# Wholistic analysis of data from *Qanuilirpitaa?*, the 2017 Nunavik Health Survey using culturally grounded concepts

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# Abstract

*Context:* Inuit experience health through language and culture. Being healthy and well requires a balance between Ilusirsusiarniq ('bodily health'), Qanuinngisiarniq ('well-being'), and Inuuqatigiitsianiq ('quality of social relationships') (IQI). Together, these interconnected concepts represent the foundation of health, as described in the IQI model of health and well-being developed in Nunavik. Previous quantitative studies focusing on health and the social determinants of health (SDoH) of Inuit most often measured health using single outcome indicators available through survey data. To study health wholistically, two research questions guided the present thesis: How can a wholistic assessment of health based in Nunavimmiut knowledge be defined and developed? How does this assessment map onto individual characteristics and communitylevel social determinants of health (SDoH)? Specific objectives were to 1) Operationalize a wholistic assessment of health and well-being; 2) Validate the assessment with an available survey question on self-rated health; and 3) Explore the relationship between community-level SDoH and the wholistic assessment of health. Methods: Latent Class Analysis (LCA) was employed to operationalize the IQI model of health. Twenty-one indicators corresponding to the foundational concepts of health as defined in the IQI model were selected. Analyses were conducted on a sample of 1196 Nunavimmiut weighted to represent over 7000 Inuit aged 16 years and older. Data were from the Qanuilirpitaa? 2017 Nunavik Health Survey. Results: LCA revealed three health profiles labeled as 'excellent', 'good' and 'fair'. Nunavimmiut in the 'excellent' health profile (41%) responded very positively to most indicators included in the LCA, while those in the 'good' health profile (37%) responded positively to the indicators. On the other hand, Nunavimmiut in the 'fair' health profile (22%) reported lower levels of community cohesion, family relationships, and emotional support. Nunavimmiut in the 'excellent' and 'good' health profiles were more likely to rate their health as *excellent/very good/good*; to be over 30 years old; to be in a relationship; and to have participated or volunteered in community events. Conclusion: This study grounded quantitative analyses in a locally developed model of health to understand health wholistically among Nunavimmiut. Understanding how wholistic health relates to individual and communitylevel SDoH can inform frameworks for promoting and supporting regional and local public health interventions, services, and programs.

## Résumé

Contexte : Les Inuit vivent la santé à travers la langue et la culture. Être en bonne santé nécessite un équilibre entre *Ilusirsusiarniq* («santé physique»), *Qanuinngisiarniq* («bien-être») et Inuuqatigiitsianiq («qualité des relations sociales») (IQI). Ensemble, ces concepts interconnectés représentent le fondement de la santé, tel que décrit dans le modèle IQI de santé et de bien-être développé au Nunavik. Cependant, les études quantitatives axées sur la santé et les déterminants sociaux de la santé (DSS) des Inuit définissent rarement la santé de manière holistique. Plus souvent qu'autrement, la santé est mesurée à l'aide d'indicateurs unidimensionnels tirés de données d'enquête. Par conséquent, deux questions de recherche ont guidé cette thèse: Comment peut-on définir et développer un indicateur de santé holistique basé sur une vision de la santé des Nunavimmiut? Comment cet indicateur est-il relié aux déterminants sociaux de la santé (DSS)? Les objectifs spécifiques étaient les suivants: 1) rendre opérationnel un indicateur holistique de la santé et du bien-être; 2) valider l'indicateur à l'aide d'une question d'enquête existante d'autoévaluation de la santé; et 3) explorer la relation entre la santé holistique les DSS au niveau communautaire. Méthodes: L'analyse des classes latentes (ACL) a été employée pour opérationnaliser le modèle de santé IQI. Vingt et un indicateurs correspondant aux concepts fondamentaux de la santé tels que définis dans le modèle IQI ont été sélectionnés. Les analyses ont été réalisées sur un échantillon de 1196 Nunavimmiut pondéré, représentant une population de plus de 7000 Inuit âgés de 16 ans et plus. Les données proviennent de l'enquête régionale de santé au Nunavik, Qanuilirpitaa? 2017. Résultats: L'ACL a révélé 3 profils de santé étiquetés «excellente», «bonne» et «moyenne». Les Nunavimmiut en «excellente» santé (41%) ont répondu très positivement aux indicateurs inclus dans l'ACL, tant dis que ceux en «bonne» santé (37%) ont répondu positivement à la majorité des indicateurs. Quant à eux, les Nunavimmiut en santé «moyenne» (22%) ont rapporté des niveaux moindres de cohésion communautaire, de relations familiales, et de support émotionnel. Les participants des profils de santé «excellente» et «bonne» étaient plus susceptibles de qualifier leur santé d'excellente/très bonne/bonne, , d'avoir plus de 30 ans, d'être en couple, et d'avoir participé ou fait du bénévolat lors d'événements communautaires. Conclusion : Cette étude a fondé des analyses quantitatives sur un modèle de santé développé localement, afin de comprendre la santé de manière holistique chez les Nunavimmiut. Comprendre le lien entre la santé holistique et les DSS peut éclairer les cadres de promotion et de soutien d'interventions, de services et de programmes de santé publique locaux et régionaux.

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# **Contribution of authors**

The research question and objectives of this thesis were formulated by myself, Morgen Bertheussen, and by Prof. Mylène Riva. I conducted the literature review, data analysis, writing and editing of the thesis. Prof. Riva and Prof. Brittany Wenniserí:iostha Jock provided guidance on the research methods and data analyses, offered feedback and advice on the chapters, and assisted with editing.

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#### **List of Acronyms**

- AIC : Akaike Information Criterion
- APS : Aboriginal Peoples Survey
- BFRS : Brief Family Relationship Scale
- **BIC : Bayesian Information Criterion**
- BLRT : Bootstrap Likelihood Ratio Test
- CFA : Confirmatory Factor Analysis
- DMC : Data Management Committee
- EFA : Exploratory Factor Analysis
- FIML : Full Information Maximum Ratio
- JBNQA : James Bay and Northern Québec Agreement
- IC : Information Criteria
- INSPQ : Institut national de santé publique du Québec
- IK : Indigenous Knowledge
- LCA : Latent Class Analysis
- LMR: Lo-Mendel-Rubin (test)
- NRBHSS : Nunavik Regional Board of Health and Social Services
- PCA : Principal Component Analysis
- SDoH : Social determinants of health
- SRH: Self-Rated Health
- SABIC : Sample Size Adjusted Bayesian Information Criteria
- VLMR : Vuo-Long-Mendel-Rubin (test)

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# 1. INTRODUCTION

Indigenous Peoples in Canada (First Nations, Inuit, and Métis) conceptualize health wholistically<sup>1</sup>; physical, mental, emotional, spiritual, and relational well-being are not viewed as separate dimensions of health, but rather as interrelated elements that, when in balance, represent being healthy and well (Beaulieu, 2011; Dyck, 2009; First Nations Health Authority, 2021; Greenwood et al., 2018; Inuit Tapiriit Kanatami, 2014). In addition to finding balance between these elements, Indigenous definitions of health encompass the collective dimensions of livelihoods, connectivity with the land and food, as well as community-oriented healing processes (King et al., 2009; Reading & Wien, 2009). Though Indigenous Peoples share wholistic and community-centered conceptualizations of health, there are differences in how health is defined across First Nations, Inuit and Métis groups in Canada, as well as distinct experiences with the social determinants of health (SDoH) (Dyck, 2009; First Nations Health Authority, 2021; Inuit Tapiriit Kanatami, 2014; Reading & Wien, 2009). The SDoH represent factors that go beyond individual-level risk factors in shaping population health outcomes. Addressing these factors contributes to the decrease of health inequalities in the population (Braveman & Gottlieb, 2014; Link & Phelan, 1995).

It is imperative for health research to approach health wholistically, as this impacts the effectiveness of health promotion programs across different cultural settings (Durie, 2004). Understanding ethnomedical models of health and well-being is important because they can identify opportunities for policies and tools aiming to address and promote community health and well-being (McNally & Martin, 2017; Public Health Agency of Canada, 2020). In addition, attention to culture in the provision of health services can further improve access, utilization and health outcomes of individuals and communities (Fletcher, 2015; Fletcher & Riva, 2016; Fraser et al., 2019; Kirmayer & Jarvis, 2019). However, health programming is often designed and imposed by the dominant culture, thus impacting the appropriateness, acceptance and use of

<sup>&</sup>lt;sup>1</sup> The words wholistic and holistic are often used interchangeably. However, the decision to describe health as *wholistic* was made based on the slight differences in the definition of these two terms: "in some academic fields (sociology, psychology, education), wholistic is used to refer to the idea of addressing all the parts of something simultaneously as in "the whole thing." Holistic (or holism) refers to the idea that the whole is more than just the sum of the parts" (Schoonover-Shoffner, 2013, p. 133). Therefore, because all dimensions of health are considered simultaneously in this thesis, expressing health as *wholistic* rather than as *holistic* is preferred.

services and resources by marginalized groups (Fraser et al., 2019).

In Canada, the dominant western conceptualization of health and provision services is characterized by a biomedical and individualist focus, which emphasizes disease prevention and treatment of health issues in 'silos' (Chandler, 2011; McNally & Martin, 2017; Reading & Wien, 2009a; Thiessen et al., 2020). Simply put, mental health is viewed as separate from other dimensions of health, and importance is placed on the individual, not how individuals relate to their broader social units (families, communities, nations). In addition, by focusing on pathology, the biomedical model emphasizes what makes people weak, rather than what makes them strong (Van Uchelen et al., 1997). Other critiques of the biomedical model include its bureaucratizing and generalizing practices. Indeed, healthcare bureaucracy depends on the identification of pathology and labelling disease for patients to receive treatment. When physical (or somatic) symptoms - which are strongly influenced by psychological and social factors - are not recognized by health care professionals, this creates an important barrier to receiving appropriate care (Wade & Halligan, 2004). The individualist, diseased-based, bureaucratic and generalizing approach of the biomedical model of health diminishes the importance of self-determined Indigenous perspectives of wellness that are rather strength-based and community-centered (Auger et al., 2016; Chandler, 2011; McNally & Martin, 2017). Not only does using a deficitbased lens in isolation fail to reflect the strength-based perspectives of Indigenous Peoples' health and well-being, but it is also problematic in that findings can perpetuate the marginalization, negative stereotypes, internalized negativity and racism encountered by Indigenous groups (Smylie & Firestone, 2015; Thiessen et al., 2020). Therefore, addressing health and well-being across different cultural and geographic settings requires the adaptation of models of health that encompass locally defined conceptualizations of health and of its determinants (Richmond et al., 2013).

My master's thesis is integrated within the scientific activities of the Community Component of *Qanuilirpitaa?*, the 2017 Nunavik Health Survey (hereafter Q2017). I ask the following questions: **How can a wholistic assessment of health based in Nunavimmiut knowledge be defined and developed? How does this assessment map onto individual and community-level social determinants of health (SDoH)?** Specific research objectives are to: 1) Operationalize a wholistic assessment of health and well-being, 2) Assess the construct validity of the wholistic assessment with an available survey question on self-rated health (SRH), and 3) Explore the relationship between community-levels SDoH and wholistic health. While objective 1 is exploratory, and therefore does not have specific hypotheses, the underlying hypothesis of objective 2 is that individuals who are assessed wholistically to be in better health, will have better SRH. Self-rated health is a proxy for clinical health status, or a measure of quality of life that is frequently used in population surveys. The widespread use of this measure is founded on its ability to predict mortality (Bombak & Bruce, 2012). While there are varying interpretations of SRH within and across different cultural settings, this measure has been demonstrated to be an effective predictor of health in different ethnic groups (Bombak & Bruce, 2012; Chandola & Jenkinson, 2000). Similarly, the underlying hypothesis of objective 3 is that individuals who are assessed wholistically to be in better health, will have greater levels of community involvement, either through participation in events, board/committee meetings, or volunteering.

This thesis employs Inuit-specific health frameworks and a strength-based approach, in that it aims to hone in on the SDoH at the individual and community level that contribute to positive health, rather than focusing on risk factors and their association with ill-health (Auger, 2016; Auger et al., 2016; Fletcher, 2015; Rowhani & Hatala, 2017; Smylie & Firestone, 2015). The main contribution from this master's thesis will be the creation of a wholistic assessment instrument of health and well-being that espouse Nunavimmiut's conceptualization of health. Understanding how community levels SDoH are related to the principle of wholistic health has the potential to inform frameworks for promoting and supporting regional and community-based public health interventions, services, and programming.

This manuscript is organized as follows: Chapter 2 provides a literature review of the important themes, starting with an overview of definitions of health, as they evolved over time and across different cultural settings. The social determinants of Indigenous Peoples' health are also discussed, finally narrowing the scope to previous quantitative, qualitative, and mixed method approaches employed to explore Inuit health and well-being. To contextualize the setting in which my thesis takes place, chapter 3 provides a brief geographical, demographic, and historical overview of Nunavik. Chapter 4 describes the conceptual framework of this thesis: the IQI model of health and well-being. Moving on, chapter 5 presents the methodological approaches employed to operationalize a wholistic assessment of health, i.e., latent class analysis (LCA). Before moving on to discussing the results, a personal statement is presented in chapter 6 to express my position as a researcher in this field, and my personal connection to this specific

research. Chapter 7 discusses the findings, and chapter 8 provides a broader discussion of the implications of these findings. Finally, chapter 9 provides a conclusion and summary of this master's' thesis.

# 2. LITTERATURE REVIEW

This chapter aims to report on the state of the literature revolving around the field of interest of this master's thesis, which seeks to assess Inuit health wholistically. For the purpose of this review, key terms were searched in Scopus and PubMed to identify literature pertaining to different conceptualizations of health held by Indigenous and non-Indigenous Peoples, as well as themes surrounding the SDoH influencing Inuit health and well-being. Additional papers were found through snowball sampling. This review is not meant to be exhaustive. Rather, its principal objectives are to examine conceptualizations of health, to gather the common methodological approaches used in Inuit health research, and to situate the present thesis project within the existing literature on Inuit health and well-being.

## 2.1. Definitions of health

In the constitution of the World Health Organization (WHO) in 1948, health was defined as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (World Health Organization, 1948). This definition of health provided a broader perspective to the prevailing biomedical model, by recognizing the importance of social well-being as an aspect of health. At this time, however, international public health was characterized by narrowed-focused, technologically-driven health campaigns targeting specific diseases such as malaria, smallpox, and tuberculosis (Irwin & Scali, 2007). These types of disease campaigns were advantageous in that they provided measurable targets (e.g., number of vaccines administered) and allowed for major advances in the field (e.g., the eradication of smallpox). Yet, by their structure, these campaigns still ignored the social context in which these diseases would proliferate in the first place (Irwin & Scali, 2007). While this definition of health provided a new paradigm to understand and address public health issues, models of health care rooted in biomedicine remained the norm in international public health.

Since the definition in the 1948 declaration of the WHO, the aspirational, binary, and absolutists terms of this definition of health have been critiqued (McCartney et al., 2019). Other definitions have since then been proposed, embracing the temporal, collective, and ecological dimensions of health, as well as the role of power and distribution of resources in influencing health (McCartney et al., 2019). For example, the 1999 *Declaration on the Health and Survival* 

*of Indigenous Peoples* offered a new definition of health, revising the links between culture, the environment, human rights, and health:

Indigenous Peoples' concept of health and survival is both a collective and an individual inter-generational continuum encompassing a wholistic perspective incorporating four distinct shared dimensions of life. These dimensions are the spiritual, the intellectual, physical, and emotional. Linking these four fundamental dimensions, health and survival manifests itself on multiple levels where the past, present, and future co-exist simultaneously. (Durie, 2004)

To further illustrate the expanding definitions of health, the 6<sup>th</sup> edition of the Oxford's dictionary of epidemiology published in 2016 provides an ecological definition of health, whereby health is perceived as interconnected with the surrounding environment, and defined as:

A state of equilibrium between humans and the physical, biological, and social environment compatible with full functional activity<sup>2</sup>. A sustainable state in which humans and other living creatures with which they interact can coexist indefinitely in equilibrium. Health is derived from the Old English hal, meaning whole, sound in wind and limb. (Porta, 2016)

Western understandings of health have evolved to recognize the importance of physical, psychological, social, and spiritual well-being. Considering these different facets of health is of fundamental importance for the development of appropriate health strategies and programs for Indigenous Peoples' health (United Nations Department of Economic and Social Affairs, 2016). Nevertheless, the dominant Western conceptualization of health and provision of services remains characterized by a biomedical and individualist focus (Chandler, 2011; Kolahdooz et al., 2015; McNally & Martin, 2017; Reading & Wien, 2009; Thiessen et al., 2020). The dualistic (physical vs. mental) and cartesian (self vs. society) perceptions of health are ill-suited to understand Indigenous Peoples' conceptions of health and well-being, as these distinctions are artificial and culturally constructed (Beaulieu, 2011; Overmars, 2019).

Approaching health as wholistic instead of isolating its different aspects is more suitable

<sup>&</sup>lt;sup>2</sup> From White, F., Stallones, L., & Last, J. M. (2013). Global public health: ecological foundations. Oxford University Press.

when working with Indigenous Peoples (Beaulieu, 2011). Indigenous Peoples' definitions of health encompass the collective dimensions of livelihoods (family, community and spirit worlds), the importance of balance (physical, emotional, psychological and spiritual), connectivity (with the land and food), as well as community-oriented healing processes (offerings, gatherings and shared preparing/undertaking) (Chandler, 2011; King et al., 2009; Reading & Wien, 2009). This interconnected view of the self, shared by many Indigenous cultures, strays away from the many dualisms that exist in western knowledge, and global definitions of health and wellness (Vicary & Bishop, 2005). For example, the interconnectedness of individuals with the environment, both social and natural, is not considered in global definitions of health (Castellano, 2006; Richmond & Ross, 2009). Therefore, while Western definitions of health have evolved to acknowledge the importance of socio-ecological conditions in shaping health outcomes, there remains an ontological disconnect between Western and Indigenous perspectives on health and well-being.

Adopting a SDoH framework acknowledges that there are factors beyond the individual that contribute to the development of health outcomes. To this end, the *socio-ecological* model (SEM) of health establishes that health outcomes are the result of ongoing political, economic, social and biophysical processes that concurrently occur at different scales (Ali, 2004). This model, developed by psychologist Urie Bronfenbrenner in the late 1970s, recognized the impact of social influences *nested* in environmental interactions on individuals' health (Kilanowski, 2017). With this model, the focus is on understanding the causal relationships between the social, political, and ecological processes that occur over space and time and observed population health outcomes. As depicted in Figure 1, the SEM emphasizes the different scales (or levels) of influence on the health of an individual who is *nested* in interpersonal, organizational, community, and public policy levels (Glanz & Bishop, 2010). This model is helpful in that it provides guidance towards understanding the different factors that influence health-related behaviors, and ultimately, health outcomes. In addition, the SEM proposes a lens to understand how behaviors may be positively modified through influencing individuals' surrounding environments (Glanz & Bishop, 2010).



**Figure 1. The Socio-ecological model of health** *Image credit from Lee et al., 2017* 

However, the *ecological* dimension of the socio-*ecological* model does not explicitly depict the role of the natural environment. For example, the interpersonal and community spheres refer to social networks and relationships, but not to the relationship between people and the land (Figure 1). Hence, this model remains anchored in Western perspectives, since it perceives natural and social causal factors as categorically distinct (Ali, 2004). Unlike this western dichotomy, Indigenous knowledge of the social and natural worlds are not separated, but rather intrinsically connected, whereby there exists a fundamental connection between a person and the environment (Kirmayer et al., 2011; Watts, 2013). This way of understanding the interconnectedness and interrelationship of a person to his/her surroundings is permitted through language, which shapes how different cultures understand and make sense of the world we live in:

The languages of Aboriginal peoples allow for the transcendence of boundaries. For example, the categorizing process in many Aboriginal languages does not make use of the dichotomies either/or, black/white, saint/sinner. There is no animate/inanimate dichotomy. Consequently, Aboriginal languages allow for talking to trees and rocks, an allowance not accorded in English. If everything is animate, then everything has spirit and knowledge. If everything has spirit and knowledge, then all are like me. If all are like me, then all are my relations (Little Bear, 2000, p. 78).

As further illustrated by the Anishinaabe creation story, Sky woman, who fell from the skies and landed on Turtle's back, formed the earth together with Turtle, "the land becoming an

extension of their bodies" (Watts, 2013, p. 21). Thus, as per Indigenous conceptualizations of the world, us humans are extensions of the land; our flesh literally made from the soil (Durie, 2004; Little Bear, 2000).

Representing Indigenous health and well-being as the result of categorically distinct social and environmental processes is therefore inappropriate. An *ecocentric* model of health (Kirmayer et al., 2009) has been presented to better reflect this connection between humans and the land. This way of understanding and representing health and well-being emphasizes the importance of people's relationships with others and with the land by bringing forward the interdependence and interconnectedness of the human and non-human agents, and the importance of understanding health wholistically (Durie, 2004). Indigenous Peoples' identities and many of their cultural practices are inseparable from the land, therefore making the connection to culture/place an essential determinant of health (Richmond & Ross, 2009). Moreover, physical geography (e.g., place, earth, land, space, ecology, territory, landscape, water, ice, soil, etc.) should not be encapsulated within the *social* realm, as the land has an agency of its own and is reflected in the knowledge, identity, language, culture, and spiritual values of all Indigenous Peoples (De Leeuw, 2018). In sum, acknowledging the relationship with the land as the foundation of health is imperative if research seeks to understand the causal relationships between the SDoH and health wholistically.

