Housing as a determinant of health in The Sayisi Dene First Nation, Tadoule Lake, Manitoba

by

David Boutilier

A thesis submitted to the Faculty of Graduate Studies of

The University of Manitoba

in partial fulfilment of the requirements of the degree of

MASTER OF ARTS

Department of Anthropology

University of Manitoba

Winnipeg

Abstract

This thesis is an exploration of housing as a social and environmental determinant of health and draws example from one Manitoban First Nation community. Aboriginal people across Canada suffer a disproportionate burden of morbidity and mortality relative to the rest of the country. Literature on the social determinants of health is reviewed with emphasis on the role of housing conditions in achieving and maintaining good health, followed by the historical context for Canadian Aboriginal settlement patterns and the current housing crisis. Local history and the results from a 2010 housing survey of the Sayisi Dene First Nation are described. Crowding, in-home water availability, housing design, and building materials are identified as risk factors for health problems, whereas occupant behavior appears to have little effect on conditions. Recent popular challenge to the longstanding and ongoing effects of colonialism sheds light on the degree to which all Canadians accept these pervasive circumstances.

Acknowledgements

Saying thank you in a way that genuinely reflects the extent of my gratitude isn't easy. I owe a great debt to the Sayisi Dene for their hospitality and benevolent reception to this project and to myself. For stories shared, cups of coffee, caribou, smokes, for all the doors opened —if we could all treat strangers so kindly the world would be a very comfortable place. In particular Danny Bighead's courteous and thoughtful company left an indelible impression on my own character.

A superb committee is responsible for the following content. My supervisor, Dr. Linda Larcombe, whose unconditional patience and good nature demonstrated to me the limits of dedication, stimulated the development of my ideas but also kept them in check. Dr. Rob Hoppa's effortless intelligence, availability, and blue email text saw me through all stages of this degree, and I'd have neither started nor finished without this investment. Dr. Jeffrey Masuda's invaluable observations provided a depth of insight I would not have otherwise attained. Without the time and energy commitments of these individuals I would've given up and left long ago and I thank them for that.

Many important family members and friends also contributed to this work, including Laura, who pushed me through its final stages. To all others I have yet to thank directly: I will.

Finally, I would like to thank the following individuals and agencies for funding: Dr. C. Thomas Shay; Dr. Jill Oakes and Dr. Rick Riewe; The University of Manitoba Department of Anthropology, Faculty of Arts, and Faculty of Graduate Studies; The National Sanitarium Association; Canadian Institutes of Health Research.

In memory of Yeleba

Table of contents

List of figures

List of tables

Chapter 1: Introduction

Introduction

This thesis is an exploration of housing as a determinant of health, drawing example from one Manitoban community: the Sayisi Dene First Nation of Tadoule Lake. The burdens of health experienced there are in many ways paralleled beyond the borders of Manitoba and Canada, as the health status of indigenous peoples around the world is consistently marked by increased burdens of morbidity and mortality relative to their non-indigenous cohabitants (Gracey and King 2009; King et al. 2009; Nettleton et al. 2007; Stephens et al. 2006). However, as will be made explicitly clear in the case study herein, analogy cannot truly describe or be used to ameliorate the problems faced in these communities.

Since the 1996 Report of the Royal Commission on Aboriginal Peoples, the study of health inequity in Canadian Aboriginal communities has gained considerable momentum (MacMillan et al. 1996; Young et al. 2000; Adelson 2005; Frohlich et al. 2006; PHAC 2008; Kirkpatrick and McIntyre 2009). Following more progressive understandings of population health emphasizing the non-behavioral risk factors for disease patterns (Evans and Stoddart 1990; Wilkinson and Marmot 2003), these studies often investigate the social, economic, political, and environmental conditions in Aboriginal communities. The "intolerable housing and living conditions" (RCAP 1996:342) at the center of the current housing crisis experienced in First Nations communities across Canada exemplify many of these underlying causes of poor health. Housing conditions are well established as agents of health and wellbeing via availability (Byrant 2003, 2009a), crowding (Clarke et al. 2002; Beggs et al. 2003), air quality (Verhoeff et al. 1995; Dales et al. 1991, 1997), or through the

availability and quality of water and sanitation (Adelson 2005). It is neither surprising nor novel to hear that living in crowded, damp, and moldy conditions causes serious health problems, and over half of the houses on Canadian First Nations reserves today contain mold (Optis et al. 2012). These conditions, their causes, and their correlates will be analysed in order to examine housing as an environmental and social determinant of health in the Sayisi Dené First Nation of Tadoule Lake, Manitoba.

