_tbl, residentdate)|>
  filter(NTResident_PHN==1) |>
  select(PatientID, EventID, PHN)

demo <- PHN_demo(demo, residentdate) |>
  select(PatientID, EventID, PHN, ETHNICITY, GENDER)

#keep NT residents only and selected needed columns

vax <- vac_tbl |>
  filter(abbr=="COVID-19" & ImmunizationRefused=="NO" &
           Series != 0) |>
  select(PatientID,
         ImmunizationDate,
         LastUpdatedDateTime,
         ImmunizingAgentTradeName,
         ImmunizingAgentGeneric,
         Dose,
         Series) |>
  mutate(ImmunizationDate = ymd(ImmunizationDate)) |>
```

```
  group_by(PatientID, ImmunizationDate) |>
  slice_max(LastUpdatedDateTime, with_ties = FALSE) |>
  distinct() |>
  ungroup() |>
  group_by(PatientID, Series) |>
  slice_max(LastUpdatedDateTime, with_ties = FALSE) |>
  ungroup() |>
  group_by(PatientID) |>
  arrange(ImmunizationDate) |>
  mutate(dose_num = row_number()) |>
  ungroup() |>
  # group_by(PatientID) |>
  # arrange(ImmunizationDate, .by_group = T) |>
  # mutate(DoseNum = row_number()) |>
  # ungroup() |>
  mutate(VaccineProduct = case_when(
    str_detect(ImmunizingAgentTradeName, "PFIZER") &
      !str_detect(ImmunizingAgentGeneric, "BIVALENT") &
      Dose == "0.3"                                  ~ "Pfizer-BioNTech Comirnaty",
    str_detect(ImmunizingAgentTradeName, "PFIZER") &
      !str_detect(ImmunizingAgentGeneric, "BIVALENT") &
      str_detect(ImmunizingAgentGeneric, "<5") &
      Dose=="0.2"                                    ~ "Pfizer-BioNTech Comirnaty pediatric 6 months-4
years",
    str_detect(ImmunizingAgentTradeName, "PFIZER") &
      !str_detect(ImmunizingAgentGeneric, "BIVALENT") &
      str_detect(ImmunizingAgentGeneric, "5-11|PEDS") &
      Dose=="0.2"                                    ~ "Pfizer-BioNTech Comirnaty pediatric 5-11 years",
    str_detect(ImmunizingAgentTradeName, "PFIZER") &
      str_detect(ImmunizingAgentGeneric, "BA.4/BA.5") &
      str_detect(ImmunizingAgentGeneric, "PEDS")          ~ "Pfizer-BioNTech Comirnaty Bivalent
BA4/BA5 5-11 years",
    str_detect(ImmunizingAgentTradeName, "PFIZER") &
      str_detect(ImmunizingAgentGeneric, "BIVALENT") |
      str_detect(ImmunizingAgentGeneric, "BA4/BA5") &
      !str_detect(ImmunizingAgentGeneric, "PEDS")         ~ "Pfizer-BioNTech Comirnaty Bivalent
BA4/BA5",
    str_detect(ImmunizingAgentTradeName, "MODERNA") &
      str_detect(ImmunizingAgentGeneric, "MONOVALENT") &
      !str_detect(ImmunizingAgentGeneric, "PEDS") |
      str_detect(ImmunizingAgentTradeName, "MODERNA") &
      str_detect(ImmunizingAgentGeneric, "MESSENGER") &
      !str_detect(ImmunizingAgentGeneric, "PEDS")        ~ "Moderna Spikevax",
    str_detect(ImmunizingAgentTradeName, "MODERNA") &
```