There exists no universal model of Indigenous health, as there are many different cultures and understandings of health across groups. There are differences in how health and well-being is conceptualized across First Nations, Inuit and Métis, since every group and community have distinct experiences with the intermediate and proximal determinants of health (Dyck, 2009; First Nations Health Authority, 2021; Inuit Tapiriit Kanatami, 2014; Reading & Wien, 2009). Therefore, addressing health and well-being across different cultural and geographic settings requires the adaptation of models of health that encompass locally defined conceptualizations of health and of its determinants (Richmond et al., 2013).

For many First Nations in Canada, the medicine wheel (Figure 2) represents a common understanding, highlighting the shared wholistic and balanced view of health (First Nations Health Authority, 2021). The four quadrants (yellow, red, black, and white) of the medicine wheel represent seven teachings: 1) the four directions: East, South, West, and North; 2) the four seasons: spring, summer, fall, and winter; 2) the four elements: fire, earth, water, and air; 4) plants:



Figure 2. Traditional Medicine Wheel Image credit from Beaulieu, 2018

tobacco, sage, sweetgrass, and cedar;5) heavenly bodies: the sun, earth, moon, and stars; as well of life: birth, adolescence, adulthood/parenthood, as 6) the four stages and Elders/grandparents/death. Animals (7) are also represented in each quadrant, although these might change by Nation. Common spirit animals that may be associated with the medicine wheel are the eagle, the buffalo, the wolf or coyote, and the bear (Beaulieu, 2018). The four quadrants also symbolize aspects of health: mental, emotional, physical, and spiritual. In its whole, the medicine wheel represents a culturally relevant framework to understand health from the perspective of First Nations in Canada.

In their 2014 report on the SDoH of Inuit, Inuit Tapiriit Kanatami (ITK), the national organization representing Inuit in Canada, emphasized the importance for research to take " a more wholistic outlook on the overall health status of Inuit", rather than solely focusing on comparing the negative health outcomes of Inuit – such as infant mortality or suicide – to those of the general Canadian population (Inuit Tapiriit Kanatami, 2014, p. 2). Therefore, this report advocates the need for a more holistic approach in understanding factors influencing health, as "the concept of health for Inuit embodies a holistic view between the mind, body, spirit and emotion" (Inuit Tapiriit Kanatami, 2014, p. 32). In sum, it is critical to explore how health and well-being are understood across different indigenous groups to better address the SDoH impacting Indigenous Peoples' health and well-being, and to provide culturally appropriate interventions (Elman et al., 2019; Kirmayer et al., 2009; McNally & Martin, 2017).

## 2.2. The social determinants of health of Indigenous Peoples

Because of cultural differences in how health is conceptualized, the considerations and prioritization of the factors deemed to influence health and well-being may also vary. The social determinants of health are the "conditions in which people are born, grow, live, work and age" (Commission on Social Determinants of Health, 2008). The SDoH represent factors that go beyond individual-level risk factors in shaping population health outcomes. By focusing on the SDoH as factors that contribute to health or inhibit it, policy and systems can be adjusted to increase access to opportunities and conditions that promote health and well-being (Braveman & Gottlieb, 2014).

#### 2.2.1. Proximal, intermediate, and distal determinants of health

Indigenous health and well-being can vary significantly depending on the extent to which protective factors are available at the individual, household and community-level (Anderson, 2015; Baron et al., 2019; Chandler & Lalonde, 1998; Fraser et al., 2018; Gray et al., 2016; Sheppard & Hetherington, 2012). In discussing the SDoH of Indigenous Peoples in Canada, both Reading and Wien (2009) and Greenwood and de Leew (2012) describe the importance of proximal, intermediate, and distal determinants of health in their influence on health outcomes and inequalities experienced by Indigenous Peoples across Canada. Proximal determinants of health refer to individuals' health behaviors, and their physical and social environment, such as housing, food, income and education (Reading & Wien, 2009). Intermediate determinants relate to community-level infrastructure, resources, systems, and capacities. These include, for example, the health care system, the education system, environmental stewardship, and cultural continuity. Distal determinants refer to the historical, political, social, and economic contexts. These can be understood as the fundamental causes of health: status, power, knowledge, colonialism, and race. Addressing these broader social factors contributes to decreasing the health inequalities present in the population (Braveman & Gottlieb, 2014; Link & Phelan, 1995).

At each of the proximal, intermediate, and distal levels, many factors have been identified to promote health and well-being. For example, accessing country food contributes to positive physical, mental, and social well-being, as it connects people with the land, to others, and to their culture (Fletcher et al., 2021; Rudolph & McLachlan, 2013). Moreover, fostering healthy

relationships with the land, community, family and with oneself further contributes to individual and community health and well-being (Hovey et al., 2014; Lines et al., 2019; Parlee et al., 2005). This relates to the importance of environmental/cultural connections, which are not only at the foundation of personhood and of health, but also represent a core determinant of First Nations, Métis and Inuit health, as the connection to the environment is vital to maintain culture and ways of life (Richmond & Ross, 2009; Watts, 2013).

Other protective factors of health and well-being include social connections, broadly defined as the network of relationships among people who share the same place (Levesque & Quesnel-Vallée, 2019). Through interaction and community participation, individuals can strengthen their social connections, which represents an important determinant of health. Social connections was demonstrated to be associated with higher subjective well-being and self-rated mental health among Indigenous Peoples in Australia and Canada (Biddle, 2012; Levesque & Quesnel-Vallée, 2019; Richmond et al., 2007).

Self-determination has also been identified as a crucial distal determinant of health, as it represents a way for communities to exercise their political power in terms of their decision-making abilities of how to control their lands, economies, education systems, and social and health services (Chandler & Lalonde, 1998; Reading & Wien, 2009). The creation of spaces facilitating intergenerational knowledge-sharing about traditional healing practices has been demonstrated to foster cultural continuity, identity, and self-determination (Auger, 2016).

Despite these different protective factors, structural and historical factors such as the detrimental impacts of colonialism on population health outcomes are at the source of health inequities experienced by Indigenous Peoples today. (Reading, 2018b; Richmond & Big-Canoe, 2018; Richmond & Ross, 2009). Colonial rule in the past 500 years has disempowered Indigenous Peoples as stewards of the lands, forced external political and economic dispossession, displaced and dislocated families and communities, created ideas of superiority based on race and skin color, and have led to the presence of low-level health and social services (Reading & Wien, 2009). Indigenous groups all across Canada have endured governmental policies explicitly aiming to suppress and eliminate culture, which has had – and is still having – tremendous impacts on their health and well-being (Fraser et al., 2018, 2019; Kirmayer & Jarvis, 2019; Rowhani & Hatala, 2017)

These distal - or structural - determinants of health can be further understood as what

Link and Phelan (1995) term as *fundamental causes of disease*. By their definition, a fundamental cause of disease is one that structures and determines the resources to which people have access, and which will continue to generate adverse health outcomes, even if policies addressing the mechanisms leading to these health outcomes are implemented (Link & Phelan, 1995). In other words, addressing the proximal or intermediate determinants of health without recognizing the fundamental cause of disease (in this case, representing the ongoing legacies of colonialism and discrimination on health outcomes, and access to culturally appropriate health care) will not contribute to decrease the disproportionate burden of disease experienced by Indigenous Peoples (Reading, 2018b, p. 201). Countering the negative health outcomes brought upon by the colonial agenda therefore requires the recognition and prioritization of principles of Indigenous self-determination.

In Canada, health interventions generally focus on the proximal determinants of health, without appropriately addressing or even acknowledging the fundamental cause of disease (Reading, 2018b). In fact, Reading argues that failing to consider these structural determinants of health actually perpetuates the systemic oppression brought upon by colonialism (Reading, 2018b) Therefore, in accepting the importance of SDoH, addressing the structural, distal, or fundamental factors influencing Indigenous Peoples' health and well-being is fundamental to the subsequent development of any health promotion or intervention strategy.

In Determinants of Indigenous Peoples' Health, Second Edition: Beyond the Social (2018), Greenwood, de Leeuw, & Lindsay ask: "How well are Indigenous ways of knowing being served when the unacceptable health disparities lived by Indigenous Peoples in Canada are principally conceptualized through a social determinant of health framework?" (Greenwood et al., 2018, p. xxvi). In other words, why are health inequities between Indigenous Peoples and their non-Indigenous counterparts persisting across time, even with the prioritization of a SDoH approach at the federal and provincial level? A simple answer to this question is that the use of Western institutional frameworks is not successful in addressing the ongoing health disparities experienced by Indigenous Peoples in Canada today, because these do not espouse their own understanding and definitions of health, as well as the factors influencing it (King et al., 2009). Moreover, these frameworks also fail to appropriately address how colonial structures in Canada have contribute – and continue to contribute – to the disproportionate burden of disease and illness experienced by Indigenous Peoples today (Inuit Tapiriit Kanatami, 2014; Reading, 2018b).

Therefore, the different experiences of Indigenous groups with regards to historical and contemporary factors are important to consider in the development of successful health promotion interventions (Bombay et al., 2014; Reading & Wien, 2009).

Across all Indigenous cultures, well-being has traditionally depended on Indigenous Knowledge (IK) systems, which "typically refers to the culturally and spiritually based ways Indigenous peoples relate both to their local ecosystems and to one another in the maintenance of health and well-being" (Richmond & Big-Canoe, 2018, p. 180). Thus, knowledge of the land is intrinsic to Indigenous Peoples' cultures, health, and well-being. Processes of environmental dispossession (i.e. the various processes leading to the reduction or elimination of Indigenous Peoples' access to their traditional lands, cultures and IK systems) have therefore had a tremendous impact on Indigenous Peoples health (Richmond & Ross, 2009). These processes can occur both directly and indirectly, through industrial activities (e.g., contamination of the land which disrupts livelihood subsistence activities), or through political decisions (e.g., the implementation of policies or regulations disconnecting Indigenous Peoples from the land) (Richmond & Big-Canoe, 2018).

Interviews conducted in a study by Richmond and Ross (2009) identified six SDoH among First Nations and Inuit groups that have been impacted by environmental dispossession: balance, life control, education, material resources, social resources, and environmental/cultural connections. Importantly, the sixth SDoH, *environmental/cultural connection* has not been identified by the Canadian government as a core SDoH, since western perspectives do not view the cultural and the natural world as two intrinsically linked factors (Richmond & Ross, 2009). While all Indigenous groups have a shared experience of colonialism and of environmental dispossession, the focus of the remaining section is shifted to describe the impacts of historical and contemporary colonial practices and environmental dispossession on Inuit health and wellbeing.

#### 2.2.2. Impact of Colonial legacies on Inuit health and well-being

In the 1950s, Inuit were forced to relocate, permanently settle, and to send their children to residential or day schools in order to receive governmental financial assistance. This financial aid was necessary for Inuit to access basic necessities such as food and medical supplies (Fraser et al., 2019). Sending children to schools required the young to travel large distances, thus separating them from their families and communities for several years at a time. In these unsanitary, underfunded and understaffed institutions, children were schooled in another language, exposed to punishment, disease, and verbal, physical, and sexual abuse (Hackett et al., 2016). The residential school system established by the federal government "systematically sought to disconnect Indigenous Peoples from their traditional lands, and the cultural, spiritual and economic roots it nurtured for health" (Richmond & Ross, 2009, p. 410). The residential school system remains a main cause of intergenerational trauma, loss of cultural identity, and decline of language among Inuit (Fraser et al., 2019; Inuit Tapiriit Kanatami, 2014; Reading & Wien, 2009a).

Similarly, certain conditions (such as tuberculosis) were only treated in southern facilities, therefore requiring the separation of families for patients to receive care. This led to families being separated, sometimes to never be reunited again. Until the mid-1980s, women in Nunavik were also systematically sent to southern hospitals to give birth (Van Wagner et al., 2007). Today, increased culturally safe local care is available, but the majority of health care provision in the North remains anchored in western biomedical methods that are provided by Qallunaat (non-Inuit) (Fraser et al., 2019). In Nunavik specifically, specialized health care is only available in the regional hospitals of Kuujjuaq or Puvirnituq, the two biggest communities, or in Montreal (Fraser et al., 2019).

The James Bay and Northern Quebec Agreement (JBNQA) also disconnected Inuit from their land. This 1975 convention led to the division of the land into different *sikkitaapiit* (small squares), of which Inuit solely owned the surface – and nothing below the ground. The government of Quebec made sure of this so that Inuit would not be the owners of any newfound mineral resources north of the 55<sup>th</sup> parallel (Nungak, 2017). The JBNQA contributed to the environmental dispossession of Inuit, as it refrained Inuit from practicing land-based activities and IK systems (Richmond & Big-Canoe, 2018; Richmond & Ross, 2009).

Across Inuit communities, the ongoing legacies of colonialism and discrimination are visible through their influence on the intermediate and proximal SDoH, as well as on health outcomes themselves (Inuit Tapiriit Kanatami, 2014; Reading & Wien, 2009). For example, the projected life expectancy for Inuit living in Canada is of 72.4 years, compared to 82.9 years for the non-Indigenous people in Canada. Rates of TB for Inuit living across Inuit Nunangat are of 181/100,000; the TB rate for non-Indigenous people in Canada is of 0.6/100,000. The rates of

suicide for Inuit living across Inuit Nunangat range from 5 to 25 times the suicide rates for Canada as a whole (Inuit Tapiriit Kanatami, 2018). Social and economic inequities continue to impact Inuit health and well-being to this day. Nonetheless, the ability to connect to the land, the ability to speak one's own language, and family connections represent sources of strength, which are important protective factors for health.

### 2.3. Health over illness

Fostering strength-based approaches, which focus on positive health and well-being, contributes to shifting the narrative away from an illness-based paradigm towards a healthpromoting and empowering discourse (Kalisch et al., 2017; Rowhani & Hatala, 2017). Indeed, straying away from the deficit-based indicators, and exploring culturally relevant health and wellbeing indicators "will be more likely to mirror the holistic understanding of health in many Indigenous cultures across the circumpolar area" (Cueva et al., 2021). This requires for Arctic scholars and policy makers to explore local narratives on health and well-being in the Arctic in order to better understand and support what makes communities in the Arctic thrive (Akearok et al., 2019). In sum, focusing on cultural understandings of health to explore how the SDoH contribute positive health and well-being can highlight and build upon the strengths that exist within and across communities, rather than focusing on factors contributing to adverse health and inequalities (Rowhani & Hatala, 2017).

The former National Aboriginal Health organization (NAHO), reported that "For Inuit, mental wellness refers to physical, emotional, mental and spiritual wellness, as well as strong cultural identity" (Inuit Tapiriit Kanatami, 2014, p. 34). Therefore, it is fundamental for Indigenous voices to be an integral aspect of both the appraisal and the development of culturally relevant tools in order to appropriately address Inuit perspectives of health and well-being(Auger, 2016; Smylie & Firestone, 2015). To do so, recognizing the importance of knowledge and the need to foster wholistic conceptualizations of health and well-being is essential (McNally & Martin, 2017). Ultimately, it important for community health interventions to be designed *with* different Indigenous community members, not just *for* them (Fraser et al., 2019; Rowhani & Hatala, 2017).

## 2.4. Measuring Inuit health and well-being

There is a large body of literature that explores the relationship between SDoH and health for Inuit using quantitative approaches. However, these studies seldom defined health and wellbeing wholistically; rather, health was measured using individual outcome variables available through survey data informed by biomedical models of health (Baron et al., 2021). Addressing this point, ITK state in their 2014 report on the SDoH of Inuit in Canada that "historically, programs and research on Inuit health have focused on narrow indicators of health status without investigating a wholistic view of social determinants of health as they relate to Inuit specifically" (Inuit Tapiriit Kanatami, 2014, p. 38). For example, quantitative studies looking at the associations between individual, household or community-level SDoH and mental health outcomes use variables such as SRH (Findlay et al., 2014; Hackett et al., 2016; Hajizadeh et al., 2018; Newell et al., 2020), mental wellness and/or distress (Anderson, 2015; Gray et al., 2016; Hackett et al., 2016), and suicidal ideation or attempts (Chachamovich et al., 2015; Hackett et al., 2016; Kirmayer et al., 2007). Other studies have focussed on documenting the relationship between the SDoH and physical health outcomes, such as the prevalence of cardiovascular disease (Young et al., 1993) and tuberculosis (Dehghani et al., 2018; Khan et al., 2016; Kilabuk et al., 2019). Hence, previous quantitative studies looking at the SDoH of mental and physical health for Inuit have largely used readily available outcome variables to measure health and well-being - and most often, ill-health. This fails to capture the wholistic perception and conceptualization of health and well-being of Indigenous Peoples, and further reinforces western principles that tend to separate physical and mental health when evaluating health outcomes (Chandler, 2011; McNally & Martin, 2017; Reading & Wien, 2009a; Thiessen et al., 2020).

Mixed methods research is defined by Johnson et. al (2007) as a type of research where elements of qualitative and quantitative research approaches are used together "for the purposes of breadth and depth of understanding and corroboration" (Johnson et al., 2007, p.123). Hence, in mixed methods research, different viewpoints, data collection and analyses may be combined and used together either convergently or sequentially to better answer a research question (Creswell & Clark, 2017).

Previous studies have used mixed methods in an Arctic Indigenous context. Cuerrier et. al (2015) explored Inuit traditional ecological knowledge in the context of climate change in Nunavik using an exploratory sequential mixed-methods design. An exploratory sequential design first aims to collect and analyse qualitative data, which is then used to inform the design of quantitative features (i.e. variables, instruments, activities, interventions) (Creswell & Clark, 2017). Therefore, in their study, the authors first conducted 46 semi-structed interviews with residents who spent a lot of time on the land as well as knowledge holders. The information was then analyzed and coded to reveal relevant themes for further analysis. Thirty (30) coded themes were then attributed numerical values and used in multivariate analyses (e.g., if a participant noticed an increase in precipitation, they were attributed a value of +1 for this specific code; if a decrease in precipitation was reported by another participant, they were attributed a value of -1; if no changes were perceived by a participant, a value of 0 was attributed). Once this was done, Principal Component Analysis (PCA), Chi-square analyses, and frequency of consensus analyses were performed to compare and contrast community patterns and determine important areas of consensus within and across communities. The authors concluded that using a mixed methods design "can provide important insights into translating traditional knowledge into quantitative evidence for environmental policy and decision-making" (Cuerrier et al., 2015, p. 379).

Among those using a mixed methods to understand Inuit health wholistically, Baron, Riva & Fletcher (2019) revealed that different SDoH were associated with different health profiles. These health profiles, classified by a multidimensional indicator of health previously developed by Baron et.al (2021), demonstrated that Inuit elders who had 'good health' profiles were more likely to report greater social connectedness (i.e., strong family ties and participation in land-based and social activities) than those with 'low health' profiles. Similarly, Inuit elder with 'intermediate health' profiles were more likely to have participated in land-based activities than those with 'low health' profiles (Baron et al., 2019). These findings highlight the differences in community-level SDoH contributing to positive health outcomes among Inuit elders. However, the wholistic assessment of health used in the aforementioned study was developed using data from the 2006 Aboriginal Peoples survey (APS), and was missing key variables that were identified, such as spirituality (Baron et al., 2021). To the best of my knowledge, no other studies have attempted to operationalize a multidimensional indicator of health using more recent and complete data. This type of study can be replicated in other settings to better understand how community-level conditions can foster positive health outcomes.

## 2.5. Conclusion to the literature review

In sum, this literature review highlighted the broad themes relevant to the cultural differences in the definition of health and the social determinants of health, the different methodological approaches used to study the association between SDoH and health and wellbeing, as well as the importance of centering Indigenous knowledge in health research and intervention. Because Indigenous Peoples' perception and experience of health is multidimensional, a wholistic conceptualization of health and well-being is required to better understand how the SDoH influence Inuit health and well-being, and to better adapt health-related policies and programs across Inuit Nunangat (Baron et al., 2019; Sheppard & Hetherington, 2012; Thiessen et al., 2020). In order to operationalize a wholistic assessment of health and well-being, and look at the associations between household and community-level SDoH and this assessment, a strength-based approach that is aligned with Indigenous knowledge is thus required (Auger, 2016; Auger et al., 2016; Fletcher, 2015; Rowhani & Hatala, 2017; Smylie & Firestone, 2015).

# 3. THE SETTING OF THE THESIS: NUNAVIK

This master's thesis uses data from the Qanuilirpitaa? 2017 Nunavik Regional health survey. Therefore, to better situate the setting of this thesis, this chapter provides an overview of the geographical, social, and historical background of Nunavik.

## 3.1. Geography of Nunavik

Inuit Nunangat, the homeland of Inuit in Canada, is comprised of four regions: Inuvialuit (Northwest Territories), the territory of Nunavut, Nunavik (Northern Quebec), and Nunatsiavut (Northern coastal Labrador) (Figure 3). Collectively, these regions encompass the area traditionally occupied by Inuit in Canada (Anderson, 2015). In 2016, more than 65,000 Inuit lived in Canada, with 73% living in one of the four regions of Inuit Nunangat (Inuit Tapiriit Kanatami, 2018).