Overview of thesis

A number of research questions and objectives are posed and addressed throughout this thesis based on my role in a 2010 housing and health survey of the Sayisi Dene First Nation, which was undertaken at the request of the band and coordinated by my advisor, Dr. Linda Larcombe. At the request of Sayisi Dene Band Chief and Council, the survey objectives (Appendix 1) included

1) assessing the physical structure of all houses in the community with particular attention to the presence of mold, and
2) interviewing community members to record health information, and to record community member perceptions of housing conditions and how those conditions may effect occupant health.

My role in Tadoule Lake was primarily to record the structural conditions of the houses in the community, and therefore the majority of the analysis herein focuses on those conditions and their potential impacts on occuapnt health. I have also given particular consideration to the day-to-day activities of house occupants that may or may not contribute to moisture generation and by extension the deterioration of homes.

During the course of the survey, personal and community stories and history were shared and – while not explicit components of my own contribution to the project – have also informed the direction of analysis. Thus, to meaningfully report and address the housing conditions in Tadoule Lake today it is not only necessary to characterize contemporary living conditions in the context of housing conditions as social and environmental determinants of health, but also to describe historical living conditions of the Sayisi Dene and of Canadian First Nations people more broadly, given Canada's dominant approach to governing its First Peoples from Treaty signings forward.

Social determinants of health (SDH) are the underlying day-to-day conditions that influence the development and maintenance of the health and well-being of individuals and populations, and their identification and study helps reveal why people continue to live in conditions that make them sick. Chapter 2 is an overview of SDH, its development as a complementary approach to traditional health care models, and its value as an application in healthy policy making. It is argued that the most effective approach to improving the health of any population must include the recognition of health as a social, political, and economic matter, and that doing so allows advocates of social justice to make significant contributions to healthcare as well as civil society. The health outcomes of inadequate housing and sanitation are also emphasized in Chapter 2. Because such conditions have long been acknowledged as determinants of health, their historical context in Canadian Aboriginal communities will be further explored and discussed in Chapter 3 along with other historical and legislative nuances of Aboriginal health over time. Changes to land use and settlement patterns since European contact are emphasized as critical influences. It is argued that the restriction of traditional land use and the relocation of people brought about by treaty negotiations, the Indian Act, and unequal power relationships have marginalized Aboriginal people and impaired their collective

health status. Current and promising legal approaches to improving housing and health disparity will be reviewed briefly.

The fourth chapter is a case study analysis of housing conditions that serve as risk factors for disease in Tadoule Lake, Manitoba. Following a contextual overview of community history, the results of the 2010 housing and health survey are detailed in full. Key results of statistical analyses demonstrate that crowding, lack of access to water, and structural damage are risk factors for mold growth and increased disease burden, and that problematic structural conditions are largely the result of inappropriate design and construction materials rather than occupant activity. Although these findings are comparable to those described in similar communities (e.g. Larcombe et al. 2011), the value of community based research is affirmed by its identification of differences in experience and need faced by Aboriginal communities throughout the province and across Canada today.

The fifth and final chapter is a summary of findings, contextualized by core discussion points from the previous chapters as well as recent social movements demanding acknowledgement of and solutions for the issues mentioned herein and elsewhere. Housing in Tadoule Lake is a significant determinant of health and well-being and these conditions must be recognized and acted upon in order to effect positive change in the health of community members. Finally, while many aspects of the case study have relevance to other First Nations communities, the health of occupants is also a result of unique community history. To further understand the complexities of Canadian Aboriginal health disparity, this chapter provides an overview of the disproportionate burden of health experienced in Canadian Aboriginal communities today, a brief introduction to SDH, and a

description of the persistently "intolerable" (RCAP 1996:342) housing conditions in many First Nations communities today.