```
      str_detect(ImmunizingAgentGeneric, "PEDS") &
      str_detect(ImmunizingAgentGeneric, "<5") &
      Dose=="0.25"                                ~ "Moderna pediatric 6 months-5 years",
    str_detect(ImmunizingAgentTradeName, "MODERNA") &
      str_detect(ImmunizingAgentGeneric, "BIVALENT") &
      str_detect(ImmunizingAgentGeneric, "BA.1")          ~ "Moderna Spikevax Bivalent
Original/BA1",
    str_detect(ImmunizingAgentTradeName, "MODERNA") &
      str_detect(ImmunizingAgentGeneric, "BIVALENT") &
      str_detect(ImmunizingAgentGeneric, "BA.1")          ~ "Moderna Spikevax Bivalent
Original/BA1",
    str_detect(ImmunizingAgentTradeName, "MODERNA") &
      str_detect(ImmunizingAgentGeneric, "BIVALENT") &
      str_detect(ImmunizingAgentGeneric, "BA.4/BA.5")     ~ "Moderna Spikevax Bivalent
BA4/BA5",
    str_detect(ImmunizingAgentTradeName, "ASTRAZENECA") &
      !str_detect(ImmunizingAgentTradeName, "COVISHIELD")  ~ "AstraZeneca Vaxzevria",
    str_detect(ImmunizingAgentTradeName, "COVISHIELD")    ~ "COVISHIELD",
    str_detect(ImmunizingAgentTradeName, "JANSSEN")       ~ "Janssen",
    str_detect(ImmunizingAgentTradeName, "NOVAVAX")       ~ "Novavax",
    TRUE                                                  ~ "Other")) |>
  select(c(
    PatientID,
    ImmunizationDate,
    VaccineProduct,
    Series = dose_num
  ))

it.date <- as.Date("2020-03-31") %m+% months(0:36)

v.name <- c("MAR2020", "APR2020", "MAY2020", "JUN2020", "JUL2020", "AUG2020",
            "SEP2020", "OCT2020", "NOV2020", "DEC2020", "JAN2021", "FEB2021",
            "MAR2021", "APR2021", "MAY2021", "JUN2021", "JUL2021", "AUG2021",
            "SEP2021", "OCT2021", "NOV2021", "DEC2021", "JAN2022", "FEB2022",
            "MAR2022", "APR2022", "MAY2022", "JUN2022", "JUL2022", "AUG2022",
            "SEP2022", "OCT2022", "NOV2022", "DEC2022", "JAN2023", "FEB2023",
            "MAR2023")

# v.list <- list()
# for(i in it.date){
#   new.df <- subset(vax, ImmunizationDate <= it.date[i])
#   v.list <- c(v.list, list(new.df))
#   return(v.list)
# }
```

```
# v.list <- map(it.date, ~filter(vax, ImmunizationDate <= it.date))

# v.list <- lapply(it.date, function(x) subset(vax, vax$ImmunizationDate <= it.date))



v.list <- lapply(it.date, function(x) vax[x >= vax$ImmunizationDate,])
names(v.list) <- v.name


v.res <- v.list |> map(~ .x |>
                  left_join(person_tbl |> select(PatientID, BirthDate, Gender)))

v.age <- v.list |> map(~ .x |>
                  left_join(person |> select(PatientID, AgeGroup), by = "PatientID") |>
                  group_by(PatientID) |>
                  mutate(numberdoses = n(),
                         lastdose = max(ImmunizationDate)) |>
                  select(-ImmunizationDate) |>
                  pivot_wider(#pivot wider b vaccine product and dose number
                    names_from = Series,
                    names_prefix = "VaccineProductDose_",
                    values_from = VaccineProduct) |>
                  fill(starts_with("VaccineProductDose"), .direction = "downup") |>
                  ungroup() |>
                  distinct() |>
                  mutate(
                    VaccinationStatus = case_when(
                      #assign vaccine status as per report from data definitions
                      VaccineProductDose_1 == "Janssen" &
                        is.na(VaccineProductDose_2)                    ~ "Primary series
completed",
                      #primary series only if received Jansen!is.na(VaccineProductDose_1) &
                      !is.na(VaccineProductDose_2) &
                        numberdoses == 2                               ~ "Primary series
completed",
                      #only primary series documented!is.na(VaccineProductDose_1) &
                      !is.na(VaccineProductDose_2) &
                        numberdoses == 3                               ~ "Primary series completed
with 1 additional dose",
                      !is.na(VaccineProductDose_1) &
                        !is.na(VaccineProductDose_2) &
```