**Figure 3. Inuit Nunangat (left) and communities in Nunavik, Quebec, Canada (right)** *Note. The size of the dot on the Nunavik map (right) is proportional to the size of the population in the community.* 

Nunavimmiut are the Inuit residing in the Arctic region known today as Nunavik, which is in the northern Quebec peninsula and extends over 560,000 square kilometers; it represents 60% of Quebec's landmass (NRBHSS, 2022). This region is bordered to the west by Hudson Bay,

to the north by Hudson Strait, and to the east by Ungava Bay and Labrador (Figure 3). Fifty-seven percent (57%) of Nunavik's population reside on the Hudson coast, while 43% reside on the Ungava coast.

The southern-most communities are located on the edge of the treeline, which has a distinctive flora relative to the northern communities. In fact, the plant composition of tundra is predominantly lichen. Regardless of the sparce plant life, a variety of flowers and berries can be harvested in the fall season (NRBHSS, 2022). The fauna is also rich in this arctic region: walruses, beluga whales, seals and fish are found in the waters surrounding Nunavik. These animals represent an important source of traditional foods, which are fundamental to Inuit cultures and economy (NRBHSS, 2022). Because of the high latitude, summers are short and mild (the average temperature is of 12 °C). Remarkably, the sun almost never sets during this period. On the other hand, winters are long, cold, and dry (the average temperature is of -24 °C) (NRBHSS, 2022).

The territory of Nunavik was established in 1975 within the JBNQA (Avataq Cultural Institute, n.d.). The 14 communities of Nunavik are solely accessible from the "South" by plane (Avataq Cultural Institute, 2012). While there are no roads connecting the communities together, snowmobiles and boats allow for nearby communities to maintain contact with each other year-round. All communities share a considerable degree of cultural and political history, albeit they are geographically distant.

## 3.2. A brief history

Inuit were traditionally nomadic people. Before the arrival of settlers and the imposition of colonial practices, Inuit lived with, and depended on, their immediate family and clan units for survival, travelling to their different camps and basing their livelihoods around hunting, finishing, harvesting and sewing (Fraser et al., 2019). Children would learn these skills by observing their parents, through storytelling, and by firsthand experience (Fraser et al., 2018). Even though they lived clustered and nomadic lifestyles as families and clans, Inuit would nonetheless come together and convene a few times every year during gatherings (Fraser et al., 2018).

At the beginning of the 1900s, certain Inuit families and clans began to engage in trading activities with newcomers, and consequentially settled camps near trading posts, religious missions, and whale hunting sites (Films Media Group, 1993). Entire families and clans were eradicated when smallpox and tuberculosis epidemics were introduced into camps by settlers.

(Fraser et al., 2019). In 1912, without the consent of Inuit, the jurisdiction over the territory of Nunavik was handed over to the province of Quebec by the Federal government (Nungak, 2017). However, the province refused to take financial responsibility for Inuit living in Nunavik until 1964.

The 1930s were marked by great scarcity and famine. The Hudson's Bay company, originally established in 1670 as a fur trading company, provided a welfare credit to Inuit living in Nunavik, and sent its invoice to the Quebec government. Quebec refused to pay, officially pleading to the Supreme Court of Canada in 1936 that Inuit were "Indians" and therefore, that they were "under federal responsibility" (Nungak, 2017, p. 104). Quebec won its case in 1939.

By the 1940s-1950s, the decrease in whale and fur trading left many Inuit in situations where they had to permanently relocate to villages to find employment opportunities, or to receive government financial assistance. The latter was only possible through the enrollment of their children in schools (Fraser et al., 2019).

Following Quebec's quiet revolution, a wave of nationalism generated a newfound interest in the North's potential for natural resource development. It was in 1964, during the Jean Lesage administration, that contact between Inuit and French Canadians began. That year, René Lévesque, natural resource minister, travelled for the first time to Fort Chimo (now Kuujjuaq) Nunavik to 'discover' the territory (Nungak, 2017).

In 1971, Quebec's Premier Robert Bourassa announced the James Bay hydro-electric development project, failing to even notify the Cree of James Bay of this immense development that would happen almost exclusively on their lands (Nungak, 2017). At that time, neither the Cree of James Bay nor the Inuit of Nunavik had political representation. It was shortly after the announcement of this project that the Indians of Quebec Association (IQA) emerged out of a need for representation. Shortly after, in 1972, the Northern Quebec Inuit Association (NQIA) was formed. Inuit "wanted Inuit interests to be defended by Inuit, from an angle and source of Inuit strengths" (Nungak, 2017, p. 48).

The James Bay and Northern Quebec Agreement (JBNQA) was signed in 1975 after two years of negotiations. This was the first ever land claim agreement to be signed by Inuit. Comparatively, the Inuvialuit final agreement in the western Arctic (1984) took 9 years of negotiations; the Nunavut land claim agreement (1993) took 17 years; and the Labrador Inuit land claims agreement (2005) took 27 years (Nungak, 2017). The agreement in principle of the JBNQA

proposed the following terms: 1) extinguishment of Aboriginal title to the lands in questions and surrender; 2) recognition of measured areas of land owned by Inuit; 3) creation of a regional municipality (and not a regional government). Inuit had to trade their lands, the very *essence* of their identity, to gain access to public services north of the 55<sup>th</sup> parallel. These services included a local and regional government, health and social services, education, administration of justice, police, environment and future development, and Inuit social and economic development (Nungak, 2017). The JBNQA broke many harmonious relationships among Inuit, who felt betrayed by the NQIA during the process of negotiations. A coalition of opposants to the JBNQA, named the *Inuuqatigiit Tunngavingat Nunamini* (ITN) was formed. Divisions among 'pro' and 'anti' agreements rapidly led to personal attacks and sometimes violent exchanges: "Harmony among families and friends was violated in ways that had never happened before among Inuit" (Nungak, 2017, pp. 86–87). Pursuant to the JBNQA, Makivik (Inuktitut for 'to rise up') was incorporated on June 28<sup>th</sup>, 1978 in order to administer the funds from this first ever comprehensive land claim for Inuit in Canada. (*Makivik Corporation*, n.d.). Since this day, Makivik Corporation has led the political and economic development of Nunavik.

One year after, the Kativik Regional Government (KRG) was created, with a mandate to deliver public services to Nunavimmiut. KRG is a non-ethnic public organization that has jurisdiction in areas such as municipal matters, transportation, the environment, policing, employment, labour training, income security, childcare services, renewable resources, land-use planning, civil security, and economic development (Kativik Regional Government, n.d.)

Since the JBNQA, there has been a move towards the reappropriation of health as conceptualized by Inuit. In 1995 the Nunavik Regional Board of Health and Social Services (NRBHSS) was created. The organization's principal mandates are to organize health and social service programs in the 14 communities of Nunavik, to evaluate the effectiveness of programs, and to ensure appropriate and quality services, adapted to users needs. The NRBHSS also oversees the efficient use of financial resources that are granted to the region of Nunavik. Over the years, the NRBHSS has mandated several health surveys to have more complete understandings of the health of Nunavimmiut. The first general health survey in Nunavik was administered in 1992, after the province's omission of Nunavik in its 1987 province-wide health survey. Following this, *Qanuippitaa*? 2004 (Q2004) was launched by the NRBHSS, with the objective to assess the health of Inuit in Nunavik (NRBHSS, 2004). In 2014, the NRBHSS

authorized a second edition to the Q2004 health survey: *Qanuilirpitaa*? 2017 (Q2017). For a second time, the INSPQ, Laval, McGill, and Trent Universities partnered to conduct this large-scale health survey: "The survey results shed light on the importance that Inuit place on traditional values, culture and environment while maintaining good health" (NRBHSS, n.d.).

The increasing involvement of Inuit-specific and Inuit-led efforts (i.e. the development and prioritization of culturally safe health care practices, educational programs, employment opportunities, development projects, and research initiatives) have all been identified as key actions supporting Inuit self-determination, ultimately contributing to uplifting their culture, language, economy, and health (Inuit Tapiriit Kanatami, 2014, p. 6).

## 3.3. Today: A demographic and health profile

Nunavik is home to 11,700 Inuit and *Qallunaat* (Inuktitut term for non-Inuit). Population sizes across the 14 fly-in communities range between 174 in Apaluk to just over 2100 individuals in Kuujjuaq (*Makivik Corporation*, n.d.). Ninety percent (90%) of Nunavik's population identify as Inuit (Statistics Canada, 2017). In 2016, the proportion of women was slightly less than the proportion of men (49.3% : 50.7%) (Statistics Canada, 2017)

The population structure of Nunavik is characterized by a large proportion of young people (Lévesque & Duhaime, 2019); one third of the population is under 15 years old, and almost half of the population (44%) is aged between 16 and 30 years old (Lévesque & Duhaime, 2019; Riva et al., 2020b). Conversely, individuals aged over 60 years old represent only 6% of this region's population (Lévesque & Duhaime, 2019). This distribution of the population is different from the broader province's population, which is characterized by a much older population, with individuals aged 60 years and representing over 25% of the population. As depicted in Figure 4, the age pyramid of Quebec (left) is shaped like a barrel, for the bulk of the population is found to be between the ages of 50 and 70. The age pyramid in Nunavik (left) resembles more an actual pyramid, with many more youths than older adults (Lévesque & Duhaime, 2019).





Image credit: adapted from Lévesque & Duhaime, 2019

The young population age structure of Nunavik may be explained by the high birth rates, high mortality rates and outmigration, including outmigration for health care. On average, Inuit women have 2.7 children (compared to 1.6 for non-Indigenous women in Canada); Life expectancy for Inuit living across Inuit Nunangat is of 72.4 years (compared to 82.9 years for all Canadians) (Inuit Tapiriit Kanatami, 2018). Out migration patterns, often motivated by better living conditions, have been observed across Arctic communities (Lévesque & Duhaime, 2019).

The population growth of Inuit across Canada between 2006 and 2016 was of 29%. Comparatively, the population growth of Canada's non-Indigenous population was of 11% during the same time period (Inuit Tapiriit Kanatami, 2018). Life expectancy has been increasing across Inuit Nunangat since the 1950s, from an average of 48 years to a current life expectancy of 72.4 years. Nonetheless, there remains an important gap compared to the life expectancy of non-Indigenous Canadians, which is of 82.9 years. (Inuit Tapiriit Kanatami, 2018; *Makivik Corporation*, n.d.). This 16-year difference is rooted in colonial structures, which are the cause of major social and economic inequities that had – and are still having today – major impacts on Inuit health and well-being.

Respiratory diseases explain 15% to 35% of the gap in life expectancy between Inuit and non-Indigenous Canadians (Peters, 2013). They represent the leading cause of hospitalization in Nunavik (Riva et al., 2020a). Additionally, alongside lung cancer, respiratory disease are among

the main causes of death in Nunavik, together with suicide, nonintentional injuries, and cardiovascular diseases (Robert et al., 2020).

Housing conditions are an important risk factor for respiratory disease, as overcrowded households increase the exposure to second-hand smoke and facilitate the transmission of respiratory bacteria (Robert et al., 2020). Results from the Q2017 health survey revealed that one third of Nunavimmiut lived in an overcrowded dwelling (i.e., a dwelling with more than 1 person per room). Additionally, 24% of Nunavimmiut reported living in dwellings needing major repairs and 52% in a dwelling not suitable in size. In comparison, only 6% of the broader Canadian population live in dwellings needing major repairs and 5% in overcrowded dwellings (Statistics Canada, 2017, Statistics Canada, 2017a).

Chronic respiratory symptoms can be prevented through traditional lifestyle. Indeed, practicing cultural activities such as going on the land and participating in harvesting/traditional activities are both protective against chronic respiratory symptoms (Robert et al., 2020). Moreover, 93% of Nunavimmiut agreed or strongly agreed that going on the land to practice activities such as hunting, fishing or berry picking were an important part of their life, while 89% were satisfied with their ability to do so (Muckle, et al., 2020). Having a strong connection to culture represents a protective factor of mental well-being and of is essential to cultural identity (Chandler & Lalonde, 1998; C. Richmond, 2009). According to the results of Q2017, 99% of Nunavimmiut reported being proud of their Inuk identity, and 90% reported being satisfied with their ability to communicate with others in Inuktitut (Muckle et al., 2020). These high percentages are important to highlight, as there needs to be more narrative on the factors that make individuals and communities healthy, rather than ill.

# 4. CONCEPTUAL FRAMEWORK: THE IQI MODEL

Within O2017's community component, an Inuitspecific model of health and well-being as developed through a collaboration between southern academic researchers and Nunavimmiut (Fletcher et al., 2021). The model was developed by means of two community workshops and in-depth interviews with 64 Nunavimmiut (Fletcher et al., 2021) from all 14 communities. With language and culture identified as the foundation of Inuit health, the model of health and well-being encompasses three key concepts: Ilusirsusiarniq, Qanuinngisiarniq, and Inuuqatigiitsianiq (Figure 5). Ilusirsusiarniq can be translated into "bodily health". This concept has both Figure 5. The IQI model of Inuit physical and spiritual dimensions. On one hand, it means



health and well-being (Fletcher et al., 2021)

being without disease or sickness, and being able to function properly. On the other hand, *Ilusirsusiarniq* implies the way the body takes its intended shape, such as acting and doing things as expected, and that the body is following a normal progression through growth and age. Qanuinngisiarniq is globally related to "well-being." This term further encompasses feelings of being unworried, without pain, comfortable, free of emotional distress, and happy. This second concept is related to peace of mind, calmness, fulfilment, and being able to move forward and carry on with ease. Last, Inuuqatigiitsianiq means having "quality interpersonal relations with people sharing the same place" (Fletcher et al., 2021, p.8). Good relationships with family members, friends, neighbors, and people in the community are essential to health and well-being. These three foundational concepts are grounded by culture and language, which shape identity. Culture encompasses the shared memory, values, and ways of living, thinking, and acting as a community. In such, the importance of *place* for health is fundamental, as community life is deeply rooted into culture and quality of relationships. Inuktitut allows Nunavimmiut to recognize their shared Inuit identity and to express feelings and the meaning of life. This model of health has been termed the 'IQI model' to reflect the three dimensions that are Ilusirsusiarniq, Qanuinngisiarniq, and Inuuqatigiitsianiq.
Eight SDoH were identified as important for Nunavimmiut's health: community, family, identity, food, land, knowledge, economy, and services. Together, these SDoH are nested within the broader IQI model and are essential to being healthy and well in Nunavik. The IQI model represents the conceptual framework that will guide my master's thesis. The concepts of *Ilusirsusiarniq*-bodily health, *Qanuinngisiarniq*-well-being, *Inuuqatigiitsianiq*-relational quality, and of culture and language as defined by Nunavimmiut's perspectives and lived experiences will guide the selection of variables from the Q2017 questionnaires to be included in the construction of the wholistic assessment of health.

# 5. METHODS

This chapter focuses on the methodological aspect of this master's thesis. This project employs data previously collected through *Qanuilirpitaa?*, the 2017 Nunavik Health Survey. The datasets used for analyses are described, followed by a statement regarding ethical implications of this project. Next, an overview of Latent Class Analysis, the method employed to operationalize the wholistic assessment of health, is presented. Variable selection, data set up and variable transformation are then explained, before moving on to the application of the LCA. Next, the methods for assessing the construct validity of the assessment are described. Finally, the assessment is used to explore the relationship between individual and community-level SDoH.

### 5.1. Description of dataset

To operationalize and characterize the wholistic assessment of health, and to explore the associations between individual, household and community-level variables, data from *Qanuilirpitaa*? the 2017 Nunavik Health Survey (Q2017), was analyzed. *Qanuilirpitaa*? means: Where are we now?/How are we now. Q2017 is a follow up to the *Qanuippitaa*? survey administered in Nunavik in 2004, and is the second large-scale health survey to take place in the region. Q2017 employed a participatory approach, and therefore relied on several partnerships with all the major Northern organisations as well as with southern institutions. Collaborations between the NRBHSS, Makivik corporation, Kativik Regional Government (KRG), Kativik Ilisarniliriniq (KI), Avataq Cultural Institute, Qarjuit Youth Council, Inuulitsivik Health Centre, Ungava Tulattavik Health Centre), the two health centres as well as representatives of the community mayors, the INSPQ, Université Laval, McGill University, and Trent University were established.

The aim of Q2017 was to update the knowledge of the health of Nunavimmiut by "collecting representative data for the purpose of monitoring various health indicators, social conditions, and environmental and community characteristics" (Hamel et al., 2020, p. 10). Data from Q2017 are the most up-to-date information available about the health and well-being of Nunavimmiut. The Q2017 survey comprised three components: the community component, the adult component, and the youth component.

To determine what themes and topics to be prioritized in the Q2017 health survey, extensive consultations with key informants from communities and organization took place in

Kuujjuaq on January 27 and 28, 2015. Working groups were created to guide the data collection, development, and process for the three components of Q2017 (Figure 6). In addition, further consultations held in 2015 and 2016 led to the selection of 26 themes to address the concerns raised during consultation periods.



Figure 6. Q2017 data collection

For each theme, questionnaires were developed by experienced researchers working in collaboration with Inuit co-leaders. Regular meetings were held by a scientific committee, comprised of researchers, the NRBHSS, Inuit co-leaders for each component (i.e., adult, youth, and community health) overseeing the entire process. In instances where needed expertise was missing, collaboration with other experts through ad hoc advisory committee was obtained.

Questionnaires were available in English, French, and Inuktitut. Quantitative data collection was conducted between August and October of 2017 in all 14 communities in Nunavik, onboard the research vessel Amundsen (Hamel et al., 2020). Laptops on board the ship allowed for English and French versions of the questionnaires to be administered through computer assisted interviews. For interviews conducted in Inuktitut, paper copies of the questionnaires were printed, and answers were transcribed in French or English on the laptop.

The youth and adult components documented the mental and physical health of Nunavimmiut aged 16 to 30 years, and 31 years and over, respectively. A total of 1,326

individuals aged 16 years and older and living in one of the 14 communities in Nunavik, participated in this quantitative phase (Hamel et al., 2020). Questionnaires were administered to gather information on a range of health outcomes and SDoH. In addition, clinical sessions allowed for the collection of anthropometric measurements (height, weight, waist circumference, BMI, and body composition), biological samples for laboratory analyses; and examinations of cardiovascular, oral and lung health (Hamel et al., 2020).

Q2017's sampling design employed a non-proportional stratified sampling method. The list of participants was obtained directly from the James Bay Northern Quebec Agreement (JBNQA) beneficiaries. Strata were formed according to sex, age group (16-19, 20-30, 31+), and home community, to ensure representativity of the size and composition of every community. From each stratum, individuals were selected using simple random sampling without replacement. For the group aged 31 years and older, the basic sample also included members of the 2004 survey who had previously agreed to be contacted for a follow-up (Hamel et al., 2020, p. 6).

The qualitative phase of Q2017, namely the Community Component, had as objective "to describe community conditions that are relevant to the health of Nunavimmiut from an Inuit perspective so that community-level strengths and challenges can be addressed effectively" (Hamel et al., 2020, p.16). As depicted in Figure 6 above, the qualitative and the quantitative data were collected simultaneously. The focus of the Community Component was to explore concepts of health and well-being grounded in Nunavimmiut world views and lived experiences. Data collection for the Community Component included workshops in two communities, 64 indepth interviews with Nunavimmiut from the 14 communities, and an inventory and characterization of 354 services and resources supporting health and well-being in the 14 communities (Hamel et al., 2020). Emerging from Q2017's community component was the IQI model of health (Fletcher et al., 2021). The IQI model guides the operationalization of the quantitative wholistic assessment of health.

## 5.2. Study Design

In 2018-2019, the Fulbright Arctic Initiative (FAI), which brought together Indigenous and non-Indigenous scholars from all eight member states of the Arctic Council (i.e., Canada,

Greenland/Denmark, Sweden, and Alaska/United States), developed research and policy recommendations to support health and well-being research in the Arctic (Cueva et al., 2021). Among the recommendations, "creating and expanding approaches to the assessment of Arctic peoples' health and well-being that include integrated mixed methods and innovative research in small populations", was proposed (Cueva et al., 2021, p. 554). Using a mixed methods approach and basing quantitative analyses on qualitative findings, allows for research to be used as a 'translation tool' and contribute towards bridging the gap between Indigenous knowledge and Western institutional knowledge (Blackstock, 2009).

My thesis was designed to integrate the quantitative and the qualitative phases of the Q2017 health survey in attempt to reflect the holistic understanding of health held by Nunavimmiut. Data from the community component report (i.e., the qualitative phase) was analysed to determine which variables from the adult and youth components (i.e., the health survey) mirror the IQI model of health. By using a statistical method known as Latent Class Analysis (LCA), wholistic health profiles were produced. Therefore, the analyses in the present study are mostly descriptive: creating health profiles, exploring the socio-economic characteristics of members within each profile, and exploring the relationship between community-level SDoH.