Overview of current health disparities among Aboriginal Canadians

Aboriginal Canadians number roughly 1.4 million people with approximately 50% off reserves (Statistics Canada 2013a) and persistent health disparity is well established in these populations (MacMillan et al. 1996; Young et al. 2000; Frohlich et al. 2006; PHAC 2008; Kirkpatrick and McIntyre 2009). Explanations for increased burdens of mortality and morbidity range from environmental to social, economic, cultural, and political inequities (Ford et al. 2010; Adelson 2005; Richmond et al. 2007; Richmond and Ross 2009) as well as the multi-generational effects of colonialism (O'Neil 1986; Smylie 2009; Hart 2010).

Despite an increasingly aging Aboriginal population in Canada, life expectancies continue to lag behind the general population by five to 14 years, with Inuit men experiencing the shortest life expectancies (Statistics Canada 2005). Compared to non-Aboriginal adults, Métis and non-Status Indian adults experience about twice the risk of dying before age 75 (Tjepkema et al. 2011). The infant mortality rate is also up to four times that of the rest of Canada (Wilkins et al. 2008; Smylie et al. 2010; Heaman et al. 2010; Luo et al. 2010).

Chronic health conditions like diabetes and cancer also disproportionately burden Canadian Aboriginal populations (Adelson 2005; Frohlich et al. 2006; Lix et al. 2009; Tjepkema et al. 2009; McDonald and Trenholm 2010). Type II diabetes mellitus prevalence is 3.6 and 5.3 times higher than that of Canadian men and women respectively, which leads to "long-term complications

affecting the cardiovascular system, eyes, kidneys and nerves [and results] in premature death, disability and a compromised quality of life" (Young et al. 2000:562). Terminal chronic conditions like cancer – while varying by type and prevalence between specific groups (MacMillan et al. 1996) – remain as one of the leading causes of death in all Canadian Aboriginal populations (Adelson 2005).

Infectious disease rates are also more pronounced among Canadian Aboriginals (Smylie 2009). The tuberculosis rate of Aboriginal Canadians is approximately six times the rate of the general Canadian population (PHAC 2008), and despite comprising 4.3% of the total Canadian population (Statistics Canada 2013a), Aboriginal people made up 27% of new HIV infections in regions of Canada where ethnicity data is recorded (Worthington et al. 2010). Children are particularly vulnerable to hospitalization and death due to respiratory illnesses with Inuit infants in Qikiqtaaluk Region of Nunavut having the highest rate of hospitalization for respiratory syncytial virus infection in the world (Banerji et al. 2001).

In Manitoba the story is no different. The average lifespan of First Nations people is eight years shorter than non-Aboriginal residents; the premature mortality rate is nearly double; infant mortality rates are two to three times higher; chronic disease is elevated (e.g. diabetes rates are over four times that of the rest of the province) and infectious disease rates are similarly disproportionate (e.g. the on-reserve rate for tuberculosis is roughly 22 times that of non-Aboriginal Manitobans).

In a nation with universal health care, explaining such divergence in morbidity and mortality demands an examination of circumstances outside of traditional biomedicine, genetics, and clinical

practice. Unmet healthcare needs and health disparity across Canada is increasingly being recognized as an outcome of public policy, socio-economic status, education levels, and other risk factors for both disease and compromised access to care (Raphael 2003; Raphael et al. 2006; Mikkonen and Raphael 2010). For example, income inequality has long been recognized as a powerful non-biomedical indicator of health disparity (Marmot et al. 1984; Townsend et al. 1992; Kaplan et al. 1996; Kennedy et al. 1996; Lynch et al. 1998) and Canada's First Nations, Inuit, and Métis men and women face a 10-50% earnings gap in comparison to Canadian-born majority workers (Pendakur and Pendakur 2011). While the correlation between income disparity and mortality has always been strong there is still no universally-accepted, sociobiological explanation for the phenomenon.