```
                    numberdoses == 4                                ~ "Primary series completed
with 2 additional doses",
                   !is.na(VaccineProductDose_1) &
                    !is.na(VaccineProductDose_2) &
                    numberdoses == 5                                ~ "Primary series completed
with 3 additional doses",
                   !is.na(VaccineProductDose_1) &
                    !is.na(VaccineProductDose_2) &
                    numberdoses == 6                                ~ "Primary series completed
with 4 additional doses",
                   !is.na(VaccineProductDose_1) &
                    !is.na(VaccineProductDose_2) &
                    numberdoses == 7                                ~ "Primary series completed
with 5 additional doses",
                   !is.na(VaccineProductDose_1) &
                    !is.na(VaccineProductDose_2) &
                    numberdoses == 8                                ~ "Primary series completed
with 6 additional doses",
                   VaccineProductDose_1 != "Janssen" &
                    !is.na(VaccineProductDose_1) &
                    numberdoses == 1                                ~ "Partially vaccinated",
                   TRUE                                          ~ "Unknown"
                  )) |>
                 select(-numberdoses) |>
                 group_by(VaccinationStatus, AgeGroup) |>
                 summarise(total = n()))


v.tot <- v.list |> map(~ .x |>
                   left_join(person |> select(PatientID, AgeGroup), by = "PatientID") |>
                   group_by(PatientID) |>
                   mutate(numberdoses = n(),
                          lastdose = max(ImmunizationDate)) |>
                   select(-ImmunizationDate) |>
                   pivot_wider(#pivot wider b vaccine product and dose number
                     names_from = Series,
                     names_prefix = "VaccineProductDose_",
                     values_from = VaccineProduct) |>
                   fill(starts_with("VaccineProductDose"), .direction = "downup") |>
                   ungroup() |>
                   distinct() |>
                   mutate(
                     VaccinationStatus = case_when(
                       #assign vaccine status as per report from data definitions
```

```
                    VaccineProductDose_1 == "Janssen" &
                      is.na(VaccineProductDose_2)                    ~ "Primary series
completed",
                    #primary series only if received Jansen!is.na(VaccineProductDose_1) &
                    !is.na(VaccineProductDose_2) &
                      numberdoses == 2                               ~ "Primary series
completed",
                    #only primary series documented!is.na(VaccineProductDose_1) &
                    !is.na(VaccineProductDose_2) &
                      numberdoses == 3                               ~ "Primary series
completed with 1 additional dose",
                    !is.na(VaccineProductDose_1) &
                      !is.na(VaccineProductDose_2) &
                      numberdoses == 4                               ~ "Primary series
completed with 2 additional doses",
                    !is.na(VaccineProductDose_1) &
                      !is.na(VaccineProductDose_2) &
                      numberdoses == 5                               ~ "Primary series
completed with 3 additional doses",
                    !is.na(VaccineProductDose_1) &
                      !is.na(VaccineProductDose_2) &
                      numberdoses == 6                               ~ "Primary series
completed with 4 additional doses",
                    !is.na(VaccineProductDose_1) &
                      !is.na(VaccineProductDose_2) &
                      numberdoses == 7                               ~ "Primary series
completed with 5 additional doses",
                    !is.na(VaccineProductDose_1) &
                      !is.na(VaccineProductDose_2) &
                      numberdoses == 8                               ~ "Primary series
completed with 6 additional doses",
                    VaccineProductDose_1 != "Janssen" &
                      !is.na(VaccineProductDose_1) &
                      numberdoses == 1                               ~ "Partially vaccinated",
                    TRUE                                           ~ "Unknown"
                  )) |>
                select(-numberdoses) |>
                group_by(VaccinationStatus) |>
                summarise(total = n()))


df1 <- bind_rows(v.age, .id="v.name")
df2 <- bind_rows(v.tot, .id="v.name")
```

```
df.list <- list("AgeGroup" = df1, "Total" = df2)