#### 5.3. Ethical implications

The Q2017 survey and data analysis received ethical approval from the Centre de recherche du CHU de Québec, Université Laval (REB 2016-2499, 2016-2499-21) and McGill University (REB 20-04-034). Q2017 is governed by a Policy on the management of databases and biological samples (hereafter Data Management Policy) that is guided by the Tri-Council Policy on Ethics in research involving Indigenous Peoples and involves elements of OCAP principles, referring to ownership, control, access, and possession of data in the context of research with Indigenous Populations (Government of Canada, 2019).

As per the guidelines to access data set forth in the Data Management Policy, a request to access and use Q2017's data for the proposed analysis was submitted to the Q2017's Data Management Committee (DMC) in January 2021. It was approved on April 16<sup>th</sup>, 2021. Upon reception of the anonymized database, all data was stored on my password protected laptop. Once the project is completed and published, all stored data will be deleted. Results will be shared with

the region and communities through the communication platform implemented by the NRBHSS. Moreover, the syntax created for the wholistic assessment of health and well-being as well as the indicator itself will be returned to *Institut national de santé publique du Québec* (INSPQ). Lastly, all the dissemination materials arising from this master's thesis, i.e., scientific papers, presentations at scientific conferences, and the thesis itself, will first be shared with the DMC for revision and approval prior to submission.

Throughout the whole process, ongoing effort was made to discuss methodological implications with Inuit colleagues and experts in the field. For example, discussion with language experts influenced how variables should be re-coded to take into account cultural implications and to best reflect the authenticity of participant answers. The selection of variable was also discussed and validated with researchers involved in the development of the IQI model. The model was also presented to the DMC. Ultimately, all the input from members of the DMC, Inuit and non-Indigenous researchers were incredibly valuable, and integrated to the best of my abilities.

#### 5.4. Latent Class Analysis

#### 5.4.1. Overview of LCA

Latent class analysis (LCA) is a statistical method used to measure an unobservable variable through two or more observable variables (McCutcheon, 1987). It is used in this thesis as a way to identify and understand wholistic health, a concept that cannot be elicited by direct observations (Baron et al., 2021). Based on the observed items included, LCA reveals who is likely to be in a group, and how a group's characteristics are different from (an)other group(s) (StataCorp LLC, 1996). By looking at the pattern of responses to the observed items within each of the classes created, it is possible to understand the meaning of each class.

For example, recent work focusing on Indigenous Peoples' health has utilized this method to conceptualize multidimensional health profiles among Inuit Elders (Baron et al., 2021), to identify health, psychological stress, and racial discrimination profiles among Australian Aboriginal adults (Cave et al., 2020), to characterize the complex food environments of Native American communities (Jock et al., 2020), to identify sleep schedule among Australian Indigenous children (Blunden et al., 2018), and to operationalize a wholistic indicator of social connectedness among Indigenous young adults (Walls et al., 2022). In each of these studies, the

different classes obtained from the LCA reflect multidimensional constructs that may not be directly observed in a population. Through this method, the different dimensions of health, food environments, sleep schedules, and social connectedness were brought to light, appropriately reflecting the complex nature of each. In this study, LCA is employed to measure wholistic health through observable survey questions relating to the foundational concepts of the IQI model: physical health, well-being, quality of social relationships, culture, and language. In such, LCA allows for a more wholistic understanding of the interrelation and interconnectedness of the different factors constituting health.

#### 5.4.2. Variable selection

As reported by Sinha et al., (2021), the indicators to be included in the LCA should be justified using a clear rationale, as these represent the "principal determinants of class characteristics" (p.e66). Therefore, in order for the variables to adequately reflect health, as understood by Nunavimmiut, close attention was brought to the construction of the terms and to the descriptions of the foundational concepts of the IQI model (Fletcher et al., 2021). The succinct definitions and the construction of the terms Ilusirsusiarniq (*'bodily health'*), Qanuinngisiarniq (*'well-being'*), Inuuqatigiitsiarniq (*'Quality relationships'*), as well as Culture and Language are presented in Table 1.

Ilusirsusiarniq	Qanuinngisiarniq	Inuuqatigiitsiarniq
The state of habitually and normally feeling good in one's body and physiological state	The state of not feeling bad, of being undisturbed by negative forces	The act of living harmoniously and well together as people
<i>ilu-:</i> inside of something	qanui-: something is	inuk: human being or Inuit person
	wrong, or a misfortune	-u-: to be
	(qanuk, how, and -i-,	<i>inuu-:</i> be Inuit and be human, be
	negation meaning)	alive
<i>ilusirsu:</i> engage in a habit, or be in any physiological state	<i>-nit-:</i> negation	<i>-qatigi-:</i> together (do, be together) -i-: verb indicator
<i>tsiaq</i> -: do something in a	tsiaq: to do something	<i>tsiaq-:</i> to do something well, in a
good way	well, in a good manner	good manner
niq-: nominalization	niq-: nominalization	<i>niq-:</i> nominalization

Table 1.	Constructing	the meaning	of the terms

Note: This table is adapted from the Q2017 community component report (2021), p.12

A broader description of the foundational concepts of the IQI model was also provided as part of the conceptual framework (chapter 4). In addition to the minimal definitions of the terms of the IQI model, longer descriptions are provided for each of the foundational concepts (Fletcher et al., 2021, pp. 10–11). An excerpt from the community component corresponding to the description of the foundational concepts of the IQI model of health is included in Appendix A. Because of the interconnectedness of health and the SDoH (e.g., relationship to the land represents both a foundation of health, as well as a SDoH) a preliminary selection of 81 survey variables related to the IQI model was made. These survey questions were then further categorized based on which one could be considered as a core concept of health vs. a determinant of health. This procedure required a continuous "back and forth" between the community component report and the survey questionnaires, as well as ongoing discussions with my supervisor and other advisors. Once the list was narrowed down to 37 survey questions, a meeting with the lead researcher in charge of developing the IQI model was held to determine the final set of key survey variables that most closely reflected the foundational concepts of the IQI model. This resulted in the retention of 21 survey variables. A depiction of the foundational concepts of the IQI model, with a number representing every survey question included in the LCA is provided in Figure 7. Because of the interconnectedness of the different facets of health, the numbered items are found at the intersection the concept(s) within which they are nested. The survey questions corresponding to the numbered items are presented next to the figure. The final selection was validated by Q2017's DMC. The DMC is comprised of Nunavimmiut, Inuit representatives, as well as other non-Indigenous representatives of Nunavik. To better understand the rationale behind the final selection of indicators that was included in the LCA, a rationale for selection is presented in Appendix B.

In sum, the foundational concepts of the IQI model guided the selection of variables included in the operationalization of the wholistic assessment. These variables span concepts relating to physical health, identity, language and culture, resilience, mental well-being, social support, community cohesion, and family relationships. Effort was made to select indicators that reflected positive health. The few questions that were posed negatively (i.e., presence of physical pain and depressive symptoms) were recoded to focus on the positive (i.e., the absence of physical pain and absence of depressive symptoms). Figure 7 illustrates the final selection of variables corresponding to the IQI model.



Figure 7. The final selection of variables corresponding to the foundational concepts of the IQI model

The number corresponding to each survey question (or scales) was positioned in the area corresponding to the concept within which it was determined to be. Because of the interconnection of many of the indicators, most of them are actually positioned at the intersection of two or more foundational concepts. In addition to emphasizing wellness, the variable transformations were kept to a strict minimum to stay as closely as possible to participant's answers. Variable transformations are described in the following section.

#### 5.4.3. Data set up and variable transformation

As proposed by Sinha et. al (2021), a stepwise approach to data set up is described in this section, beginning with examining, and transforming the data, before describing how the LCA was conducted.

In a first step, all data was explored and recoded (using Stata version 16.1 StataCorp LLC). Data was checked for any extreme or implausible values. All missing data, non-response, refusal to answer or 'don't know's' response codes were recoded as missing values ('.'). Given the independent selection of participants according to strata, 514 were living in the same dwelling, bringing forth issues of non-independence of observations. This clustering at the dwelling level is important to consider as an adjustment variable in statistical analyses. In addition, the distribution of the final sample of participants obtained was not representative of the population. Therefore, the data was weighted to "ensure that estimates produced from survey data are representative of the population covered and not solely of the sample itself' (Hamel et al., 2020, p. 37). The weights used in the analysis were calculated using the bootstrap method (Hamel et al., 2020). Frequencies of categorical variables were also examined. For the purpose of conducting a LCA, collapsing polytomous variables into indicators containing fewer response options makes it generally easier to interpret findings while maintaining power/sample size. In such, it is common practice to recode polytomous indicators into indicators containing fewer categories. For example, polytomous indicators can be recoded into a binary variable reflecting the presence or absence of an outcome or collapsed with another answer option to increase cell size (Weller et al. p.291). Nonetheless, polytomous indicators may be analyzed with their original response option, rather than being recoded into binary items. While this methodological decision may render the interpretation of results more difficult, it was deemed more culturally relevant in the context of this research, as language influences the interpretation of questions and of their possible answer choices. Two Inuit

colleagues both affirmed and confirmed that neutral answers were neither deemed as 'positive', nor 'negative' answers. In Inuktitut, neutral answers are simply neutral, and not meant to be fitted into a binary indicator.

All data transformation and subsequent regressions were conducted in *Stata version 16.1*. The final distribution of response categories for each indicator is presented in Table 2. Categorical variables were only re-coded in instances where there were low frequencies observed in a given answer category.

Indicator	n	weighted (%)	Indicator	n	weighted (%)
Having enough energy			Having someone showing lo	ve and	affection
Completely	251	24.76	All of the time	496	40.93
Mostly	605	49.99	Most of the time	358	31.02
Moderately	196	14.7	Sometimes	233	19.15
A little/Not at all	122	8.83	Rarely/Never	90	7.69
missing (.)	22	1.72	missing (.)	19	1.21
Ability to perform daily a	activitie	es	Feeling of belonging		
Very satisfied	173	15.07	Strongly agree	624	52.66
Satisfied	772	66.32	Agree	408	34.41
Neither (dis)satisfied	177	13.22	Neither dis (agree)	84	6.67
Dissatisfied/Very	43	3.08	Disagree/Strongly	65	5 31
dissatisfied	75	5.00	disagree	05	5.51
missing (.)	31	2.31	missing (.)	15	0.95
Physical pain as a limit			Satisfying country food crav	rings	
Not at all	441	37.88	Very satisfied	588	48.67
A little	493	41.66	satisfied	450	38.38
A moderate amount	168	12.84	Neither (dis)satisfied	100	8.25
Very much/An	65	5 53	Dissatisfied/Very		4 04
extreme amount	05	5.55	dissatisfied	50	4.04
missing (.)	29	2.09	missing (.)	8	0.66
Having someone to have	1 0000	l time with	Knowledge & skills of cultur	ral and	traditional
Having someone to have	<i>u</i> 5000		activities, games & art		
All of the time	310	25.68	Very satisfied	327	26.76
Most of the time	488	40.85	satisfied	557	47.16
Sometimes	311	26.33	Neither (dis)satisfied	202	17.3
Rarely/Never	74	6.5	Dissatisfied/Very		8.01
	/ T	0.0	dissatisfied	100	0.01
missing (.)	13	0.64	missing (.)	10	0.77

Table 2. Descriptive statistics of selected (transformed) indicators corresponding to the foundational concepts of the IQI model of health, 2017 (n=1,196)

Table 2 (cont'd)

Indicator		weighted	Indiantan		weighted	
Indicator	n	(%)	Indicator	n	(%)	
Going on the land, hunting, fish	ing, bei	rry picking	Close connection to Elders			
Very satisfied	581	49.55	Strongly agree	477	40.61	
satisfied	464	38.59	Agree	487	41.15	
Neither (dis)satisfied	94	7.63	Neither dis (agree)	158	12.9	
Dissatisfied/Very dissatisfied	50	3.84	Disagree/Strongly disagree	70	5.16	
missing (.)	7	0.39	missing (.)	4	0.18	
Feeling safe			Visiting others / being vis	sited		
Extremely	107	9.6	Daily	465	39.44	
Very much	423	34.96	A couple times/week	416	35.07	
A moderate amount	279	23.05	A few times/month	132	10.14	
Slightly	183	15.46	Rarely	179	15.18	
Not at all	152	13.13	missing (.)	4	0.18	
missing (.)	52	3.8				
Speaking Inuktitut			Emotional support			
Without difficulty	707	56.85	High	276	22.16	
Fairly well	396	34.96	Moderate	455	38.21	
With difficulty/Not at all	87	7.75	Low	441	37.81	
missing (.)	6	0.43	missing (.)	24	1.82	
Family relationships			Community cohesion			
High	349	29.14	High	282	25.07	
Moderate	364	31.83	Moderate	477	40.38	
Low	456	36.91	Low	397	31.55	
missing (.)	27	2.11	missing (.)	40	3	
Growing up watching and learn	ing Inu	it skills	Spiritual values			
Yes	1053	88.35	Play an important role	982	81.03	
No	133	11.08	Don't play an important role	182	16.75	
missing (.)	10	0.57	missing (.)	32	2.22	
Food sharing			Depressive symptoms			
With 1 household or more	915	78.48	Absence of symptoms	654	57.37	
With no households	227	17.49	Presence of symptoms	488	37.52	
missing (.)	54	4.03	missing (.)	54	5.11	
Ability to bounce back quickly						
Very well	305	25.2				
Somewhat well	601	52.06				
Not well	278	22.03				
missing (.)	12	0.71				

This is because indicators are more informative when there is a higher variability among participants' answers. When there is little variability (e.g., 99% of participants answered yes to a specific question), there is less power to see a significant difference between groups. Therefore, when there was fewer than 5% of participant observations in a specific response category, items were recoded and collapsed with the neighboring answer choice. For example, if less than 5% of participants answered option 5- 'Very dissatisfied' to a question, then this category of response was collapsed with option 4- 'dissatisfied'. However, to reflect participants' original responses most accurately, the data was manipulated as little as possible. Therefore, no question underwent more than 1 transformation, even if the newly combined categories of answer had a cumulative frequency of <5%. This was only the case for two of the variables: satisfaction with the ability to satisfy country food cravings, and satisfaction with ability to perform daily activities, which had 4.38% and 3.38% of participants in category 4 – 'dissatisfied', respectively.

In one instance, two questions were combined to create a binary indicator. To represent food sharing more generally, a pair of survey question related to 1) giving food and 2) receiving food was collapsed. Therefore, rather than observing if participants have shared or receive food with 1-3 households, 4-9 households, 10 or more households, or no households at all, these variables were recoded to observe if participants had participated in food sharing with at least 1 household vs. no household. Another reason for recoding variables was to group questions that seemingly tapped into a single construct. For example, there were multiple questions on emotional support, family relationships and community cohesion (Table 3). An exploratory factor analysis (EFA) followed by a confirmatory factor analysis (CFA) was performed on these sets of indicators to determine if these questions were tapping similar constructs. These analyses, in addition to the LCA, were performed using Mplus version 8.6. As revealed by the EFA and CFA (Appendix C), there are seemingly three separate constructs (support, family relationship and community cohesion) being explained by these sets of variables. Therefore, answers to these three sets of questions were scored and summed into a continuous scale. Based on the distribution of answers to these constructs, the three different scales were transformed into 3-category indicators based on the distribution quantiles. This analytical choice was made due to the nature of the statistical modelling program used to conduct the LCA, Mplus, which allows for a maximum of 10 categories for a variable to be treated as categorical.

### Table 3. Survey Questions included in EFA

Questions on Support

- 1. How often do you find that you have someone to have a good time with?
- 2. How often do you have someone to talk to if you feel troubled or for some reason need emotional support?
- 3. How often do you have someone you can count on when you need advice?
- 4. How often do you have someone you can count on to listen to you when you need to talk?
- 5. How often do you have someone to take you to the doctor or another health professional if you need it?
- 6. How often do you have someone who shows you love and affection?

Questions on family relationships:

- 1. In my close family, we really help and support each other
- 2. In my close family, we spend a lot of time doing things together at home
- 3. In my close family, we spend a lot of time doing things together on the land
- 4. In my close family, there is a feeling of togetherness
- 5. I am proud to be a part of my family
- 6. In my close family, we really get along well with each other

Questions on community cohesion:

- 1. There is a feeling of togetherness or closeness in this community
- 2. People in this community help others
- 3. People in this community can be trusted
- 4. I feel like I belong in this community

In sum, these categorical indicators were included in the LCA, alongside the other indicators corresponding to elements described within the foundational concepts of the IQI model. Last, approaches for missing data were considered. Across all indicators considered, the CESD-10 item depression scale was the indicator with most missing answers (5.11%). All other indicators had less than 5% missing answers (Table 2). When it comes to handling missing data, Mplus uses by default the Full-information maximum likelihood (FIML) estimates, which is a recommended method to deal with missing data. In FIML, all the data (complete and incomplete) is used which is efficient, but computationally intensive (Sinha et al., 2021).

## 5.4.4. Conducting the Latent Class Analysis

LCA was applied to categorize participants in various 'health profiles' along the selected indicators. For LCA, a sample size is considered as being 'large' if n>500; conversely, sample sized of n<300 are not recommended, for results are less likely to be reliable (Sinha et al., 2021).

Within the scope of Q2017, there are 1196 Nunavimmiut who participated in the health survey, therefore making the sample size adequate for the LCA. The grouping of participants into *n* classes is not established a priori; rather the outcomes of different models are tested, starting with a 1-class model, and increasing the number of classes until the goodness to fit statistics no longer improves.

In the Mplus input, weights were specified as they affect parameter estimates and model fit. Clusters corresponding to the household identification of each participant were also used, as some participants lived at the same address, therefore bringing potential issues of non-independence of observations. Last, 2000 random starts and 400 iterations were specified to increase the chances of model convergence (Masyn, 2013). The LCA was conducted for the whole population, irrespective of sex and age and of any other possible covariates. To account for the structural component of the model, the final number of classes was extracted to *Stata* to explore the relationship between the latent classes and community-level SDoH. The selection of the most representative model was guided by goodness to fit statistics.

Previously, researchers would employ a one-step approach when conducting a LCA (Weller et al., 2020), i.e., including covariates alongside the selected indicators, to examine if sociodemographic characteristics, would alter the composition of classes (Vermunt, 2010). However, because this approach resulted in miss-specified models, researchers have been turning towards a different approach, whereby a measurement model is first identified, and then covariates are examined in relation to the best-fitting class solution (Weller et al., 2020).

#### 5.4.4.1. Selection of the best fitting model

To determine the best fitting model, the fit statistics are reported for each iteration of the LCA. Models with 1 to 7 class were tested. The fit statistics of the models with an additional class (k) are reported in order to guide the selection of the model that best suits the data. Models with k classes are conducted until the fit statistics are no longer improving. Although there is no consensus about what the *best* criteria are for selecting the best class-solution, it is agreed that multiple fit-statistics should be reported, that the Bayesian Information criteria (BIC) is the most reliable, but also that theoretical interpretability (i.e. that the best model can be understood) should be considered when choosing a solution (Weller et al., 2020).

There are three relative goodness-to-fit statistics that are produced when conducting a

LCA. The first one is the Bayesian Information Criteria (BIC) which is the most widely accepted fit statistic for latent class analysis and thereby the most commonly used. The second IC is the Akaike Information Criterion (AIC), and finally, the Sample-size adjusted BIC (SABIC). The latter is not commonly used, and in most cases, it is better to use the BIC. Previous research has found that the AIC does not perform as well when using categorical variables (Nylund-Gibson & Choi, 2018). To visualize model-fit, Nylund-Gibson & Choi (2018) introduced the concept of using an elbow plot of different fit statistics to examine the model fit. Using this plot, researchers can visually identify where the fit changes (Weller et al., 2020). As a general rule, the lower the IC, the better the model.

To determine if a model with an additional class (k) is better than the previous model with k-1 class, different likelihood-based tests can be used. The Vuong-Lo-Mendell-Rubin test (VLMR), the adjusted LMR, and the bootstrapped likelihood ratio test (BLRT) are commonly demanded in the model to test the number of classes (Asparouhov & Muthen, 2012). With these three tests, a p-value <0.05 indicates that the model with k-classes "provides a significantly better fit to the observed data than the k-1-class model" (Tein et al., 2013, p. 4).

However, the BLRT may not be requested when the study design is complex, and analyses must take into account clustering. In *Mplus*, the following warning message appears in the output when requesting the BLRT (TECH 14): "TECH14 option is not available for TYPE=MIXTURE COMPLEX. Computing the BLRT is not possible if the survey design is complex and requires a clustering variable (Muthén, 2006). Nonetheless, the VLMR and adjusted LMR (TECH 11) will output a p-value, but Muthén cautions using this value for it does not consider complex survey data. In fact, the "BIC is the only index that is useful here because it is the only one that takes complex sampling features into account" (Muthén, 2006).

There is, however, no consensus on how to determine the best solution in LCA. Software packages such as *Mplus* provide various fit indices (AIC, BIC, SABIC) as well as likelihood ratio tests (BLRT, VLMR, adjusted LMR) (Jeong, 2015). A Monte-Carlo simulation study conducted by Nylund (2007) concluded that among all the IC and likelihood tests, the BLRT outperformed all other tests, followed by the BIC, and then by the adjusted BIC. Due to the sheer amount of model fit indices and tests, the researcher may have to compromise and use theory to guide the decision of optimal number of classes (Jeong, 2015).