To make research outcomes more salient to policy makers, its discussion has shifted from abstract concepts like class (Marmot et al. 1984), power and prestige (Link and Phelan 1995), social (Kaplan et al. 1996) and human capital (Kennedy et al. 1996), or the psychosocial environment (Kawachi et al. 1997) to more directly pragmatic, policy-oriented foci with existing institutions already systematically considering these issues (e.g. minimum wage, education, housing). A straightforward explanation of the SDH includes the following considerations:

1) that as an independent area study comprised of numerous different disciplines, its authors seek to improve the health of individuals and populations by bringing social issues to the attention of governments and policy makers,

2) that the vast and seemingly ambiguous societal union of poverty and illness can be framed by its pre-existing and manageable corollaries in social planning and governance, and
3) that health equity is a goal for advocates of health promotion, social justice, and economic development alike, and there has long been well established evidence to support their efforts regardless of political or professional alignment.

The SDH and their development over time will be discussed in greater detail in the next chapter, with particular emphasis on the health outcomes of poor housing conditions like crowding, air quality, and water availability, as these are central to the housing crisis happening across the country right now. The remainder of this chapter describes those housing conditions as experienced by Aboriginal people in communities across Canada today.

Overview of housing conditions in First Nations Communities in Canada today

The housing crisis currently experienced in Canadian Aboriginal communities and especially reserve communities today is an outcome of both a lack of adequate housing (i.e. housing that does not require any major repairs) and a lack of suitable housing (i.e. housing with enough space for its occupants[1]) (AFN 2010; CMHC 2011a; Optis 2012). Both of these circumstances seriously influence occupant health, and like all SDH, these circumstances are linked with income. While the Assembly of First Nations has encouraged greater Band control of housing management (Assembly

[1] Housing is considered suitable when it contains enough bedrooms for its occupants based on the following National Occupancy Standard (NOS) requirements: "one bedroom for each cohabiting adult couple; unattached household member 18 years of age and over; same-sex pair of children under age 18; and additional boy or girl in the family, unless there are two opposite sex children under 5 years of age, in which case they are expected to share a bedroom. A household of one individual can occupy a bachelor unit" (CMHC 2011a:9).

of First Nations 2010), housing on reserves remains a joint responsibility between the Canadian federal government and of elected Band Councils. Consequently the ability of on-reserve Band members to access housing depends on two major factors:

1) the amount of funding Band Council receives from the Canadian Mortgage and Housing Corporation (CMHC) and Indian and Northern Affairs Canada (INAC) in order to construct and repair housing units, and
2) income, which is often markedly lower and in 56% of cases primarily dependent on government assistance such as old age pensions or employment insurance benefits (Statistics Canada 2010).

While the number of on-reserve households has steadily increased from 1996 to 2006, Canadian Aboriginal communities continue to lag behind the rest of the country in terms of adequacy and suitability. Primarily federally designed and delivered wood-frame reserve housing is prone to mold and air quality problems due to inappropriate materials and design and their lack of upkeep (International Housing Coalition 2003). Over half of on-reserve houses in Canada need repairs, are crowded, or both, and the incidence of those living below standards who are unable to access acceptable housing due to low income increased from roughly 28% 2001 to 33% in 2006 (CMHC 2011a). Furthermore those households are larger than the rest of the country on average with 3.7 persons per household vs. 2.5 persons for Canada (CMHC 2011a).

Housing conditions on Reserves in Manitoba

Housing conditions and infrastructure adequacy vary from province to province. The average number of persons per housing unit in Manitoba is 2.6, whereas the average number of persons per

housing unit in Manitoba First Nations communities is 4.8 and increases to 7.6 when only those units not in need of major repair or replacement are considered (Martens et al. 2002). That spike in occupancy resides in the 20-30% of houses on reserves in need of major repairs or complete replacement (Martens et al. 2002). The percentage of crowded households is the highest in the country (32%) and the percentage of households falling below suitability and adequacy standards is 65% -- second only to Saskatchewan's 66% (CMHC 2011a). In Manitoba as elsewhere, geographic isolation plays an important role in both home maintenance and infrastructure adequacy as higher transportation costs for materials makes new construction and maintenance expensive and technically demanding in remote communities. At 55.2% Manitoba has the highest number of isolated First Nations communities (i.e. with seasonal road access for transporting building supplies) in Canada (Clark et al. 2002). The lack of access to running water also varies largely according to geographic isolation. Overall 22% of housing units in Manitoba First Nations lack modern plumbing, although the more northerly located reserves are most lacking: Island Lake Tribal Council had over 95% of homes lacking running water and Keewatin Tribal Council, where Tadoule Lake is located, had over 40% (Martens et al. 2002).