###################################

#WRITE PATH REDACTED

###################################

# vaxcoverage <- vaxPerson |>
#   #filter df for patientIDs with valid PHN as per demo df above
#   filter(PatientID %in% demo$PatientID) |>
#   filter(!is.na(VaccineProduct)) |>
#   select(PatientID, ImmunizationDate, Doses, AgeGroup, VaccineProduct, Sex) |>
#   group_by(PatientID) |>
#   #calculate last vaccine dose month
#   mutate(MonthOfLastDose = lubridate::month(max(ImmunizationDate), label = T, abbr = F),
#          YearOfLastDose = year(max(ImmunizationDate))) |>
#   select(-ImmunizationDate) |>
#   distinct() |>
#   #add column with total number of doses completed by PatientID
#   mutate(numberdoses = n()) |>
#   ungroup() |>
#   group_by(PatientID) |>
#   pivot_wider( #pivot wider b vaccine product and dose number
#     names_from = Doses,
#     names_prefix = "VaccineProductDose_",
#     values_from = VaccineProduct
#   ) |>
#   fill(starts_with("VaccineProductDose"), .direction= "downup") |>
#   ungroup() |>
#   distinct() |>
#   mutate(VaccinationStatus = case_when( #assign vaccine status as per report from data
definitions
#     VaccineProductDose_1 == "Janssen" & is.na(VaccineProductDose_2)   ~ "Fully
vaccinated", #primary series only if received Jansen
#     !is.na(VaccineProductDose_1) & !is.na(VaccineProductDose_2) &
#       numberdoses == 2                                  ~ "Fully vaccinated", #only primary series
documented
#     !is.na(VaccineProductDose_1) & !is.na(VaccineProductDose_2) &
#       numberdoses == 3                                  ~ "Fully vaccinated with 1 additional
dose",
#     !is.na(VaccineProductDose_1) & !is.na(VaccineProductDose_2) &
```

```
#       numberdoses == 4                                    ~ "Fully vaccinated with 2 additional
doses",
#     !is.na(VaccineProductDose_1) & !is.na(VaccineProductDose_2) &
#       numberdoses == 5                                    ~ "Fully vaccinated with 3 additional
doses",
#     !is.na(VaccineProductDose_1) & !is.na(VaccineProductDose_2) &
#       numberdoses == 6                                    ~ "Fully vaccinated with 4 additional
doses",
#     !is.na(VaccineProductDose_1) & !is.na(VaccineProductDose_2) &
#       numberdoses == 7                                    ~ "Fully vaccinated with 5 additional
doses",
#     !is.na(VaccineProductDose_1) & !is.na(VaccineProductDose_2) &
#       numberdoses == 8                                    ~ "Fully vaccinated with 6 additional
doses",
#     VaccineProductDose_1 != "Janssen" &
#       !is.na(VaccineProductDose_1) & numberdoses == 1               ~ "Partially vaccinated",
#     TRUE                                                ~ "Unknown")
#   ) |>
#   select(-numberdoses) |>
#   group_by(Sex, AgeGroup, VaccinationStatus, MonthOfLastDose, YearOfLastDose,
#            VaccineProductDose_1, VaccineProductDose_2, VaccineProductDose_3,
VaccineProductDose_4,
#            VaccineProductDose_5, VaccineProductDose_6, VaccineProductDose_7) |>
#   summarise(Count = n()) |>
#   ungroup() |>
#   #add missing coverage categories (if present)
#   full_join(coverage_fields) |>
#   mutate(Count = replace_na(Count, 0)) |>
#   mutate(across(starts_with("VaccineProductDose_"), ~replace_na(., "Not applicable"))) |>
#   arrange(AgeGroup, YearOfLastDose) |>
#   mutate(SubmissionDate = submissiondate, .before = Sex) |>
#   mutate(ReportDate = reportdate) |>
#   mutate(Jurisdiction = "NT",
#          VaccineProductDose_5 = "Not Applicable") |>
#   select(SubmissionDate,
#          ReportDate,
#          Jurisdiction,
#          Sex, AgeGroup,
#          VaccinationStatus,
#          MonthOfLastDose,
#          YearOfLastDose,
#          VaccineProductDose_1,
#          VaccineProductDose_2,
#          VaccineProductDose_3,
```

```
#         VaccineProductDose_4,
#         VaccineProductDose_5,
#         Count) |>
#   distinct()
```

Appendix 6: Code in R (Ali Qadri)

```
#Installing and Loading Packages
install.packages("tidyverse")
library(tidyverse)
install.packages("gt")
library(gt)
install.packages("gtsummary")
library(gtsummary)

#Setting EpisodeDate as a Date Column
episode_tbl_all <- mutate(episode_tbl_subset, EpisodeDate=as.Date(EpisodeDate, format =
"%Y-%m-%d"))