In addition to primarily relying on the fit statistics, classification diagnostics are also

important to consider. For one, considering the relative size of the smallest class is recommended. A model that includes 3 classes or more should not have a class-size of <10% of the sample, as this may be suggestive of a poor-fitting model (Sinha et al., 2021). Class collapsing occurs when the number of latent classes that are being extracted are greater than what the data can support.

Moreover, the average latent posterior probability can be considered in the selection of the best-fitting model (Weller et al., 2020) In LCA, each participant is attributed a probability of belonging to a certain class based on their answers to the indicators included. This probability is known as a posterior probability, which may be reported alongside the fit statistics. A posterior probability close to 1 indicates that an individual has a low degree of 'classification uncertainty', while a posterior probability close to 0 indicates the opposite, whereby there is no class that emerges as being the most likely (Nielsen, 2020). A common cutoff value for posterior probabilities is 0.8, meaning that participants have a sufficiently high probability of belonging to the class in which they were assigned(Weller et al., 2020). In *Mplus*, the average posterior probabilities are presented in a matrix, with diagonals representing the "average probability of a person being assigned to a class given his or her scores on the indicator variables used to create the classes" (Weller et al., 2020, p. 293). Therefore, higher values in the diagonals, and lower ones in the off-diagonals are desirable.

Entropy is another statistical diagnostic test that indicates the accuracy with which the model describes the classes. Generally, the closest the entropy value is to 1, the better, although there is no established cut-off criterion (Weller et al., 2020). Nonetheless, an entropy value <0.6 may render a study difficult to publish. In sum, once the best model solution is selected based on the fit statistics and looking at other criteria such as the smallest class size and entropy, the researcher can move on to interpreting the classes.

Last, looking at the *Condition Number for the Information Matrix*, outputted by Mplus, is another way to ensure that the model appropriately reflects the data If the condition number for the best model is not smaller than 10<sup>-6</sup>, empirical under identification is most likely not an issue, meaning that there is high confidence that the optimal solution is reached.

#### 5.4.4.2. Interpreting findings

Once a best-fitting model has been selected, the researcher can interpret what items are characteristics of class membership. Class homogeneity informs us about the extent to which an item reflects the 'typical' answer of a participant in one class. Therefore, to establish which items are considered as being "most" representative of a certain class, we look at the item estimated probability of endorsement, i.e., if the probability of endorsement of a certain answer choice (e.g., without difficulty) is of 0.9, this means that someone in class X has a 90% probability of answering 'without difficulty' for a specific indicator (e.g., speaking Inuktitut). We can thus conclude that 'speaking Inuktitut without difficulty' is a "typical" answer of a participant in class X. Optimally, if an indicator is dichotomous, the model-estimated probabilities of endorsement should be >0.7 for an item to be deemed 'representative' of a class. However, this is not always straight forward in a categorical variable with >2 possibilities of answers. Therefore, caution in the interpretation of class homogeneity is warranted. Rather than going by >0.7 threshold, looking at the overall pattern of response across all response categories may be informative for polytomous indicators.

In addition to determining which items represent "typical" answers for members within each latent class, one can also consider how each class either resembles or differs from another. This is known as class separation and is calculated based on the estimated propensity of itemendorsement. For example, the probability of endorsement of item *m* for members in class *j* are divided by the probability of endorsement of this same item (*m*) for members in class *k*, thus giving the ratio of the odds of endorsement (OR) . A class separation is considered high if the odds ratio calculated is <0.3 or >5.0 (Masyn, 2013). It is possible for an item to have high class homogeneity, while also having low class separation. Simply put, an item can be 'typical' of more than one class. However, because the OR is calculated based on the probability of category endorsement, the same issue arises with categorical indicators with more than 2 answer choices.

In sum, establishing class homogeneity and class separation is not always straight forward for categorical variables with more than 2 categories of answers (e.g., if the answer to a question is a 5-item Likert scale). Because of this, LCA is typically applied to dichotomous indicators to allow easier interpretation of results. This means that when indicators are categorical, recoding them into binary indicators (i.e., positive vs. negative answers) is often performed. Albeit collapsing categories of answers may allow for ease of interpretation, this also means that the nuance in the participant's answer is lost. Therefore, when looking at the estimated probabilities of endorsement for categorical indicators, looking at patterns of responses with the use of a heat map may be more informative than solely relying on the >0.7 threshold. A heat map allows the visual representation of the results, thus providing a comparative view of the data.

#### 5.5. Validating the assessment

To answer objective 2) Assessing construct validity with an available survey question on SRH, a weighted proportion test was performed using a survey question SRH: *In general, would you say your health is: 1-Excellent 2-Very Good 3-Good 4-Fair 5- Poor.* The underlying hypothesis for this specific objective is that individuals who are in better health, assessed wholistically, will have better SRH. Previous work has demonstrated that subjective health assessments are effective predictors of health in multiple ethnic groups (Chandola & Jenkinson, 2000). However, this measure has also shown to be interpreted differently within and across ethnic groups, and research on the validity of SRH across Indigenous groups remains scarce (Bombak & Bruce, 2012). While SRH is typically used as an outcome variable, "a better understanding of how different cultures perceive their health and what contributes to these perceptions is required" (Bombak & Bruce, 2012, p. 6). Therefore, as a form of face validity<sup>3</sup> for the wholistic assessment, a weighted proportion test was conducted to reveal any differences in SRH by class membership.

# 5.6. Exploring the relationship between wholistic health and community-level social determinants of health.

Separate multinomial regressions were performed to examine the influence of communitylevel SDoH on the wholistic assessment, while controlling for variables known to have an impact on health and well-being, such as age, sex, employment status, marital status, community size, and region (Inuit Tapiriit Kanatami, 2014; Muckle, Fraser, et al., 2020). Among the socio-economic variables considered (i.e., income, education, and employment), employment was retained because of the proportion of missing answers across each variable: income had 13.88% missing answers, education had 2.93%, and employment had 0.84%. Moreover, education is viewed by Nunavimmiut as both formal and informal. Formal education relates to the schooling system, and informal education is more about cultural knowledge. However, the survey question on educational attainment solely pertains to the former. Income, on the other hand, is said to be "related to work"(Fletcher et al., 2021, p. 17). Therefore, in addition to the higher proportion of missing answers, employment was favored over education and income, since it represents an important determinant of health among Nunavimmiut, as it is encompassed within the SDoH

<sup>&</sup>lt;sup>3</sup> Face validity is defined as how well a measure captures what it is supposed to measure – the extent to which a measure makes sense (Remler & Van Ryzin, 2015, p. 560)

*Economy* in the IQI model (Fletcher et al., 2021).

In terms of associations of the wholistic health indicator with community-level SDoH, three specific questions in *Q2017* relating to one's involvement at the community-level were considered. These three questions are: 1) In the past 12 months, outside of work or school, how often have you participated in a cultural, community or sports event such as a festival, dance, feast, Inuit games? 2) In the past 12 months, outside of work or school, how often have you volunteered for a group, an organization, or community event such as a rescue team, church group, feasts, spring clean-up? 3) In the past 12 months, outside of work or school, how often have you participated in local committees or board meetings? To these three questions, participants could answer between: '*Always'*, '*Often'*, '*Sometimes'*, '*Rarely'*, and '*Never'*. The levels of involvement were recoded into a binary variable, whereby '*Always'*, '*Often'*, and '*Sometimes'* were grouped together in one category, and '*Rarely'*, and '*Never'* in another category. To look at these items, three separate multinomial regressions were performed, adjusted for age, sex, employment status, marital status, community region, and community size.

The underlying hypothesis of the third, and last, objective is that individuals who are in better health, assessed wholistically, will have greater levels of community involvement, either through participating in events, board/committee meetings, or volunteering. The rationale for selecting these three questions is founded on theory and methodological implications. First, on a theoretical front, participation in cultural, community, or sport events, volunteering, and/or attending local committee or board meetings broadly relate to social capital, which has been demonstrated to influence well-being: different levels of community involvement, such as "participation in sporting events and community events and attending public meetings represent involvement in activities that are likely culturally relevant for community members" (Newell et al., 2020, p. 67). Hence, these three questions were selected because they offer an insight to the relationship between community involvement, social capital, and wholistic health.

# 6. PERSONNAL STATEMENT

"Who we are, the values that underpin our concept of self and our concept of others, our perspective on how the world operates and our own place within it and our understandings of how knowledge is construed and who the knowers are, fundamentally impact our research practices and presumptions." (Walter & Suina, 2019, p. 235)

Before moving on to the results, I would like to share a little bit about who I am, and how my own background and experiences may shape the methodological considerations and interpretation of findings employed in this master's thesis. I am a white, privileged, mid 20-s woman born in Montreal (Tiohtià:ke), Quebec, Canada. I grew up living in this city with my mother, who is a 13<sup>th</sup> generation settler. It is in this city that I received all my education, from elementary school to now graduate studies. While living most of my life in southern Quebec, I spent my summers in Norway, with my Norwegian father. There, I grew up having a special connection to the North, as I spent my time in the Norwegian Arctic on a small island called Loppa. On this small island, I spent a lot of time fishing with my grandfather and picking multebær – otherwise known as cloudberry in English, or Arpik in Inuktitut. I remember picking liters upon liters of these blood-orange berries to make jam, or simply sitting in a huge patch of them eating away while reading a book. I mention this sliver of my upbringing because these experiences allowed for an immediate connection to the IQI model of health. While I knew about the model itself, I had never seen the way it was portrayed before fall 2020 - as an arpik/multebær/cloudberry.

Who I am as a person and the experiences I've had until now shape the way I see the world and understand it. As a researcher, I cannot detach myself from my personhood or positionality. I am aware that my understanding of the IQI model is constrained to my personal worldviews and lived experience. Subsequently, the selection of survey questions that best correspond to the IQI model are also tied to my interpretation of it. Nonetheless, continuous efforts were made to consult, discuss, and validate the variables that were ultimately selected to ensure that these reflect the foundational concepts of the IQI model, and that I was not imposing my own world views on the data. Throughout this whole process, I was – and still continue to be – reflexive about why, as a *Qallunaat*, I chose to engage in studying conceptualization of Inuit health and well-being. I am in this field because I believe that quantitative methodologies, when paired with qualitative findings emerging from Indigenous knowledge, can reframe health research in a way that allows a more nuanced and culturally relevant look at the intersecting SDoH. Grounding quantitative analyses in knowledge constructed by Inuit, using data from *Q2017?*, a study conducted by *Inuit for Inuit*, contributes to the approach of decolonizing research methodologies.

# 7. RESULTS

This section presents the results of the LCA, the validation of the assessment, and the multinomial regressions conducted to look at the relationship between wholistic health and individual and community-level SDoH. The rationale for selecting the optimal class solution is first presented, followed by the interpretation of the best-class solution. Then, the wholistic health profiles are characterized based on the items that are 'typical' answers of members within each profile. Lastly, results of the proportion tests and multinomial regressions of individual and community-level SDoH are presented.

# 7.1. Selection of the best fitting model

The final sample of the study included 1,196 participants who were properly matched to a class solution. This sample represents a weighted population of 7,638 Nunavimmiut aged 16 years and over. The weights used in the analysis were calculated using the bootstrap method (Hamel et al., 2020).

The fit indices as well as the classification diagnostics for the models with 1 to 7 classes are presented in Table 4. As indicated by the VLMR and LRT values, the 4 class-solution onwards did not provide a significantly better fit than the 3-class model (p<0.05). Therefore, while the 6-class solution shows the smallest SABIC value, this solution was not considered as properly 'fitting the data', based on the VLMR and LRT. On the other hand, the 3-class solution has the lowest BIC value and shows a significantly better fit than the 2-class solution.

		class-solutions						
		1 class	2 class	3 class	4 class	5 class	6 class	7 class
ics	AIC	49855.7	48345.47	47869.08	47725.27	47602.08	47497.02	47399.42
tist	BIC	50115.12	48869.41	48657.53	48778.22	48919.55	49079	49245.9
sta	SABIC	49953.13	48542.24	48165.19	48120.71	48096.86	48091.14	48092.88
fit	VLMR	p<0.001	p<0.001	0.0101	0.6478	0.7709	0.8606	0.8095
	LRT	p<0.001	p<0.001	0.0104	0.6489	0.7709	0.8606	0.8095
AIC: Akaike Information Criteria BIC: Bayesian information criteria SABIC: Sample Size								
Adjusted BIC VLMR: Vuong-Lo-Mendell-Rubin test LRT: Lo-Mendell-Rubin adjusted LRT								
test							-	

 Table 4. Goodness of fit statistics for 1-7 class models

To visualize the goodness-of-fit statistics, an elbow plot was created to determine the presence of any breaks in the BIC, SABIC, AIC (ICs) values (Figure 8). The decrease of the ICs

is rather steep from the 1 to 2 class-solution, and further decrease from the 2 to 3-class solution. Looking at the 4-class solution onwards, the decrease is less noticeable for the SABIC, and the BIC is on the other hand, increasing. The AIC keeps decreasing, but as previously mentioned, this fit-statistic does not perform well when using categorical variables, and therefore is not reliable (Nylund-Gibson & Choi, 2018). Therefore, based on the SABIC, VLMR and LRT, the 3-class solution was considered the optimal fit.



Figure 8. Elbow plot of IC for the 1-7 class model

Based on the 3-classs solution estimated posterior probabilities, the final class counts and proportions for the latent classes are of 40.5%, 36.5%, and 23.0% (Table 5). Here, the smallest class size of the 3-class solution is of 23%, which is a sufficiently large ( $\geq 10\%$ ) (Sinha et al., 2021).

Latent Class	class counts	proportion							
1	485	0.405							
2	436	0.364							
3	275	0.230							

 Table 5. Final class counts and proportions for the latent classes based on estimated posterior probabilities of the 3-class solution

The average latent posterior probability for the best-fitting model can be considered to inform the degree of certainty that participants were classified into the right class (Weller et al., 2020). A posterior probability close to 1 indicates that an individual has a low degree of 'classification uncertainty', while a posterior probability close to 0 indicates the opposite.

Therefore, higher values in the diagonals (nearing 1) and lower values in the off-diagonals (nearing 0), are desirable (Nielsen, 2020; Weller et al., 2020). A common cutoff value for posterior probabilities is 0.8, meaning that participants have a sufficiently high probability of belonging to the class in which they were assigned. For the 3-class solution, the average probability of a person being assigned to class 1 given their answers to the survey questions is of 0.92. Similarly, the average probability of a person being assigned to class 2 given their answers to the survey questions is of 0.87, and of 0.89 for a person being assigned to class 3. As presented in Table 6, on average, participants have a low level of classification uncertainty for being classified in their respective latent class based on their answers to the survey questions.

 Table 6. Average Latent Class Probabilities for Most Likely Latent Class Membership

 (Row) by Latent Class (Column)

	1	2	3
1	0.92	0.07	0.02
2	0.07	0.87	0.07
3	0.02	0.09	0.89

Entropy is another statistical diagnostic test that indicates the accuracy to which the model describes the classes. The closest the entropy value is to 1, the better, but there is no established cut-off criterion (Weller et al., 2020). Nonetheless, an entropy value >0.8 is acceptable, and one that is <0.6 may render a study hard to publish (Weller et al., 2020). In this case, the entropy value for the 3-class solution is of 0.756, which is <0.8, but >0.6. In addition, the condition number for the information matrix is of  $3.4E^{-03}$ , which is smaller than  $10^{-6}$ . Lastly, the best log-likelihood value (-23779.541) was replicated more than twice, indicative of high confidence that the solution has indeed reached the global maximum.

In sum, once the best model solution is selected based on the fit statistics (BIC), and that other criteria for the best-class solution are met (i.e., the smallest class size, average probability of classification, entropy, and the condition number for the information matrix), the researcher can move on to interpreting the meaning behind classes.

#### 7.2. Interpreting the final model

A heat map allows for visual representation and comparison of the results. Table 7 shows the estimated probabilities of item category endorsement for the 21 indicators included in the LCA.

# of item	#	Labels	Class 1 (41%) ' <i>Excellent</i> ' health			Class 2 (37%) ' <i>Good</i> ' health			Class 3 (22%) 'Fair' health					
categories (c)			++	+	-		++	+	-		++	+	-	
5 c	1	safety	0.18	0.38	0.17	0.10 0.17	0.05	0.42	0.29	0.18 0.06	0.03	0.24	0.30	0.23 0.20
	2	energy	0.43	0.44	0.08	0.06	0.11	0.65	0.21	0.03	0.18	0.41	0.18	0.24
	3	daily activities	0.29	0.64	0.06	0.01	0.03	0.79	0.16	0.02	0.10	0.56	0.23	0.10
	4	absence of pain	0.46	0.38	0.11	0.06	0.31	0.51	0.16	0.02	0.38	0.37	0.14	0.11
	5	good time	0.44	0.37	0.16	0.03	0.12	0.48	0.39	0.01	0.16	0.37	0.25	0.22
	6	love	0.65	0.18	0.11	0.06	0.25	0.55	0.18	0.02	0.26	0.17	0.36	0.21
4 c	7	belong	0.78	0.18	0.03	0.01	0.42	0.52	0.05	0.01	0.27	0.37	0.16	0.20
	8	country food cravings	0.68	0.27	0.05	0.01	0.39	0.52	0.08	0.01	0.31	0.39	0.15	0.15
	9	Inuit knowl. & skills	0.47	0.40	0.08	0.05	0.14	0.60	0.24	0.02	0.12	0.41	0.25	0.23
1	10	elder connection	0.70	0.27	0.02	0.01	0.21	0.60	0.16	0.03	0.20	0.36	0.27	0.17
	11	visit	0.48	0.32	0.09	0.11	0.34	0.46	0.10	0.10	0.33	0.23	0.12	0.32
	12	going on the land	0.74	0.21	0.03	0.01	0.36	0.58	0.05	0.01	0.29	0.39	0.19	0.13
	13	community cohesion scale	0.48	0.34		0.18	0.14	0.55		0.31	0.06	0.33		0.62
	14	family relationships scale	0.55	0.32		0.13	0.16	0.40		0.44	0.06	0.21		0.74
3 c	15	emotional support scale	0.40	0.36		0.24	0.11	0.51		0.38	0.11	0.24		0.64
	16	bounce back	0.39	0.45		0.16	0.09	0.69		0.22	0.27	0.40		0.34
	17	speaking Inuktitut	0.67	0.27		0.07	0.53	0.42		0.05	0.48	0.38		0.14
	18	Inuit skills	0.94			0.06	0.94			0.07	0.72			0.28
2.0	19	spirituality	0.87			0.13	0.84			0.16	0.74			0.27
20	20	food sharing	0.85			0.15	0.88			0.12	0.66			0.34
	21	absence of depressive symptoms	0.70			0.31	0.57			0.43	0.50			0.50

Table 7. Heat map of the estimated item-probability of endorsement for the 21 indicators included in the LCA, by class membership

++: very positive answers (i.e., completely, strongly agree, very well, all of the time, very satisfied, extremely, daily, without difficulty, high, yes) +: positive answers (i.e., mostly, agree, well, most of the time, satisfied, very much, a couple times per week, fairly well, moderate)

- : neutral or slightly negative answers (i.e., slightly, neither (dis)satisfied, neither (dis)agree, a moderate amount, a few times per month)

--: negative or very negative answers (i.e., disagree, strongly disagree, not at all, low, dissatisfied, strongly dissatisfied, no) Shading is based on quartiles

Darker shades of grey represent greater propensities of endorsement. Looking at the pattern of responses for members of class 1, we observe that the darkest region is the column falling under the '++' category. This means that on average, members in class 1 tend to answer very positive answers to most of the indicators. Therefore, members in class 1 were named the '*excellent*' health-class/profile<sup>4</sup>. For members of class 2, the concentration of the darkest shades falls under the '+' category of answer, meaning that members of class 2 tend to answer positively to the indicators, but not as positively as members of class 1. Consequentially, members in class 2 were named the '*good*' health-class/profile. Last, looking at the pattern of responses for members of class 3, there is a noticeably darker area under the '- -' column for indicators number 13, 14 and 15. This means that members in class 3 have a high propensity of answering negatively to questions pertaining to community cohesion, family relationships and emotional support. Hence, members of class 3 were named the '*fair*' health-class/profile

Members in the '*excellent*', 'good' and 'fair' health profiles answered very positively to indicators 18 through 20, meaning that these indicators are characteristic of all three classes. Indicator 18 corresponds to having had the chance to watch and learn Inuit skills while growing up (vs. not having the chance). Therefore, if a participant was classified in the 'excellent' or 'good' health-class =, they have a 94% chance of answering 'yes' to having the chance to watch and learn Inuit skills while growing up. If a participant was classified in the 'fair' health-class, they have a 72% chance of answering the same. Indicator 19 corresponds to spiritual values playing an important role in their life (vs. not playing an important role). A participant in the 'excellent' health profile would have an 87% chance of answering 'yes' to spiritual values playing an important role in their life; for someone in the 'good' health profile, this probability decreases to 84%, and to 74% for members in the 'fair' health-class. Last, indicator 20 corresponds to having shared food with, or received food from, at least one household in the past 12 months (vs. no households). For this indicator, a participant classified in the 'excellent' health profile would have an 85% chance of having received food from, or shared food with at least one household in the past year. A participant in the 'good' or 'fair' health-class would have an 88% and 66% chance, respectively, of answering the same.