As will be discussed throughout this thesis, these inadequate and unsuitable living conditions (i.e. crowding, lack of sanitation, poor ventilation, and inhabitants' exposure to dampness and mold) are strongly associated with communicable diseases directly in Manitoba First Nations communities (Rosenberg et al. 1997; Bernstein et al. 1999; Clark et al. 2002; Larcombe and Orr 2007; Larcombe et al. 2011). Yet despite the well known connections between detrimental living conditions and poor health, the housing crisis continues to affect communities across the country (Optis et al. 2012). Without addressing the crisis and all of its health implications at its socioeconomic and political base, positive change will remain inaccessible. However, as will also become clear in the following

chapters, not all communities are homogenous in terms of need, and thus policies grounded in community-based initiatives may be the most effective methods of improving conditions.

Chpater 2: The Social Determinants of Health

Good health is the bedrock on which social progress is built. A nation of healthy people can do those things that make life worthwhile, and as the level of health increases so does the potential for happiness.

Marc Lalonde, 1974:5

Background to SDH

Health and health care are not the same thing. In recent discussions of the tendency to conflate these two concepts (Goldberg 2012; Bezruchka 2010), two issues come to light. The first is a highly individualistic ideological culture which assumes a degree of equality among individuals and places the state of their health largely on their behavior and decision making (Kingdon 2002); the second is a predominant model of health care which focuses on clinical medicine and centers health care on the ability of the doctor to relieve sickness (Wikler 2002; Leichter 2003). While these examples are grounded in American dialogue, Canadian authors describe similar ideological issues in our own health system (Byrant 2009b; Raphael 2007).

Ultimately these discussions all stress the shortcomings of traditional approaches to health policy and demand recognition of health as more than just the absence of disease. Indeed, traditional approaches to preventative medicine and health promotion have tended to focus on behavioral factors. Proper diet, regular exercise, and avoiding tobacco and alcohol are some common foci of such strategies, and while these are certainly important determinants of health, they are strongly influenced by an individual's access to income, education, work environment, and numerous other social provisions or constraints. These *social determinants of health* (SDH) are defined by the World Health Organization as the "conditions in which people are born, grow, live, work, and age"

(CSDH 2008:1) – a definition which coincides well with the WHO's holistic recognition of health i.e. "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity" (preamble to the 1946 Constitution of the World Health Organization:1).

By accepting both the WHO's broad definition of health and a SDH approach to health and health care, the conditions of life quickly become pivotal factors in the establishment and maintenance of a healthy population. Among the most day-to-day of these SDH, housing conditions emerge as absolutely integral to health and wellbeing – a relationship that has been described by public health researchers and practitioners for over a century (Fuller-Thomson et al. 2000; APHA 1938; Griscom 1845). Although this thesis is an exploration of housing conditions as social and environmental determinants of health in northern First Nations communities, the scope of the problems faced by the occupants of those suspect houses extends well beyond poor insulation or moldy crawlspaces. It has become well acknowledged that housing conditions in these communities – like many other issues band councils must navigate – are largely a result of political decision making that is both distant in origin and frustrating to challenge. Understanding how housing conditions are not only contributing to the burdens of morbidity and mortality in these communities, but also how they are the product of a long history of colonial disenfranchisement is important. This chapter is meant to provide the reader with an overview of select SDH with special emphasis on the ways in which housing conditions influence health in northern First Nations communities before moving on to some historical and legal background to First Nations housing conditions today (Chapter 3).