#Removing OOT cases
episode_tbl_IT <- filter(episode_tbl_all, residency == 1 & region != "Oot")
episode_tbl_OOT <- filter(episode_tbl_all, residency == 0)

#Merging vaccine data set
#newvac <- left_join(episode_tbl_IT, vac_tbl_subset, by = join_by(EpisodeID == EpisodeID))
newvac <- merge(x = episode_tbl_IT, y = vac_tbl_subset, all = TRUE)
newvac_IT <- filter(newvac, residency == 1 & region != "Oot")
newvac_IT <- newvac_IT %>% mutate(VacStat=if_else(EpisodeDate > ImmunizationDate + 14,
1, 0))
newvac_IT <- newvac_IT %>%
  group_by(EpisodeID) %>%
  mutate(lastvac = if_else(row_number() == n(), 1L ,0))
vacfin <- filter(newvac_IT, lastvac == 1)
vacfin <- vacfin %>% select(EpisodeDate, broad_eth, sex, health_authority, region, Series,
age_group, wave, hosp_admission, ICU_admission, deceased)
#vacfin %>% tbl_summary(by = broad_eth) %>% add_p()


unvacc <- filter(newvac, is.na(Series))
#unvacc %>% tbl_summary()
#unvacc %>% tbl_summary(by = broad_eth) %>% add_p()

unvacc_22 <- filter(unvacc, EpisodeDate <= as.Date('2022-03-31'))
unvacc_22 <- unvacc_22 %>% select(broad_eth, sex, health_authority, region, age_group,
wave)
#unvacc_22 %>% tbl_summary(by = broad_eth) %>% add_p()

unvacc_23 <- filter(unvacc, EpisodeDate > as.Date('2022-03-31'))
```

```
unvacc_23 <- unvacc_23 %>% select(broad_eth, sex, health_authority, region, age_group,
wave)
#unvacc_23 %>% tbl_summary(by = broad_eth) %>% add_p()

#Demographic Characteristics for all COVID-19 Cases
episode_tbl_cases <- episode_tbl_IT %>% select(broad_eth, sex, health_authority, region,
age_group, residency, wave, Series)
episode_tbl_cases %>% tbl_summary()
episode_tbl_cases %>% tbl_summary(by = broad_eth) %>% add_p()

#Demographic Characteristics for COVID-19 Cases until March 31, 2022 inclusive
episode_tbl_interim <- filter(vacfin, EpisodeDate <= as.Date('2022-03-31'))
episode_tbl_cases_22 <- episode_tbl_interim %>% select(broad_eth, sex, health_authority,
region, age_group, wave, Series)
episode_tbl_cases_22 %>% tbl_summary()
episode_tbl_cases_22 %>% tbl_summary(by = broad_eth, missing_text = "(Missing)") %>%
add_p() %>%  add_overall()

#Demographic Characteristics for COVID-19 Cases after March 31, 2022 inclusive
episode_tbl_interim_b <- filter(vacfin, EpisodeDate > as.Date('2022-03-31'))
episode_tbl_cases_23 <- episode_tbl_interim_b %>% select(broad_eth, sex, health_authority,
region, age_group, wave, Series)
episode_tbl_cases_23 %>% tbl_summary()
episode_tbl_cases_23 %>% tbl_summary(by = broad_eth, missing_text = "(Missing)") %>%
add_p() %>%  add_overall()

#COVID-19 Cumulative Case Counts by Month until March 31, 2022 inclusive
#episode_tbl_interim[, .N, by=year(EpisodeDate)]
#episode_tbl_interim[, .N, by=.(year(EpisodeDate), month(EpisodeDate))]

#Demographic Characteristics for Severe Outcome Episodes
episode_tbl_sev <- filter(vacfin, hosp_admission + ICU_admission + deceased != 0)
episode_tbl_sev <- episode_tbl_sev %>% select(broad_eth, sex, health_authority, region,
age_group, wave, Series)
episode_tbl_sev %>% tbl_summary(by = broad_eth)
episode_tbl_sev %>% tbl_summary(by = broad_eth) %>% add_p()