Items 18 through 20 have high class homogeneity, but seemingly low class separation, meaning that these items are 'typical' for all three classes. In such, these items don't contribute to

<sup>&</sup>lt;sup>4</sup> Health class and health profile are used interchangeably throughout this thesis.

distinguishing the '*excellent*', '*good*', and '*fair*' health classes from one another, but inform on the presence of these items across the board. Nonetheless, some items demonstrated high class homogeneity and class separation, which can help us interpret which items are 'typical' within each class. Class homogeneity for a specific indicator was considered 'high' if 70% or more of participants in a certain class answered similarly for binary indicators, or if 60% or more of participants in a certain class answered similarly for a categorical indicator.

The '*excellent*' health-class is comprised of 40.5% of the population. In addition to having the chance to watch and learn Inuit skills while growing up, spiritual values playing an important role in their lives, and sharing food with and/or receiving food from at least one household, members in class 1 could be characterized as:

**Often** having someone that shows them love and affection,

Being satisfied with their ability to perform daily activities,

Being **very satisfied** with their ability to satisfy country food cravings,

Strongly agreeing with having close connections with Elders in the community,

Being very satisfied with their ability to go on the land, hunting, fishing, berry picking,

Speaking Inuktitut without difficulty,

The **absence** of depressive symptoms.

The 'good' health-class is comprised of 36.6 % of the population. Based on the item propensities of endorsement, typical answers of members in class 2 include:

Being able to bounce back quickly after a stressful event **quite well.** Being **satisfied** with their knowledge and skills of cultural and traditional activities, games, arts.

Agreeing with having strong connections with Elders in the community.

Whereas members in the '*excellent*' health-class 'strongly agree' to have close connections to Elders in the community, members in the 'good' health-class tend to 'agree' to having strong connections. Similarly, members in class 1 are 'very satisfied' with their ability to go on the land, hunting, fishing, and berry picking, while members in class 2 are 'satisfied' with their ability to do the same. Therefore, although these answers are both positive, members in the '*excellent*' health-class seem to be answering very positively, and members in the '*good*' health-class are answering positively to most of the items included in the LCA.

Finally, the '*fair*' health-class is comprised of 22.3% of the population. Only three items had high propensity of endorsement:

Reporting **lower levels** of community cohesion Having **lower levels** of family relationships Having **lower levels** of emotional support

These three items were the only scales included in the LCA. They are comprised of survey questions that pertain to community cohesion, family relationships, and emotional support. Therefore, participants having 'lower' levels of community cohesion, family relationships and emotional support, represent those who answer most negatively to the questions included in the scales. Now that the three health profiles have been described by the items deemed to be 'typical' of each, descriptive statistics of the socio-economic characteristics of members across the health profiles are presented.

## 7.3. Characterizing the wholistic health profiles

Figure 9 illustrates the weighted proportions of wholistic class membership by different socio-economic characteristics of Nunavimmiut. Each graph shows a different socio-economic characteristic (i.e., sex, age, marital status, employment, education income, community size, and region). The y-axis represents the different categories of socio-economic characteristics, and the x-axis represents the weighted proportion of Nunavimmiut in each category by wholistic class membership. The percentage is also provided within each bar. The upper and lower confidence Interval (CI) are presented using a horizontal error bar. Non-overlapping CIs is indicative that the percentages of Nunavimmiut within a single category (e.g., females) across health-class (e.g. excellent) is significantly different from membership in another health class (e.g. fair).

**a. Sex**. There are 38% of females in the 'excellent' health profile; 36% in the 'good' health profile; and 26% in the 'fair' health profile. The CIs for females in the 'excellent' and 'good' health profiles do not overlap with the CI of females in the 'fair' health profile, meaning that there are significantly more females in the 'excellent' and 'good' health classes. A similar pattern is observed for males: 44% of males are in the 'excellent' health class; 37% are in the 'good' health class; and 19% are in the 'fair' health class. There are significantly more males in the 'excellent' and 'good' health classes than in the 'fair' health class.



Figure 9. Wholistic class membership by socio-economic characteristics of Nunavimmiut (weighted proportions)

**b. Age**. Within the 16-30 years old age group, 32% are in the '*excellent*' health profile; 38% are in the 'good' health profile; and 30% are in the 'fair' health profile. Because the CIs for the percentage of youths and young adults aged 16-30 years old across each health class do not overlap, we cannot conclude that there is a significant difference in class membership in this age group. For Nunavimiut aged 31-54 years old, 46% are in the '*excellent*' health profile; 38% are in the 'good' health profile; and 16% are in the 'fair health profile. The CI for the 'fair' health profile does not overlap with the CIs of the 'good' and '*excellent*' health profiles. This means that there are significantly more Nunavimmiut aged 31-54 years old in the 'good' and '*excellent*' health profile; and 16% are in the 'good' health profile, and 16% are in the 'good' health profile. Last, in the 55 years and over age group, 55% are in the '*excellent*' health profile; 30% are in the 'good' health profile; and 16% are in the 'fair' health profile. Last, in the 55 years and over age group, 55% are in the 'excellent' health profile; 30% are in the 'good' health profile; and 16% are in the 'fair' health profile. The CIs do not overlap for any of the health classes, meaning that there are significantly more Nunavimmiut aged 55 years and over in the 'excellent' health profile than in the 'good' and 'poor' profiles, and there are significantly more Nunavimmiut in the 'good' health class than in the 'fair' health profile

**c. Marital status**. There are significantly more Nunavimmiut who are in a relationship that are in the *'excellent'* and *'good'* health profiles (47% and 38%) compared to in the *'fair'* health

profile (15%). When it comes to those who are single, there is no significant difference in healthclass membership. 35% of those who are single are in the *'excellent'* and *'good'* health profiles, respectively; and 30% are in the *'fair'* health profile.

**d. Employment.** Looking at employment status, there are significantly more Nunavimmiut who are employed in the *'excellent'* (41%) and *'good'* (40%) health profiles compared to in the *'fair'* health profile (19%). For those who are not working, 40% are in the *'excellent'* health profile; 30% are in the *'good'* health profile; and 29% are in the *'fair'* health profile. The difference in the percentage of unemployed in *'excellent'* health compared to *'fair'* health is significant.

e. Education. Looking at education level, 43% of Nunavimmiut who have not completed high school are in the 'excellent' health class; 34% are in the 'good' health class, and 22% are in the 'fair' health profile. These differences are all significant. A similar pattern is observed when it comes to those who have their high school diploma, or higher education. For Nunavimmiut with at least a high school diploma, 33% are in the 'excellent' health profile; 45% are in the 'good' health profile, and 22% are in the 'fair' health profile.

**f. Income.** Regarding income, 27% Nunavimmiut who make less than \$20,000/year are in the 'excellent' health profile, compared to 35% in the 'good' health profile, and 38% in the 'fair' health profile. The difference between the percentage of those in the 'fair' health profile and those in the 'excellent' health profile is significant. As for Nunavimmiut who reported an annual income of or greater than \$20,000, 16% are in the 'excellent' health class, 40% are in the 'good' health class, and 44% are in the 'fair health class. There are significantly more Nunavimmiut with an income of or greater than \$20,000 that are in the 'fair' and 'good' health profiles relative to the 'excellent' health profile.

**g.** Community size. 41% of Nunavimmiut who live in a large community are in the *'excellent'* health profile; 35% are in the *'good'* health profile; and 24% are in the *'fair'* health profile. There is a significant difference between Nunavimmiut in the *'excellent'* and *'good'* health profiles relative to the *'fair'* health profile. A similar pattern is observed for Nunavimmiut living in small communities. 41% of Nunavimmiut who live in a small community are in the *'excellent'* health profile; 39% are in the *'good'* health profile; and 21% are in the *'fair'* health profile. There is a significant difference between Nunavimmiut in the *'excellent'* and *'good'* health profile; and 21% are in the *'fair'* health profile. There is a significant difference between Nunavimmiut in the *'excellent'* and *'good'* health profiles relative to the *'fair'* health profile.

h. Region Just as for Community size, within each region, there are significantly more

Nunavimmiut who are likely to be in the '*excellent*' and '*good*' health profiles than in the '*fair*' health profile.

Above, the different socio-economic characteristics of Nunavimmiut have been described by health profile (e.g., how many females are in each health class). Yet, this description does not reveal who, between the different categories of socio-economic characteristics (e.g., males vs. females), is more or less likely to be in the '*excellent*', 'good', or 'fair' health profiles. Similar to Figure 9, Figure 10 a), b), and c) illustrate the weighted proportions of the socio-economic characteristics of Nunavimmiut across the three wholistic health profiles.



Figure 10. Socio-economic characteristics of Nunavimmiut in the 'excellent' (a), 'good' (b), and 'fair' (c) health profiles (weighted proportions)

The y-axis is the weighted proportion of Nunavimmiut in each category of sociodemographic characteristics (represented on the x-axis). The corresponding percentage is also provided within each bar. The upper and lower confidence Interval (CI) are also presented using a horizontal error bar. Again, non overlapping CIs indicate that the percentages of Nunavimmiut within a category (e.g., females) is significantly different from the membership of the other category (e.g. males) in a specific health class.

The proportion of men and women in the 'excellent' health profile is similar. Most Nunavimmiut in the 'excellent' health profile are aged 31-54 years old, are in a relationship, working, have not completed their high school education, live in a large community and around the Hudson bay.

Now looking at those in the 'good' health profile, again, there is not significantly more males than females. Most Nunavimmiut in the 'excellent' health profile are aged 31 years and over, are working, have not completed their high school education, live in a large community and around the Hudson bay.

Lastly, those in the '*fair*' health profile are more likely to be females, aged 16-30 years old, single, working, have not completed their high school education, earn less than \$20,000 yearly, live in a large community and around the Hudson bay.

#### 7.4. Assessing the validity of the health profiles

As a form of face validity, a weighted proportion test was performed, using a question on SRH. Because of the low cell frequency of latent class members in certain answer categories (e.g., only 9 participants in class 2 answered *1-Excellent*), the question on SRH was recoded into a 3-category indicator, where Excellent/Very Good, Good, and Fair/Poor, are represented. The weighted proportion test revealed differences in how members of the 'excellent' 'good' and 'fair' health profiles rate their health.

Figure 11 depicts the weighted proportion of SHR by class membership. As illustrated in Figure 11, 55% of Nunavimmiut in the '*excellent*' health-class rate their health as 'Excellent/Very Good', compared to 31% of Nunavimmiut in '*good*' health-class, and to 14% of members in the '*fair*' health class. When looking at the proportion of Nunavimmiut with 'Good' SRH, there is little difference between members of the '*excellent*' health-class (37%) and those of the '*good*' health class (42%). However, there are noticeably fewer members of the '*fair*' health-class who

rated their health as 'Good' (21%). Lastly, there is little to no difference in the SRH of Nunavimmiut, either they be in the '*excellent*', '*good*', or '*fair*' health profiles. Indeed, 35% of Nunavimmiut in the '*excellent*' health class rate their health as 'fair/poor' compared to 34% in the 'good' health profile, and 32% in the 'fair' health profile.



Figure 11. Weighted proportion test of self-rated health by class membership

A multinomial regression was performed to look at the associations between wholistic health and SRH, while adjusting for individual-level socio-economic characteristics. The selection of variables to include in this model was informed by existing literature on factors known to have an impact on Inuit health and well-being, such as *age*, sex, employment, marital status, region, and community size (Inuit Tapiriit Kanatami, 2014; Muckle, Fraser, et al., 2020). Cross tabulations with Pearson chi-square tests (results of the cross tabulations not shown), further revealed that age and sex are confounding, as they are significantly related (p<0.05) to both the outcome (wholistic health) and the primary predictor (SRH). Employment, and marital status are significantly related (p<0.05) to wholistic health, but not to SRH. Similarly, but to lesser extent (i.e., with a 10% CI), region is related (p<0.1) to wholistic health, but not to SRH. Lastly, no variable was solely significantly related to SRH, meaning that there are no instrumental variables to be considered. In sum, age, sex, relationship status, employment, and community region are the variables that were included in the regression. No variables were correlated with each other above a value of 4, therefore there are no issue of multicollinearity (results of the correlation matrix not shown). Results of the standardized multinomial regression model using the wholistic health indicator (IQI)

as the dependent outcome, and self-rated heath as the primary predictor, adjusted for age, sex, employment status, marital status, community region, and community size, are presented in Table 8.

 Table 8. Standardized multinomial regression model of wholistic health as dependent outcome, and self-rated health, adjusting for covariates (N=1,159)

'Fair' health-class	'Excellent	t' health-class	'Good' ]	health-class
(Base outcome)	RRR	(95% CI)	RRR	(95%CI)
Self-Rated Health				
Fair/Poor (ref.)				
Good	2.17**	(1.38, 3.4)	2.28***	(1.52, 3.41)
Very Good/Excellent	5.02***	(2.97, 8.5)	2.30**	(1.31, 4.03)

Model adjusted for age, sex, employment, marital status, region, and community size. *Note.* \*\*\* p-value <0.000; \*\* p-vale <0.01; \* p-value <0.05; † p-value <0.1

In comparison to members in the 'fair' health-class, members in the 'excellent' health-class are 2.17 times more likely to rate their health as Good, and 5.02 times more likely to rate their health as 'Excellent/Very good' than they are to rate it 'Fair/poor' after adjusting for confounders. Similarly, members in the 'good' health-class are 2.28 times more likely to rate their health as Good, and 2.30 times more likely to rate their health as 'Excellent/Very good' than they are to rate their health as 'Excellent/Very good' health-class are 2.28 times more likely to rate their health as Good, and 2.30 times more likely to rate their health as 'Excellent/Very good' than they are to rate it 'Fair/poor', relative to members in the 'fair' health-class.

# 7.5. Associations of wholistic health and community-level social determinants of health

In terms of associations of the wholistic health indicator with community-level SDoH, three specific questions in *Q2017* relating to one's involvement at the community-level were of interest. Three separate regressions were conducted adjusting for age, sex, employment status, marital status, community size and region. The results of the three separate adjusted multinomial regression, are presented in Table 9. Relative to members in the 'fair' health-class, members in the '*excellent*' health-class are 3.89 times more likely to have participated in a cultural, community, or sport event 'always/often/sometimes' than 'rarely/never'. In addition, members in the '*excellent*' health-class are 3.76 times more likely of having volunteered always/often/sometimes' than 'rarely/never' relative to members in the 'fair' health-class. Last, members in the '*excellent*' health-class are 3.89 times more likely to have participated in local committee or board meetings 'always/often/sometimes' than 'rarely/never', relative to members in the 'fair' health-class.

				/ /
'fair' health-class	'Excellent	' health-class	'Good'	health-class
(Base outcome)	RRR	(95% CI.)	RRR	(95% CI.)
Participation in cultural, community,				
or sport event				
Rarely/Never (ref.)				
Always/Often/Sometimes	3.89***	(2.61, 5.81)	2.33***	(1.56, 3.48)
Volunteering				
Rarely/Never (ref.)				
Always/Often/Sometimes	3.76***	(2.60, 5.45)	2.25***	(1.58, 3.21)
Participation in local committee or				
board meetings				
Rarely/Never (ref.)				
Always/Often/Sometimes	2.45***	(1.70, 3.54)	1.77**	(1.21, 2.61)

Table 9. Standardized multinomial regression model using the health profiles as dependent outcome, and involvement at the community level, adjusting for covariates (N=1,169)

*Note. Each variable modelled in a separate regression model. Models are adjusted for* age, sex, employment status, marital status, community size and region \*\*\* p-value <0.001; \*\* p-value <0.01

Similarly, members in the 'Good' health-class are 2.33 times more likely to have participated in a cultural, community, or sport event 'always/often/sometimes' than 'rarely/never', relative to members in the 'fair' health-class. In addition, members in the 'Good' health-class are 2.25 times more likely of having volunteered always/often/sometimes' than 'rarely/never' relative to members in the 'fair' health-class. Last, members in the 'Good' health-class are 1.77 times more likely to have participated in local committee or board meetings 'always/often/sometimes' than 'rarely/never', relative to members in the 'fair' health-class.
### 8. DISCUSSION

Because of the complex nature of health, addressing health and well-being across different cultural and geographic settings requires the adaptation of models that encompass culturally defined conceptualizations of health and of its determinants (Richmond et al., 2013). The principal research question of this master's thesis was: How can a wholistic assessment of health based in Nunavimmiut knowledge be defined and developed? In such, a first objective was to operationalize a wholistic assessment of health and wellness based on the IQI model. As per the IQI model, physical health, well-being, quality of relationships, culture, and language represent interconnected principles that together, are at the foundation of health for Nunavimmiut.

LCA was applied to operationalize the IQI model of health. LCA is a method for identifying something that is unobservable, or 'latent' – in this case, wholistic health. This latent concept is comprised of several items that are observable – here, survey questions from Q2017 were selected based on their ability to best reflect the IQI model. Participants were then categorized into a certain latent profile based on their answers to the questions included in the analysis. The wholistic health profile was validated against a SRH question, and associations with community-level SDoH were made using multinomial regression models.

### 8.1. Summary of principal findings

The LCA revealed three distinct wholistic health profiles. Across all three, Nunavimmiut agreed that spirituality played an important role in their lives; that they had the chance to watch and learn Inuit skills while growing up, and reported having shared food with, or received food from, at least one household in the past 12 months. While these three factors are shared, members across each health profiles had differing characteristics.

The first health profile – or health-class – is comprised of 40.5% of the sample. Participants who were classified in this first health profile typically answered very positively to the 21 survey questions included in the LCA; it was named the *'excellent'* health-class. In the second health profile, members in class 2 would typically answer positively to the questions. Because of the tendency to endorse positive answers, class 2 was renamed *'Good'* health-class. Finally, the third health profile is comprised of 22% of the sample. Since class 3 participants had a tendency of answering more negatively, this health-class was renamed as *'fair'* health-class.

Once the wholistic indicator was operationalized and validated, the second research question of this master's thesis was: How does this indicator map onto individual and community-level social determinants of health (SDoH)? Hence, individual characteristics such as age, sex, relationship status, employment, community size and region, were selected to examine how these influenced wholistic health. As for the community-level SDoH, the impact of being involved at the community level on wholistic health was explored through separate multinomial regressions.

Members of the 'excellent' and 'good' health-classes were more likely to rate their health as 'excellent/very good' and 'good' relative to members in the 'fair' health-class. Age, sex, relationship status, employment, and community size also appeared to be factors influencing wholistic health. Members in the 'excellent' and 'good' health-classes were more likely to be older (aged 31 years and over), to be men, and to be in a relationship, relative to those in the 'fair' healthclass. Last, members in the 'Good' health-class were found to be more likely to be working and living in a small community, relative to members in the 'fair' health-class. No differences between health-class were revealed by region.

Finally, three separate multinomial regressions were performed to examine how 1) participation in cultural, community, or sport events such as a festival, dance, feast, Inuit games; 2) volunteering for a group, an organization, or community event such as a rescue team, church group, feasts, spring clean-up influences class membership; and 3) participation in a local committee or board meeting, influence health. While adjusting for age, sex, employment, relationship status, community size and region, members in the '*excellent*' and '*good*' health-class were more likely to have participated in a community event, to have volunteered, and to have participated in a local governance 'always/often/sometimes' rather than 'rarely/never', relative to members in the '*fair*' health-class. A gradient was observed, whereby members in the '*excellent*' health-class.

### 8.2. Interpretation of principal findings

### Class similarities

It is perhaps unsurprising that all three classes are characterized by a high propensity of endorsing a positive answer category for spirituality playing an important role, growing up watching and learning Inuit skills, and sharing/receiving food with at least one household, since the majority of participants answered positively to these questions in the first place. Among all 21 indicators included in the LCA, these three were the ones with the highest percentage (>78%, weighted) of participants answering the same answer category. Albeit these three indicators not distinguishing one class from another, this represents a positive outlook for health. Indeed, most Nunavimmiut, regardless of their health profile, agree with these aspects related to culture that are foundational to health and well-being, as described by the IQI model: spiritual values, growing up watching and learning Inuit skills, and sharing/receiving food. These questions all relate to connection to culture and cultural continuity, a well-established protective factor for health (Auger, 2016).

### Class differences

Members in class 1, namely the 'excellent' health class, typically endorsed very positive answers to elements corresponding to each facet of the IQI model: *Ilusirsusiarniq*, *Qanuinngisiarniq*, *Inuuqatigiitsiarniq*, culture and language. Speaking Inuktitut without difficulty relates to language; strongly agreeing with having close connections with Elders in the community corresponds to having connections to culture, as well as to *Inuuqatigiitsiarniq*; always having someone that shows them love and affection is linked to the concept of *Inuuqatigiitsiarniq*; being *satisfied* with their ability to perform daily activities relates to *Ilusirsusiarniq*; being very satisfied with their ability to go on the land, hunting, fishing, berry picking is linked to culture; having an *absence* of depressive symptom relates to *Qanuinngisiarniq*; and, being very satisfied with their ability to satisfy country food cravings relates to all foundational concepts of the IQI model. In such, the main characteristic of class 1 closely relates to having a positive, wholistic health, as described by the IQI model.