Definition and development of SDH

The SDH are understood as the structural conditions of life and living, including

> "… the distribution of power, income, goods and services, globally and nationally, as well as the immediate, visible circumstances of peoples [sic] lives, such as their access to health care, schools and education; their conditions of work and leisure; their homes, communities, and rural or urban settings; and their chances of leading a flourishing life. In addition, these structural determinants influence how services are provided and received and thereby shape health care outcomes and consequences."
>
> (Blas and Kurup 2010:5)

Denis Raphael (2009a:2) defines the SDH most simply as "the economic and social conditions that shape the health of individuals, communities, and jurisdictions as a whole." Raphael's advocacy is strongly social justice oriented (Mikkonen and Raphael 2010, Raphael 2009b), which has been an underlying current in SDH-related literature since its inception; this dimension of SDH research and advocacy will be discussed later in this chapter. While much of today's SDH research draws heavily from social and epidemiological sources, the foundational literature was steeped in economic thought and largely appeared to quantify what Raphael (2009a, 2010; Bryant 2009) suggests was already known anecdotally since Virchow and Engels: that poverty begets illness. The creation of public servants and accompanying legislation addressing the links between social and environmental conditions and health in Canada were often piecemeal, administrative responses to epidemiological crises (Oberlander 1984; see also Bryce 1910). It was not until much more recently that researchers and policy makers began to more systematically acknowledge the reality that "medical care alone for the poor is too little and too late" (Sparer and Okada 1974:558).

Perhaps it was the impending failure of the WHO's "Health for All" agenda (WHO 1978, 1981) that spurred commitment to these new directions in health equity. With the absurdity of ending world hunger with simple increases in existing technology and medicines sinking in (Mahler 1981), alternative responses with more clearly defined, measurable elements were sought to address disease

at its true roots. Acknowledging the impracticality of "expect[ing] any substantial health improvements in [impoverished] populations unless [social and economic] constraints are first removed or alleviated" (Mahler 1981:8) was as important to recognize and broadcast three decades ago as it is today. The significance, however, of seeing and hearing identical rallying cries embedded in recent work can be a mixture of energizing and discouraging. "What good does it do," asks former Minister of Health and Welfare Monique Bégin in her foreword to *The Canadian Facts* (Mikkonen and Raphael 2010), "to treat people's illnesses [and] then send them back to the conditions that made them sick?" (Bégin 2010:5).

Connecting impoverishment to poor health has long been the backbone of SDH research. Early studies examining the disparity of income across society and seeking its corresponding measures of morbidity and mortality (Rogers 1979; Wilkinson 1986) paved the way for tests of validity with new and robust data. In 1996, George Kaplan and colleagues presented "the first report of an association between variations in income distribution [...] and a variety of health outcomes" (1996:1003). Finding a strong correlation between household income and mortality via "social indicators" and "social capital," they called for confirmation of their results and suggested greater consideration of these factors when evaluating future health policy:

> "While there may be higher rates of adverse psychosocial outcomes in states with high inequality these may be only a reflection of the greater difficulties in life that are caused by the structural characteristics that distinguish between states with high and low inequality. From a prevention point of view it may be more important to deal with these structural features than their psychosocial consequences."
>
> (Kaplan et al. 1996:1002)

In the same issue of BMJ, Kennedy and colleagues (1996) suggested the magnitude of the gap between the wealthy and the poor was linked to population health. They pointed to the "lack of access to medical care [to be] part of the mechanism by which income inequality produces higher

mortality" in cases of "*treatable* causes of mortality (Kennedy et al. 1996:1006, *emphasis added*). Policy considerations were mentioned briefly in closing. Ben-Shlomo, White, and Marmot's (1996) similarly ecological study considered employment, car ownership, homeownership, and home crowding (following Townsend et al. 1988) and also found population mortality to depend on "relative deprivation." Each of these studies independently confirmed the strength of the relationship between income inequality and mortality despite varying measurement criteria. They showed that it is not simply absolute income that conditions health, but it is the way in which wealth is distributed throughout the population (i.e. the size of the gap between the rich and poor) that affects our health. These early studies began to illustrate why, for example, as Amartya Sen put it:

> "[D]eprivation among African Americans cannot be adequately understood when […] measured by the yardstick of income. According to that scale, African-Americans are poor in comparison with US whites, but they are immensely richer than Chinese and Keralan citizens. On the other hand, in terms of life and death, African-Americans are less likely to survive to a ripe old age than are people in some of the poorest Third World countries."
>
> (Sen 1993:47)

However, even with strong correlations between income disparity and mortality, the sociobiological mechanisms often remained as abstract concepts or only as allusions to the larger picture of economic and social inequality e.g. social cohesion (Kawachi et al. 1997); human and social capital (Kaplan et al. 1996); relative deprivation (Ben-Schlomo et al. 1996); knowledge, power, prestige, and social networks (Link and Phelan 1995); and even *class* (Marmot et al. 1984). How these postulations were developed into more practical constructs did not happen overnight. Following House and colleagues (1988), Link and Phelan (1995:90) provided some crucial, straightforward dialogue on the fundamental social causes of disease and suggested that the policy level implications of socially contextualized risk factors should help to guide research, reminding their readers that

existing government institutions already regularly consider many of these issues, including minimum wage, education, and housing.