#Demographic Characteristics for Mortality
episode_tbl_mort <- filter(vacfin, deceased != 0)
episode_tbl_mort <- episode_tbl_mort %>% select(broad_eth, sex, health_authority, region,
age_group, wave, Series)
episode_tbl_mort %>% tbl_summary(by = broad_eth)
episode_tbl_mort %>% tbl_summary(by = broad_eth) %>% add_p()
```

```
#Demographic Characteristics for Hospital Admissions
episode_tbl_hosp <- filter(vacfin, hosp_admission != 0)
episode_tbl_hosp <- episode_tbl_hosp %>% select(broad_eth, sex, health_authority, region,
age_group, wave, Series)
episode_tbl_hosp %>% tbl_summary(by = broad_eth)
episode_tbl_hosp %>% tbl_summary(by = broad_eth) %>% add_p()

#Demographic Characteristics for ICU Admissions
episode_tbl_icu <- filter(vacfin, ICU_admission != 0)
episode_tbl_icu <- episode_tbl_icu %>% select(broad_eth, sex, health_authority, region,
age_group, wave, Series)
episode_tbl_icu %>% tbl_summary(by=broad_eth)
episode_tbl_icu %>% tbl_summary(by = broad_eth) %>% add_p()

#Vaccine Eras
episode_tbl_era1 <- filter(vacfin, EpisodeDate <= as.Date('2021-03-31'))
episode_tbl_sev1 <- filter(episode_tbl_era1, hosp_admission + ICU_admission + deceased !=
0)
episode_tbl_mort1 <- filter(episode_tbl_era1, deceased != 0)
episode_tbl_era2 <- vacfin %>% filter(between(EpisodeDate, as.Date('2021-04-01'),
as.Date('2021-07-31')))
episode_tbl_sev2 <- filter(episode_tbl_era2, hosp_admission + ICU_admission + deceased !=
0)
episode_tbl_mort2 <- filter(episode_tbl_era2, deceased != 0)
episode_tbl_era3 <- vacfin %>% filter(between(EpisodeDate, as.Date('2021-08-01'),
as.Date('2021-12-31')))
episode_tbl_sev3 <- filter(episode_tbl_era3, hosp_admission + ICU_admission + deceased !=
0)
episode_tbl_mort3 <- filter(episode_tbl_era3, deceased != 0)
episode_tbl_era4 <- vacfin %>% filter(between(EpisodeDate, as.Date('2022-01-01'),
as.Date('2022-03-31')))
episode_tbl_sev4 <- filter(episode_tbl_era4, hosp_admission + ICU_admission + deceased !=
0)
episode_tbl_mort4 <- filter(episode_tbl_era4, deceased != 0)
episode_tbl_era5 <- filter(vacfin, EpisodeDate > as.Date('2022-03-31'))
episode_tbl_sev5 <- filter(episode_tbl_era5, hosp_admission + ICU_admission + deceased !=
0)
episode_tbl_mort5 <- filter(episode_tbl_era5, deceased != 0)

episode_tbl_era1s <- episode_tbl_era1 %>% select(broad_eth, sex, health_authority, region,
age_group, Series)
episode_tbl_era2s <- episode_tbl_era2 %>% select(broad_eth, sex, health_authority, region,
age_group, Series)
```

```
episode_tbl_era3s <- episode_tbl_era3 %>% select(broad_eth, sex, health_authority, region,
age_group, Series)
episode_tbl_era4s <- episode_tbl_era4 %>% select(broad_eth, sex, health_authority, region,
age_group, Series)
episode_tbl_era5s <- episode_tbl_era5 %>% select(broad_eth, sex, health_authority, region,
age_group, Series)

episode_tbl_era1s %>% tbl_summary(by = broad_eth)
episode_tbl_era2s %>% tbl_summary(by = broad_eth)
episode_tbl_era3s %>% tbl_summary(by = broad_eth)
episode_tbl_era4s %>% tbl_summary(by = broad_eth)
episode_tbl_era5s %>% tbl_summary(by = broad_eth)