When looking more closely at the principal characteristics of class 2, namely the 'good' health class, elements corresponding to *Qanuinngisiarniq* and *Inuuqatigiitsiarniq*, as well as to culture are highlighted. Being able to bounce back quickly after a stressful event *quite* well speaks to the concept of resilience and is encompassed within *Qanuinngisiarniq*; being *satisfied* with their knowledge and skills of cultural and traditional activities, games, arts relate to culture; and *agreeing* with having strong connections with Elders in the community is also tied to culture and *Inuuqatigiitsiarniq*. Therefore, while language and *Ilusirsusiarniq* are not represented in any of

the 'typical' characteristics of members in class 2, positive links to culture, *Qanuinngisiarniq* and *Inuuqatigiitsiarniq* are apparent in this class.

Last, members in class 3, namely the 'fair' health class, was revealed to have lower levels of community cohesion; family relationships; and emotional support. These three elements broadly relate to *Inuuqatigiitsiarniq*, or rather to a lack thereof. The absence of emotional support and social relationships at the family and community-level represents an important barrier to health and well-being, as the quality of social relationships with the people sharing the same place is foundational to health.

#### Wholistic health and individual socio-economic characteristics

While there is a higher percentage of Nunavimmiut aged 16-30 and 31-54 years old in the '*excellent*' and '*good*' health profiles (Figure 10a, 10b), youths and young adults aged 16-30 years old are not more or less likely to be in the 'excellent' 'good' or 'fair' health class (Figure 9b). The low percentage of Nunavimmiut aged 55 years and over in the '*excellent*' and 'good' health profiles may be due to the overall smaller number of individuals aged 55 years and over, who represent only 17% of the total population in Nunavik (Riva et al., 2020b) However, by only looking at the adults in the 55 years and older age group, 55% of Nunavimmiut in this age group are in the '*excellent*' health class, followed by 30% in the 'good' health class, and only 10% in the '*fair*' health class. Similarly, adults aged 31-54 years old are more likely to be in the '*excellent*' and 'good' health profiles than they are to be in the '*fair*' health profile.

Within each age group (Figure 9b), Nunavimmiut aged 31-54 and 55 years and over are more likely to be in the '*excellent*' and '*good*' health profiles. This perhaps represents greater levels of cultural and self-continuity, which have been established as protective factors for health (Chandler & Lalonde, 1998), among adults and Elders. Echoing this finding is a study conducted among Alaska Natives, which highlighted generational differences in the perceptions and connections to culture (Wexler, 2014). In this study, Elders spoke about culture as transcending time and space, allowing them to link notions of self as part of a greater whole. This allows them to understand and overcome their problems, as these are part of collective experiences. "Through this lens, adults and Elders see themselves as capable actors who draw strength, resources, and skills from those who came before them" (Wexler, 2014, p. 86). Conversely youths spoke of connection to culture as a limited set of skills, and linked current issues to personal problems and

family hardships, rather than to a shared vision of the past and future rooted in Inupiaq values in traditions (Wexler, 2014). These results are congruent with the findings of the present study, whereby the '*fair*' health class, is characterized by lower levels of emotional support, family relationships and community cohesion. In sum, fostering notions of self that are rooted in culture can be a protective factor for youths' health as they enter adulthood, for culture provides a greater sense of self, belonging and purpose, and can help overcome challenges in the tumultuous life stage that is adolescence.

There are more women in the '*fair*' health class than there are males (Figure 9a) are. This contrasts with findings of previous studies conducted on the disruption of traditional roles brought forth by colonial policies aiming to suppress Indigenous Peoples' culture (Kirmayer et al., 2000). The social role of women has been impacted to a lesser extent than that of men, for women remained involved in traditional practices including child-rearing, work, and school. In contrast, the traditional role of men was largely severed by the limited opportunities offered in many communities (Kirmayer et al., 2003). Nonetheless, the multiple roles that women have to fill may still represent an important source of strain (Kirmayer et al., 2000). On the other hand, sexism may also influence the observed difference between men and women and wholistic health. In interviews about contaminant decision-making conducted with women in Inukjuak, many felt that "women's voices are not heard clearly because we are women" (Kafarowski, 2008, p. 192). This highlights persistent inequities between gender, for the decision-making power between women and men is not equally valued.

Looking at Nunavimmiut who are in a relationship, there are significantly more individuals in the '*excellent*' and '*good*' health class than there are in the '*fair*' health class (Figure 9c). Moreover, the '*excellent*' health profile is characterized by 60% of Nunavimmiut who are in a relationship, while the '*fair*' health profile is comprised of 64% of Nunavimmiut who are single (Figure 10a and 10c)This aligns with the IQI model, whereby the quality of social relationships is a fundamental to being healthy and well. Previous studies have identified the importance of social support (i.e., positive social interaction, emotional support, tangible support, and affection and intimacy) for thriving health among Inuit and Métis (Richmond et al., 2007). Among these 4 types of social support, affection and intimacy is one that may most often be provided by a significant other. This finding aligns with Richmond's previous work, which highlighted that Inuit who were unmarried were less likely to report high levels of social support (Richmond, 2009). However, Nunavimmiut in the '*excellent*' and '*good*' health class are also, and therefore may be more susceptible to being in a relationship, thereby influencing the significance of this finding.

Across all health profiles, the majority of Nunavimmiut have not completed high school (Figure 10a, 10b, 10c). This finding is not surprising in that 60.5% of the population in Nunavik did not complete their high school education (Riva et al., 2020b). Educational attainment has nonetheless increased from 55.6% since the previous health survey conducted in 2004, (Riva et al., 2020b). Similarly, across all health profiles, there is a higher proportion of Nunavimmiut who are working. However, the difference between those who are employed and unemployed is no longer significant for Nunavimmiut in the '*fair*' health profile, as the CI overlap (Figure 10c). These higher percentages of employment across all three health profiles are likely since 45.4% and 19.6% of Nunavimmiut reported working full or part-time with a salary. Lastly, differences in income are only significantly different in the '*fair*' health class, whereby 65% of Nunavimmiut in this health profile earn an annual income of less than \$20,000\$. This points towards the importance of income for Nunavimmiut in the '*fair*' health profile, as the difference is significant for people in this health class, but not for those in the '*good*' or '*excellent*' health class.

As for characteristics related to community size and regions, Nunavimmiut living in large communities (Kuujjuaq, Salluit, Puvirnituq, and Inukjuak) and on the Hudson coast (Kuujjuarapik, Umiujaq, Inukjuak, Puvirnituq, Akulivik, Ivujivik, and Salluit) are found across all three health profiles (Figure 10a, 10b, 10c). Therefore, because these proportions are consistently similar across all three health profiles, no conclusions as to the importance of community size and region for wholistic health can be reached.

### Wholistic Health vs. Self-rated health

Another interesting finding lays in the tests of association performed between the covariates and the primary predictor (SRH), as well as with the outcome of interest (wholistic health). Most covariates were significantly associated (p-value <0.05) with the wholistic assessment, but not with SRH, therefore making these variables predictors of wholistic health, but not of SRH. The only variables that were confounding (i.e., associated with both wholistic health and SRH) were age and sex. Overall, results confirm the hypothesis that individuals who are in better health, assessed wholistically, have better SRH. Yet, when looking at 'poorer' ratings of SRH, there seems to be no significant difference across the three health profiles since the

confidence intervals for all three classes overlap. This means that there are similar proportions of people reporting poorer SRH across the *'excellent' 'good'* and *'fair'* health profiles.

Conceptualizations of health influence how different people rate their health. A qualitative study conducted in Michigan revealed differences in individuals' frames of references when they have to rate their health (Krause & Jay, 1994): Some people think about the *presence* of health problems, while other think about the absence of health problems. Others refer to their capacity to physically function, and some to their general physical conditions (Krause & Jay, 1994). In Krause & Jay's work, other frames of reference for assessing one's own health included a person's energy level, their positive or negative health behaviours, mental health comparison, or their general mental health. This study further concluded that how people thought about their health varied by ethnic group: White individuals were more likely to base their SRH assessment on physical functioning, while most Hispanics and Black people thought to use health problems as a referent. Indeed, evidence from a literature review on SRH and ethnicity "suggests that ethnic groups differ in their self-perceptions of health, their conceptualization of what constitutes health, and the determinants that factor into their self-assessments of health" (Bombak & Bruce, 2012, p. 1). While this diversity has been cautioned to be taken into account in cross-national, ethnic, minority and Indigenous comparisons (Bombak & Bruce, 2012), the ability of SRH to appropriately reflect different conceptualizations of health within different Indigenous groups has not been studied. Therefore, while SRH is a widely used measure of health and health-related quality of life, it remains a subjective assessment, meaning that response categories can be interpreted differently (Anderson & Thompson, 2016). In this context, SRH may not be fully measuring wholistic health, as defined by the IQI model.

### Class membership and community-level SDoH

The wholistic assessment of health highlighted the relationship between community participation and social connections. Nunavimmiut in the 'excellent' and 'good' health class revealed to be more likely to have been involved at the community level (through participation in events, volunteering, or participation in local governance). This finding points to the importance of social interactions as a protective factor for health. Previous work has demonstrated that individuals build up their social "stocks" through social interactions and community participation (Biddle, 2012). Having strong social ties also encourages the participation of community members

in health-promoting activities (Richmond, 2009). This may explain the 'typical' characteristics of members in the '*fair*' health class, which included reporting lower levels of emotional support, of family relationships and of community cohesion.

### 8.3. How is this useful for the NRBHSS?

Through a strength-based and culturally appropriate approach, the IQI model was used to operationalize a wholistic assessment of Nunavimmiut health. This tool allowed to study the individual and community-level determinants of health in Nunavik. The wholistic assessment of health, which is a categorical variable with three categories (1-*'excellent'*, 2-'good', and 3-'fair') will be shared and integrated into the Q2017 database. This will allow for future work to use this variable in other analyses relating to Nunavimmiut health.

Results of this master's thesis point towards the protective factors of social connections and the participation of individuals in community activities as protective factors for health. Through community events, connections between an individual and the community may be fostered, as establishing these connections "provides opportunities for the development of social supports" (Richmond et al., 2007). Fostering healthy relationships at the family and community scale are of fundamental importance, as those in *'fair'* health profiles tend to report lower levels of family relationships, emotional support, and community cohesion.

### 8.4. Wholistic assessment of health vs single outcome indicator

Conducting this analysis was very complex; the interpretation of the IQI model, the selection of survey variables, the numerous decisions regarding variable transformations, and the development and interpretation of the LCA required a tremendous amount of work. With all of this being done, few questions come to mind: Was this all worth it? What do we gain from using a wholistic assessment of health rather than a single outcome indicator?

Thinking of the broader implications of this work, the operationalization of a wholistic assessment of health allowed for quantitative analyses to be culturally grounded in an ethnomedical model of health. This type of method can be applied in other Indigenous contexts, that have other culturally developed models of health. When thinking about it this way, then yes, operationalizing the IQI model of health was worth it, as it is a way for quantitative research to acknowledge and incorporate wholistic conceptualizations of health.

Nonetheless, there are ways in which such analyses could be improved. For one, health surveys ought to co-develop and incorporate questions directly related to cultural definitions of health. For example, only two questions were found to specifically address *Ilusirsusiarniq*, as no questions relating to the body being able to follow a normal progression through growth and age were in the survey. Thus, by intentionally incorporating questions on the foundations of health into a health survey, the process of selecting these variables for subsequent analyses is made much easier. In the context of this master's thesis, the IQI model did not directly inform the health surveys. To compensate for this, twenty-one categorical indicators were selected to make sure that every facet of the IQI model and its interpretation much more complex. Thus, as informative as this study could be, there is room for improving the ways in which quantitative and qualitative analyses can inform and benefit each other.

### 8.5. Strengths and limitations

### 8.5.1. Strengths

The operationalization of the wholistic assessment of health was possible thanks to the scope of the Q2017 health survey. The survey comprised of hundreds of questions related to Nunavimmiut health and well-being, and over 1300 individuals participated in this study. Without the breath of available data and the large sample size, conducting this exploratory study would not have been feasible. For quantitative research to be culturally grounded, health surveys should include questions central to the conceptualizations of health and of the SDoH of the target population. By collaborating with community members, future researchers can thus develop more rigorous indicators of wholistic health.

The use of a multidisciplinary, intersectoral and cross-cultural committee was a strength of the study. Researchers from a range of fields, including Geography, Nutrition, Statistics, and Anthropology, provided scientifically-sound and theory-driven advice to connect the concepts described by the IQI model to available variables, and to inform model building. Inuit and First Nations committee members also provided invaluable input on how to integrate Indigenous Knowledge into this cross-sectional analysis.

Due to the interconnectedness of many survey variables related to the IQI model, techniques to reduce the final number of indicators included in the LCA were used. For example, factor analysis was employed to find variables related to a same construct (i.e., family relationships, emotional support, and community cohesion). This enabled respect of the integrity of the IQI model, while easing its estimability and interpretability. In addition, this study conducted a rigorous analysis to choose the optimal number of classes. This study reported multiple goodness-to-fit statistics (i.e., AIC, BIC, SABIC) and likelihood-based tests (VLMR, LRT) in order to choose the optimal model.

#### 8.5.2. Limitations

The many details and nuances provided by the descriptions of the foundational concepts of the IQI model were oftentimes not captured by survey questions. This made the task of selecting indicators best reflecting the IQI model quite arduous. Consequentially, finding and selecting variables that best 'correspond' to the different facets of health required a lot back and forth between the health questionnaires and the community component report. One reason behind the 'misalignment' of the survey and the IQI model may be due to the nature of the data collection itself. During the Q2017, qualitative and quantitative data collections were conducted independently and, for the largest part, concurrently with the administration quantitative health questionnaires, although some questions derived from initial community workshops were included in the survey. Consequently, the health questionnaires did not necessarily ask questions that accurately reflected the foundational health concepts of the IQI model. The indicators had to be selected while keeping with this methodological misalignment in mind.

Although there is no optimal number of indicator variables for LCA, many studies limit the numbers of indicators included (e.g. between 6 and 12) as well as the number of response categories of each indicator (i.e. binary indicators are preferred) included to ease estimability and identifiability of the model (Masyn, 2013). In this case, only 4 indicators were binary; 5 indicators had 3 categories of answers, 11 indicators had 4, and 1 indicator had 5. Being mindful of the implications of culture and language, variable transformations were kept to a strict minimum in order to reflect the authenticity of participant answers. This rendered the interpretation of class homogeneity and class separation harder, as the propensity of endorsement was split between multiple categories for every indicator included. In addition, few variables included uniquely describe every element of the IQI mode. Therefore, future studies aiming to base quantitative analyses on qualitative works should consider employing an exploratory sequential design, as the development of key survey variables to be included in quantitative questionnaires can be tailored to the qualitative findings.

When considering methodological implications, the choice of community-level SDoH was limited, given the wholistic nature of the indicator of health. For example, the question on one's ability to go on the land, hunting, fishing, or berry picking is considered as a SDoH related to one's access and use to the land. However, this same question is also a foundational aspect of health and well-being, due to the importance of the land in Inuit culture. This question was therefore included in the wholistic assessment of health. Using it again in regression models would not be methodologically sound. Hence, these three questions on social participation were selected because of the interconnectedness of many SDoH with the foundational concepts of health described in the IQI model, as well as the availability of survey questions in the Q2017 health survey.

### 9. CONCLUSION

Quantitative analyses were grounded on a locally developed model of health to understand health wholistically among Nunavimmiut. This is the first study to provide a wholistic assessment of Nunavimmiut health across different age groups. Two research questions guided the thesis: How can a wholistic assessment of health based in Nunavimmiut knowledge be defined and developed? How does this assessment map onto individual and community-level social determinants of health (SDoH)? Specific research objectives were to: 1) Operationalize a wholistic assessment of health and well-being, 2) Assess construct validity with an available survey question on self-rated health, and 3) Explore the relationship between individual and community-level SDoH and wholistic health.

Exploring ways to operationalize culturally relevant health and well-being indicators has the capacity to reflect the wholistic conceptualizations of health of Nunavimmiut. Indeed, research can build on western and traditional knowledge systems to "reach more comprehensive understandings of health and illness" (Durie, 2004, p. 1138). Non-Indigenous researchers have the responsibility to recognize and incorporate Indigenous models of health on research specifically focusing on Indigenous health and well-being. In this study, LCA allowed for an unobservable construct (i.e., wholistic health) to become an indicator of health that could be used in subsequent analyses. By doing this, the SDoH were studied in relation to wholistic health, rather than with a single variable representing one dimension of health. Understanding how wholistic health relates to individual community-level SDoH can inform frameworks for promoting and supporting regional and community-based public health interventions, services, and programming.

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### **11. APPENDICES**

# Appendix A. The foundational concepts of the IQI model of Inuit health and well-being

Excerpt from the Community Component Report (Fletcher et al., 2021, pp. 10–11)

The opening statement that we heard on the first day of the workshops and that has been reaffirmed throughout the Community Component process is that language (uqausiq) and culture (iluqiutiq/piusiq) are the foundation of health for Inuit. They form the basis of identity and emerge from a way of living as Inuit that is present in the memory, the values, the bodies, and the practices of people in Nunavik. While much has changed in recent generations - living in permanent communities being the most obvious example – a fundamental and enduring way of being together prevails. The term piusiq encompasses the idea of community life or the behavior of the community. More precisely, nunaliup piusinga translates into ways of doing that belong to the community. These include every aspect that keeps the community well by helping it to work together. Nunaliup plusing represents the way of life or the "core of things" and refers to both the strengths and values of the community and how these are known and shared. Iluqiutiq is a second term that refers to culture and it involves ways of thinking, acting, and doing that are specific to Inuit. Together piusiq and iluqiutiq constitute an Inuit frame of reference for experiencing health and well-being. Language serves to situate people in relation to each other in the community and allows people to share experiences and internal and subjective states. Through language, people organize and recognize each other as sharing Inuit identity and ways of being. For many people, the true feelings of experience, joy and hurt, as well as the meaning of life can best be expressed in Inuktitut. Locating health in language concepts allows an Inuit experience of health to inform the analysis of the Community Component. This opens up the possibility of describing health in ways that contrast with the prevailing "Western" vision of the health care system, structured as it is according to southern provincial and national norms. A great deal of information was shared during the community workshops and from this, three key concepts that describe different scales and orientations of health were identified. These are ilusirsusiarniq, ganuinngisiarniq, and inuuqatigiitsiarniq. These terms have been explored in depth with Inuktitut language experts in

Nunavik. The model and terminology were also verified with people of Kangiqsujuaq and Puvirnituq during the validation phase.

**Ilusirsusiarniq** is a broad term that relates to the body. The root ilusiq is widely recognized and is used regularly in everyday discourse in Inuktitut; it is also commonly found in publications from health authorities. In an Inuit model of health, the body is imbued with strength and capacity through the energy and nourishment of blood-rich animals. The blood of a person carries energy through the body allowing him or her to feel strong and to be active. Conversely, feelings of tiredness, lassitude and disinterest are often attributed to a reduction of energy in the blood that requires good country food to be replenished. Favored and sought-after animal foods (seal liver, fresh meat, mattaq, dried caribou, etc.) all replenish the blood, bringing vitality back to the person. Gaining access to energy-rich food requires that people are successful in hunting and that the catch is shared – in other words, that they engage in social actions that link the body to networks, other people and ways of doing. Also embedded in the term ilusirsusiarniq is the sense of "things taking their intended form," a concept which presumes that health is the normal state of human beings from birth onwards. It is an unfolding of an inherent potential within every person as they grow and age. The ability to work, to use the body for its intended functions, to learn and master skills, and to do what needs to be done to live are all features of that condition. Ilusirsusiarniq includes a sense of inevitability about some health events that may seem like fatalism to non-Inuit but that is better pictured as being part of a person's normal progression along the path of life. The body gets weaker with age, and people need more help from family and friends. This is normal and even a rewarding time in that the social world can compensate and mitigate bodily health problems. Regardless, ilusirsusiarniq is a conceptualization of health that is normal and not "earned" or achieved, that reflects an openness to differences between bodies and people, and which is understood to be beyond human control, and which thus calls for humility in the face of disease and infirmity.

The second term **qanuinngisiarniq** is quite broad in meaning. It encompasses feelings of being comfortable, content, and without worries or pain. The term is framed as a negative (-ngi-), which conveys the sense that the absence of pain or being unaware of pain, difficulty or troubles is a state of well-being. People experience qanuinngisiarniq when they are able to move forward with what they are doing with fluidity and ease and can feel fully relaxed in their homes and lives. The term is often translated as "well-being" in English, but it encompasses a broader semantic

scope of experience that includes mental, physical, and social states respectively; to be unworried, to feel comfortable, and to be happy and comfortable with others. Thus, freedom from the emotional distress caused by grief or adverse life experience, or simply the capacity to relax after a day of work is one facet of qanuinngisiarniq; the satisfaction of eating a good meal and of plenitude, warmth and energy (aqqiatuq) is another. Finally, to share in a joy-filled afternoon picking berries with friends laughing and conversing, or simply having loved ones around are also experiences of qanuinngisiarniq.

The final term of the model, **inuuqatigiitsiarniq**, refers to harmonious relations among people who share a place. An always important consideration for Inuit, the quality of relations with family, friends, neighbors, and people within the community (including non-Inuit) is a key dimension of the lived experience of health. Inuuqatigiitsiarniq is seen in the close attention given to the quality of relations at work, in the home and in the community generally. There is an appreciation for being together in a way that is comforting, supportive and productive. Tensions that emerge between people can cause ripple effects of discomfort, sadness, anger, and frustration among those who are affected by them. Conversely, when relations are comfortable and fluid, much can be accomplished with ease and people may share joy. At the household level, the relations of couples and their ability to work as a family across generations is part of this quality of social health. Likewise, the capacity of a municipality to have productive employees who provide the needed services of a community and to work well amongst themselves is characteristic of inuuqatigiitsiarniq. On a broader scale, the sense of being well represented by political, regional, and intergovernmental relations that bring effective responses to the evolving needs and aspirations of Inuit are also encompassed by the term. In the everyday life of people in communities, inuuqatigiitsiarniq is most often reflected in the sense of knowing and trusting people in the community, of recognizing each other and working well together. In the time before the establishment of permanent communities, inuuqatigiitsiarniq was a quality that individual camp and family group leaders would work to instill amongst people. This is still the case today, but the density of relations is broader and community members are much more numerous and diverse than in the past. The principle of inuuqatigiitsiarniq remains a major feature of the Inuit conception of community health.

### Appendix B. Rationale for indicator selection

### 1. How safe do you feel in your daily life?

The construction of the word Inuuqatigiitsiarniq translates to "The act of living harmoniously and well together as people" (p.12). Therefore, feeling safe is important for people to be healthy and well.

### 2. Do you have enough energy for everyday life?

Having enough energy is closely tied to the principle of ilusirsusiarniq. Feeling *strong* and *active* is tied to the energy provided by country food (p.10). This survey question was selected because it reflects an important aspect of health - having enough energy – which is also the opposite of feelings of "tiredness, lassitude, and disinterest [that] are often attributed to a reduction of energy in the blood" (p.10). In sum, this question reflects "the state of habitually and normally feeling good in one's body and physiological state" (p.12).

### 3. How satisfied are you with your ability to perform your daily living activities?

"The ability to work, to use the body for its intended functions, to learn and master skills, and to do what needs to be done to live are all features of [ilusirsusiarniq] ('bodily health')" (p.10). Therefore, this question was included because it reflects one's ability to go about life. This question also relates back to *ilusirsu* (Table 1) which is "to engage in a habit, or be in any physiological state", as well as to *tsiaq*-, which is a part of Qanuinngisiarniq, and means "to do something well, in a good manner" (p.12).

## 4. To what extent do you feel that physical pain prevents you from doing what you need to do?

This question is related to Ilusirsusiarniq because it reflects "The state of habitually and normally feeling good in one's body and physiological state" (p.12). Moreover, albeit being posed in a way that asks about *physical pain* specifically, this question is also related to qanuinngisiarniq for this broad term also encompasses physical and social states of being." The term is often translated as "well-being" in English, but it encompasses a broader semantic scope of experience

that includes mental, physical, and social states respectively [...]. (p.11).

### 5. How often do you find that you have someone to have a good time with?

This question was included because it is important for Qanuinngisiarniq and Inuuqatigiitsiarniq. The term is constructed with *-qatigi-*, which means together (do, be together), as well as with *tsiaq-*, which means to do something well, in a good manner. In such, the construction of the term Inuuqatigiitsiarniq means "the act of living harmoniously and well, in a good manner" (Table 1). Furthermore, "to share in a joy-filled afternoon picking berries with friends laughing and conversing [...] are also experiences of qanuinngisiarniq" (p.11). Therefore, the social world is intrinsic to qanuinngisiarniq, justifying the importance of including questions on social connection.

#### 6. How often do you have someone who shows you love and affection?

This question was included because it was described as an important facet of Qanuinngisiarniq: "[...] having loved ones around are also experiences of qanuinngisiarniq" (p.11). This question further reflects the importance of social support to be healthy and well.

### 7. I feel like I belong in this community

Feelings of belonging extend to a person's relationship with the people surrounding them. "Inuuqatigiitsiarniq refers to harmonious relations among people who share a place" (p.11). In such, the "quality of relations with family, friends, neighbors, and people within the community (including non-Inuit) is a key dimension of the lived experience of health" (p.11). In sum, living harmoniously with the people sharing the same place influences feelings of belonging.

### 8. How satisfied are you with: Your ability to satisfy country food cravings?

Country food is a fundamental aspect of all facets of Inuit health. First, when describing Ilusirsusiarniq, "the taste of food and being able to satisfy cravings for specific animal parts and preparations of traditional foods are an important part of maintaining a strong body and a healthy sense of well-being" (p.16). Not only is country food important for ilusirsusiarniq and qanuinngisiarniq, but "gaining access to energy-rich food requires that people are successful in hunting and that the catch is shared – in other words, that they engage in social actions that link

the body to networks, other people and ways of doing" (p.10). The physical, psychological, and social benefits brought by the consumption of country food is deeply rooted into culture, and is important for ilusirsusiarniq, qanuinngisiarniq and Inuuqatigiitsiarniq.

## 9. How satisfied are you with: Your knowledge and skills of cultural and traditional activities, games, arts?

This question speaks to one's connection to culture, which is at the foundation of Inuit health. "Maintaining strong bonds with Inuit traditions" is mentioned as "a pathway to collective health and well-being" (p.16). Therefore, the inclusion of a survey question speaking to one's own satisfaction with their knowledge and skills of cultural and traditional activities, games and arts reflects the cultural facet of the IQI model, which is at the foundation of health for Inuit.

## 10. How strongly do you agree with the following statements: I have close connections to elders in my community?

Connecting with Elders was mentioned by a participant as a means to "emphasize culture". Moreover, "the youth strongly believe that if they are taught their culture and identities, they would have more power to say 'Ok, here is who I am and I am representing myself..' We want them to be confident" (p.15). Hence, this question about one's connection to Elders is a pathway towards empowerment, as well as a way promote culture and Inuit identity.

### 11. Community cohesion scale

"Inuqatigiitsiarniq refers to harmonious relations among people who share a place" (p.11). In such, the "quality of relations with family, friends, neighbors, and people within the community (including non-Inuit) is a key dimension of the lived experience of health" (p.11). The concept of Ilusirsusiarniq is also linked to social connections: "The body gets weaker with age, and people need more help from family and friends. This is normal and even a rewarding time in that the social world can compensate and mitigate bodily health problems. In such, social support is "intrinsic to bodily health" (p.23). Not only is social cohesion and support important for ilusirsusiarniq ('well-being') (p.11). Last, "In the everyday life of people in communities, inuuqatigiitsiarniq is most often reflected in the sense of knowing and trusting people in the

community, of recognizing each other and working well together" (p.11). Therefore, community cohesion is important to maintain a state of health, which justifies the inclusion of these three items. Questions included in the social cohesion scale include: (1) There is a feeling of togetherness or closeness in this community; (2) People in this community help others; (3) People in this community can be trusted.

### 12. Family relationships scale

The "quality of relations with family, friends, neighbors, and people within the community (including non-Inuit) is a key dimension of the lived experience of health" (p.11). Moreover, "At the household level, the relations of couples and their ability to work as a family across generations is part of this quality of social health" (p.11). The community component report also states that family cohesion supports bodily health, as it is a way to have access to some necessities of life. Furthermore, "Family harmony supports well-being, as it creates a safe environment where people can find emotional support and peace of mind, in addition to feeling loved, cared for, welcome and appreciated" (p.23). In such, the quality of relations with families is "a key dimension of the lived experience of health." (p.11). Therefore, the 6-item Brief Family Relationship Scale (BRFS) was included in the LCA, as it reflects Inuit health and well-being.

In sum, the BRFS is comprised of the following items: (1) In my close family, we really help and support each other; (2) In my close family, we spend a lot of time doing things together at home; (3) In my close family, there is a feeling of togetherness; (4) I am proud to be a part of my family; (5) In my close family, we really get along well with each other; (6) In my close family, we spend a lot of time together on the land.

### 13. Emotional support scale

Emotional support is also important for qanuinngisiarniq: "to be well, people need to feel welcome, respected, safe, and comfortable enough to express their feelings" (p.21). Respondents mentioned that a "healthy community has people who visit each other, look out, help and care for others, are aware of what is going on and are ready to intervene if something goes wrong" (p.22). Therefore, this scale was selected because it relates to the importance of the social world to be healthy and well.

#### 14. How often do you visit or get visited?

"Respondents mentioned that a healthy community has people who visit each other, look out, help, and care for others, are aware of what is going on and are ready to intervene if something goes wrong" (p.22). Therefore, this question was selected because it relates to Inuuqatigiitsiarniq, as the importance of the social world is fundamental to be healthy and well.

## 15. *How satisfied are you with your ability to go out on the land, hunting, fishing, berry picking?*

Going out on the land is fundamental to culture, and is important for all facets of health, as per the IQI model. The community component report also states that "picking berries with friends" represents an experience of qanuinngisiarniq. Moreover, "going on the land is a fundamental component of Inuit social life. The land is a place where families and community members spend quality time together, strengthen ties, share stories, and teach and learn the many skills of an Inuit lifestyle" (p.32). Because this question represents a facet of cultural and social connectedness, it was selected for the operationalization of the IQI model.

## 16. Tell us how much the response describes you well... I tend to bounce back quickly after hard times

This question speaks to the concept of resilience, which is an important facet of Nunavimmiut collective identity. "[...] Inuit have shown great resilience in the face of historical and ongoing pressure to change. [...] This ability to overcome challenges is increasingly recognized within Nunavik as part of an Inuit collective identity. The accomplishments that have been made make people extremely proud." (p.26). This question was included to reflect culture, which alongside language, "form the basis of identity and emerge from a way of living as Inuit that is present in the memory, the values, the bodies, and the practices of people in Nunavik" (p.10).

### 17. How well can you speak Inuktitut?

Language, alongside culture, represents the foundation of health for Inuit. "Language serves to situate people in relation to each other in the community and allows people to share

experiences and internal and subjective states. Through language, people organize and recognize each other as sharing Inuit identity and ways of being. For many people, the true feelings of experience, joy and hurt, as well as the meaning of life can best be expressed in Inuktitut" (p.10).

### 18. When growing up, did you have the chance to watch and learn Inuit skills?

A positive connection to culture, which represents the foundation of health, "usually develops during childhood" (p.26). Thus, this survey question relating to one's ability to connect to their culture as a child, reflects this aspect.

### 19. Do spiritual values play an important role in your life?

Faith and spirituality create "a sense of peace, a sense of calmness," and even if religious practices differ from one person to another, they tend to provide comfort and support" (p.39). Therefore, this question was included in the operationalization of the IQI model, as it reflects a facet of qanuingisiarniq.

### 20. In the past 12 months how many different households have you received food from, or have you given food to?

"Sharing food is perceived as one of the most important Inuit values and practices. Respondents noted that both giving and receiving food were gratifying because they demonstrate love and mutual support." (p.29).

### 21. Center for epidemiological studies-depression 10 item scale (CESD-10)

The CESD-10 item scale was included to assess the absence of depressive symptoms in a person, because "freedom from the emotional distress [...] is one facet of qanuinngisiarniq" (p.11). To assess psychological distress (or the absence thereof), the Q2017 health survey used the 10-item version of the Center for Epidemiologic Studies Depression Rating Scale (CESD-10) (Hamel et al., 2020). This scale, which has been addressed as having strong psychometric properties for identifying individuals suffering from depression (Björgvinsson et al., 2013), has previously been validated in a North American Indigenous adolescent population (Armenta et al., 2014). Items in the CESD-10 Scale include: (1) I was bothered by things that usually don't bother me; (2) I had trouble keeping my mind on what I was doing; (3) felt depressed; (4) I felt that

everything I did was an effort; (5) I felt hopeful about the future; (6) I felt fearful; (7) My sleep was restless; (8) I was happy; (9) I felt lonely; (10) I could not get going.

In conclusion, this section explains the rationale behind the selection of the 21 final indicators included in the operationalization of the IQI model of Inuit health and well-being. Survey questions relating to the Inuktitut *terms Ilusirsusiarniq*, *Qanuinngisiarniq* and *Inuuqatigiitsiarniq*, as well as to culture and language were selected based on their definitions and descriptions provided by the Q2017 community component report.
## Appendix C. Exploratory and Confirmatory Factor Analysis

### Exploratory Factor Analysis

As by its name, exploratory factor analysis aims to explore, or to "discover the nature of constructs influencing a set of responses" (DeCoster, 1998, p. 1). In other words, the aim is to test whether a set of survey questions 'hang together' to describe a common construct.

In Q2017, six question about support (either it be from family, friends, neighbors, or coworkers), four questions on community life, and six questions about family relationships (five were from the brief family relationship scale, and an additional question was added to adapt the scale to Inuit culture) were asked to participants (Table 10). To examine if the answers to these questions were influenced by an underlying construct (i.e., social support, community cohesion, and family relationships), an EFA was first conducted in *Mplus* version 8.6 (1998-2021 Muthen & Muthen) on these 16 variables.

#### Table 10. Survey Questions included in EFA

Questions on Support

- 1. How often do you find that you have someone to have a good time with?
- 2. How often do you have someone to talk to if you feel troubled or for some reason need emotional support?
- 3. How often do you have someone you can count on when you need advice?
- 4. How often do you have someone you can count on to listen to you when you need to talk?
- 5. How often do you have someone to take you to the doctor or another health professional if you need it?
- 6. How often do you have someone who shows you love and affection?

Questions on family relationships:

- 1. In my close family, we really help and support each other
- 2. In my close family, we spend a lot of time doing things together at home
- 3. In my close family, we spend a lot of time doing things together on the land
- 4. In my close family, there is a feeling of togetherness

Questions on community cohesion:

- 1. There is a feeling of togetherness or closeness in this community
- 2. People in this community help others
- 3. People in this community can be trusted

Three factors are shown in Table 11 below, as these were the only ones with eigenvalues >1 (as per Kaiser's rule). Overall, the fit statistics of the model are acceptable. Without solely relying on the Chi-Square test results (which rejects the model, at a p value of 0.0013), the RMSEA (0.021), CFI (0.993) and TLI (0.989) are all in acceptable ranges, indicated good model fit.

Factor 1 seems to be tapped by three of the six elements relating to social support, as these indicators show high factor loadings ( $\geq 0.6$ ). This value represents the threshold as a rough and ready decision rule, as there is no established cutoff value. These correspond to having someone to talk to, having someone you can count on, and having someone that can listen to you. Factor 2 seems to be tapped by elements relating to family relationships, as these indicators show high factor loadings ( $\geq 0.6$ ). Five of these six indicators are part of the original Brief Family Relationship scale (BFRS) and an additional question (spending time on the land with your close family) was added in the survey to include a component relevant to Inuit specifically. Last, factor 3 appears to be about community cohesion, as these 4 indicators have high factor loadings ( $\geq .6$ ). The only indicators that do not 'hang' together with any of the three factors are: sm1\_love, sm1\_dctr, sm1\_good\_time, and comm\_belong. These variables have a factor loading  $\geq 0.6$  and therefore will not be retained in the CFA, which is conducted to confirm that these 12 indicators are well suited to fit the model.



Model fit statistics:

Chi-Square: 117.118 (.0013) RMSEA: 0.021 CFI: 0.993 TLI:0.98

Table 11. EFA factor loadings

GEOMIN ROTATED LO	DADINGS					
	1	2	3			
SM1_LOVE	0.549*	-0.202*	-0.006			
SM1_TALK	0.841*	0.029	-0.002			
SM1_CNT_	0.848*	0.012	-0.013			
SM1_LIST	0.818*	-0.007	0.053			
SM1_DCTR	0.554*	-0.002	0.012			
SM1_GOOD	0.409*	-0.046	0.152*			
FAM_HELP	-0.049	0.706*	-0.085			
FAM_HOME	0.008	0.709*	0.002			
FAM_TOGE	-0.008	0.811*	0.058			
FAM_PROU	0.043	0.761*	-0.084			
FAM_GETA	0.015	0.635*	-0.063			
FAM_LAND	0.071	0.605*	-0.046			
COMM_CLO	-0.065	0.01	0.701*			
COMM_HEL COMM_TRU	0.009 -0.092*	0.122* -0.019	0.869* 0.710*			
COMM_BEL	0.036	-0.077	0.563*			
*significant at a 5% level						

**Eigenvalues for sample correlation matrix:** 

 $\frac{1}{5.432} \ \frac{2}{2.651} \ \frac{3}{1.460} \ \frac{4}{0.802}$ 

#### Figure 12. EFA diagram

#### Confirmatory Factor Analysis

These three different concepts, tapped by the indicators with high factor loadings in the EFA were run in a Confirmatory Factor Analysis: The first concept, *Support*, is hypothesized to be tapped by the following 3 indicators: having someone to talk to, having someone you can count on, and having someone that can listen to you. The second concept, *Family Relationships*, is hypothesized to be tapped by the following 6 indicators: helping and supporting one another, spending a lot of time at home together, spending a lot of time on the land together, having a feeling of closeness and togetherness, being proud of being part of their family, and getting along well with each other. The third concept, *Community Cohesion*, is hypothesized to be tapped by the following 3 indicators: feeling of closeness and togetherness and togetherness and togetherness in the community, feeling of trust, and people in this community helping each other out.



**Table 12. CFA factor loadings** 

	Estimate	S.E.	Est./S.E.
SUPPORT BY			
SM1_TALK_T	0.789	0.032	24.981
SM1_CNT_ON	0.845	0.029	28.821
SM1_LISTEN	0.87	0.03	28.732
FAMILY_R BY			
FAM_HELP	0.795	0.023	35.049
FAM_HOME	0.705	0.025	28.775
FAM_TOGETH	0.754	0.023	32.251
FAM_PROUD	0.793	0.034	23.424
FAM_GETALO	0.68	0.028	24.586
FAM_LAND	0.591	0.03	19.695
<b>COMMUNIT BY</b>			
COMM_CLOSE	0.687	0.024	28.401
COMM_HELP	0.775	0.021	37.414
COMM_TRUST	0.72	0.023	30.982
SUPPORT WITH			
FAMILY_RLS	-0.309	0.042	-7.349
COMMUNITY_	0.176	0.044	3.978
FAMILY_R WITH			
COMMUNITY_	-0.566	0.033	-17.211

The model fit statistics are all within acceptable range, demonstrating an overall good model fit (RMSEA: 0.024, CFI: 0.992, TLI:0.990). The Chi-Square test results still reject the model at a p value of 0.009). As revealed by the CFA, there are seemingly three separate constructs (support, family relationship and community cohesion) being explained by these sets of 3,6 and 3 variables respectively. Therefore, answers to these three sets of questions will be scored and summed into a continuous scale. Based on the distribution of answers to these constructs, the three different scales will be transformed into 4-category indicators based on the distribution quantiles. This analytical choice was made due to the nature of the statistical modelling program, *Mplus*, which allows for a maximum of 10 categories for a variable to be treated as categorical. In sum, these categorical indicators will be used in the LCA, alongside the other indicators corresponding to elements described within the foundational concepts of the IQI model.

# Appendix D. Declaration of confidentiality



#### I, Morgen Bertheussen

## DECLARATION OF CONFIDENTIALITY



Masters Student

(First and last names)

(Function or job title)

McGill University, Geography Department | Burnside Hall | 805 Sherbrooke St W, local 427

(Name and address of place of work)

#### hereby

- declare that I shall respect entirely the *Politique sur la protection et la sécurité de l'information* (PO-04-2014) [hereinafter referred to as the policy on the protection and security of information] of the *Institut national de santé publique du Québec* [hereinafter referred to as the *INSPQ*], as well as all the laws, regulations, policies, directives and procedures relative to the protection of personal information and information security in effect;
- commit to respecting the Qanuilirpitaa? 2017 Policy on the Management of Databases and Biological Samples (version dated of 2019-01-08);
- commit, once the agreed products are finalized, to destroy the database(s) in my possession and return any remaining biological samples in accordance with the policy on the protection and security of information;
- commit to returning to the INSPQ coded variables that may be useful for other data analyses;
- declare that I or highly qualified personnel (research professionals and assistants; undergraduate and graduate students, and postdoctoral fellows) under my supervision who will have access to the data, will be informed of the confidentiality requirements and will sign the present declaration, and return all data at the end of their assignment/study project;
- declare that I shall neither disclose nor allow to be known, without being duly authorized, any confidential information to which I became privy in assuming my functions related to the Qanuilirpitaa? 2017 Health Survey and that I commit to respect, in perpetuity, the confidentiality of such information;
- declare that I am fully aware that the Nunavik Regional Board of Health and Social Services may use
  procedures to ensure information security and the protection of personal information. Any breach of
  confidentiality on my part may lead to the termination of the data access.

On the faith of which, I have signed

in	Montreal, QC, Canada	, on this <sup>16th</sup>	day of April 2021	
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(SIGNATURE OF THE PERSON MAKING THE DECLARATION)