episode_tbl_sev1s <- episode_tbl_sev1 %>% select(broad_eth, sex, health_authority, region,
age_group, Series)
episode_tbl_sev2s <- episode_tbl_sev2 %>% select(broad_eth, sex, health_authority, region,
age_group, Series)
episode_tbl_sev3s <- episode_tbl_sev3 %>% select(broad_eth, sex, health_authority, region,
age_group, Series)
episode_tbl_sev4s <- episode_tbl_sev4 %>% select(broad_eth, sex, health_authority, region,
age_group, Series)
episode_tbl_sev5s <- episode_tbl_sev5 %>% select(broad_eth, sex, health_authority, region,
age_group, Series)

episode_tbl_sev1s %>% tbl_summary(by = broad_eth)
episode_tbl_sev2s %>% tbl_summary(by = broad_eth)
episode_tbl_sev3s %>% tbl_summary(by = broad_eth)
episode_tbl_sev4s %>% tbl_summary(by = broad_eth)
episode_tbl_sev5s %>% tbl_summary(by = broad_eth)

episode_tbl_mort1s <- episode_tbl_mort1 %>% select(broad_eth, sex, health_authority, region,
age_group, Series)
episode_tbl_mort2s <- episode_tbl_mort2 %>% select(broad_eth, sex, health_authority, region,
age_group, Series)
episode_tbl_mort3s <- episode_tbl_mort3 %>% select(broad_eth, sex, health_authority, region,
age_group, Series)
episode_tbl_mort4s <- episode_tbl_mort4 %>% select(broad_eth, sex, health_authority, region,
age_group, Series)
episode_tbl_mort5s <- episode_tbl_mort5 %>% select(broad_eth, sex, health_authority, region,
age_group, Series)

episode_tbl_mort1s %>% tbl_summary(by = broad_eth)
episode_tbl_mort2s %>% tbl_summary(by = broad_eth)
episode_tbl_mort3s %>% tbl_summary(by = broad_eth)
```

```
episode_tbl_mort4s %>% tbl_summary(by = broad_eth)
episode_tbl_mort5s %>% tbl_summary(by = broad_eth)
```

Appendix 7: Interview Question Guide

Theme: Resilience and Community

1. What has made you feel proud about your community's response to COVID-19?
2. What has kept your community strong when responding to COVID-19?

Theme: Communication

1. Where did you get your information for COVID-19 updates (e.g., Facebook, Instagram, Snapchat, websites, local newsletters)?
2. What do people in your community think about COVID-19 vaccinations?
3. Was there enough information about vaccinations available?
4. Were COVID-19 policies from the federal or territorial government difficult to follow?

Theme: Healthcare

1. Some doctor appointments were changed to virtual appointments (e.g., phone appointments). What did you think of this?
2. Travel restrictions made it more challenging to travel to Yellowknife or Edmonton for care. How was this experience for you or your community?
3. Has the pandemic changed your access to care for other health issues for yourself or your community?

Theme: Areas of Change

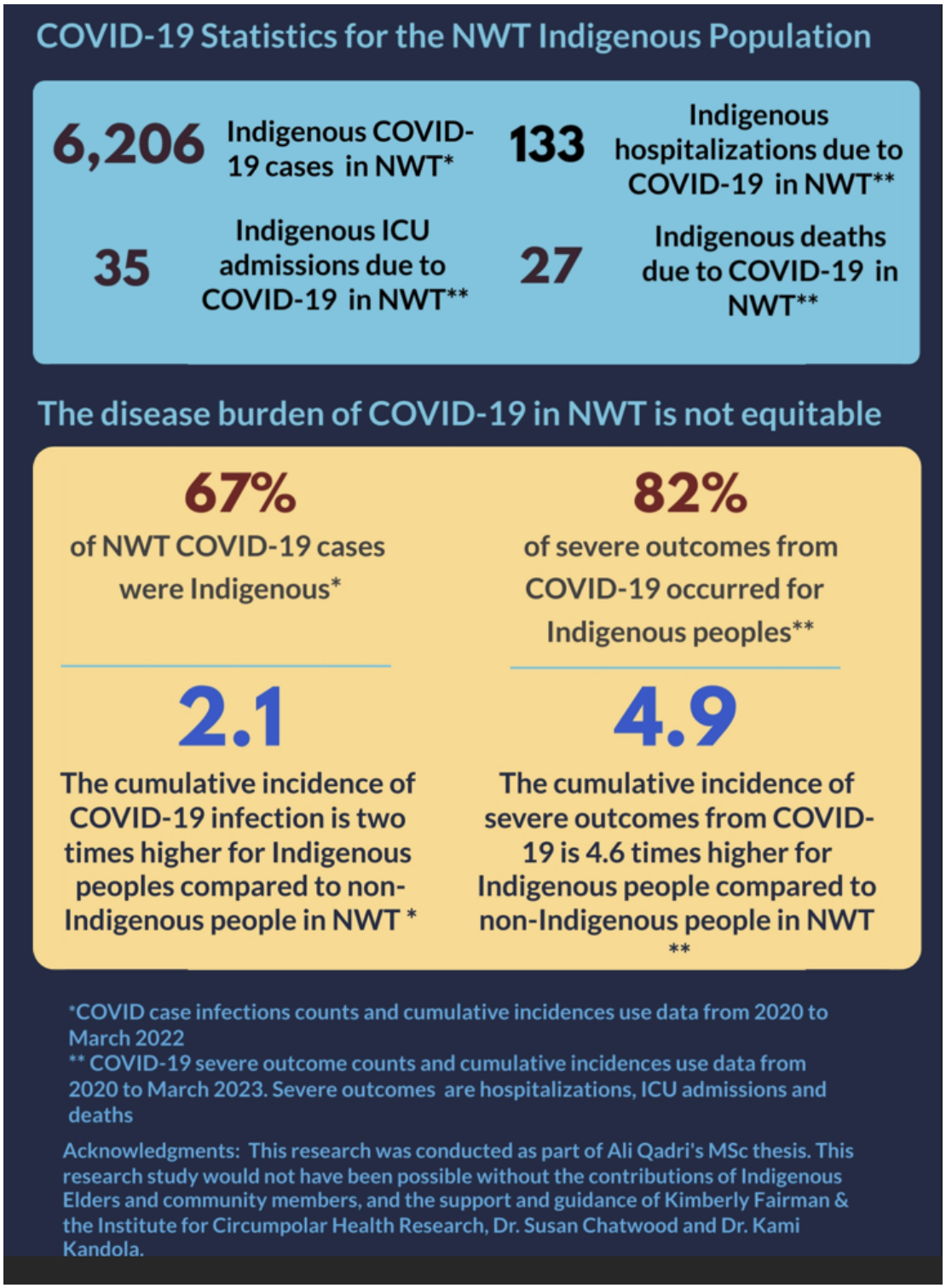
1. Is there anything you think the government (federal or territorial) could have done differently in responding to COVID-19?
2. Is there anything you think your community could have done differently in responding to COVID-19?

Theme: Youth

1. How has COVID-19 impacted youth in your community?

Some questions adapted from:
https://www.canada.ca/en/public-health/corporate/publications/chief-public-health-officer-reports-state-public-health-canada/from-risk-resilience-equity-approach-covid-19/indigenous-peoples-covid-19-report.html

Appendix 8: Infographic of project results to be shared with project partners and Elders


COVID-19 Statistics for the NWT Indigenous Population
6,206
Indigenous COVID-19 cases in NWT*
133
Indigenous hospitalizations due to COVID-19 in NWT**
35
Indigenous ICU admissions due to COVID-19 in NWT**
27
Indigenous deaths due to COVID-19 in NWT**
The disease burden of COVID-19 in NWT is not equitable
67%
of NWT COVID-19 cases were Indigenous*
82%
of severe outcomes from COVID-19 occurred for Indigenous peoples**
2.1
The cumulative incidence of COVID-19 infection is two times higher for Indigenous peoples compared to non-Indigenous people in NWT *
4.9
The cumulative incidence of severe outcomes from COVID-19 is 4.6 times higher for Indigenous people compared to non-Indigenous people in NWT **
*COVID case infections counts and cumulative incidences use data from 2020 to March 2022
** COVID-19 severe outcome counts and cumulative incidences use data from 2020 to March 2023. Severe outcomes are hospitalizations, ICU admissions and deaths
Acknowledgments: This research was conducted as part of Ali Qadri's MSc thesis. This research study would not have been possible without the contributions of Indigenous Elders and community members, and the support and guidance of Kimberly Fairman & the Institute for Circumpolar Health Research, Dr. Susan Chatwood and Dr. Kami Kandola.