Alvin Tarlov is noted for having coined the term "social determinants of health" in his description of a systemic model for the sociobiological translation of social stress into illness. Following Lalonde's (1974) multi-field approach to health and health care, Tarlov described and discussed the importance of recognizing the "sensory stimuli received by man and translated into biological signals that are antecedent to disease that becomes clinically manifest later in life" (Tarlov 1996:71). Tarlov separated the "social characteristics within which living takes place" (Tarlov 1996:72) into signals received during childhood and adulthood, suggesting that dissonance between expectations and reality during the transition into adulthood affects health and well-being. Being restricted by social forces from doing or becoming what a person wants (and what they have developed socially to expect) triggers subtle biological signals that, after extended periods of time, lead to clinical illness – although those illnesses were still considered by Tarlov to be determined by an individual's specific polygenic inheritance.

While Tarlov's and others' models emphasized the role of social policy in a broadened health care system, relatively little practical research over the next decade addressed policies aimed at reducing health inequality. Many of those who did generally did so under economic guise, suggesting reorientation of investments from primary care services to public health would both improve population health and decrease the economic burden of preventable illnesses and death (Wise and Nutbeam 2007). Mackenbach and Bakker (2002) recounted many of the European policies aimed at reducing socioeconomic inequalities as a health service, urging that more evaluation was necessary

for more effective policy making. Nations that adopted such public health initiatives in that period include Australia (Abelson et al. 2003), Sweden (Ågren 2004; Kristenson and Weinehall 2006), and arguably Canada (Romanow 2002) although the lack of policy initiatives reflecting the Romanow Commission's (Romanow 2002) recommendations has been pointed out (Raphael et al. 2006; Raphael et al. 2005; Armstrong et al. 2003; CPHI 2002) as well as its steadfast reinforcement of physical lifestyle choices as primary determinants of health (Raphael 2003).

Acknowledging that health equity could only be achieved by looking beyond the immediate causes of disease, an independent Commission on the Social Determinants of Health was launched by the World Health Organization (WHO) in 2005 (Marmot 2005, Irwin et al. 2006). The primary aim of the Commission was to link research knowledge with policy development to promote a global movement for better and more fairly distributed health within and between countries. Researchers, policy makers, and practitioners from academic institutions, government ministries, and civil society organizations from around the world participated in gathering evidence, and within three years they produced the Commission's final report (CSDH 2008) with recommendations to the Director-General of the WHO. In order to "close the gap in a generation," these recommendations included (1) improving daily living conditions, (2) reducing unequal distributions of resources and power, and (3) measuring both the underlying social causes of poor health and potential solutions (Marmot et al. 2008). To realize these goals, training for policy makers was strongly recommended (Marmot et al. 2008), and while "the gap" is by no means closed (Kumanyika 2012) our understanding of the SDH, their biological pathways, and the circumstances under which they interact continues to develop, and public or policy-level acknowledgement and implementation of knowledge is only slowly rising (Raphael 2011a, b, 2013).

Examples of SDH

Lists of specific SDH have been present in the literature for decades, with Wilkinson and Marmot's (2003) *Solid Fact* marking the beginning of a series of accessible publications detailing specific SDH and affording each an exposition of its causes and effects (e.g. Raphael 2009a; Marmot and Wilkinson 2006). While the term "social determinants of health" was not always used in that literature to describe such phenomena, the principle concepts have always been analogous and the policy-level objectives have always been explicit (WHO 1986). Today, Raphael (2009a:7) is particularly unambiguous about the utilization of the research, criticizing Health Canada's (1998) definitions of health determinants as too abstract and often without corresponding government institutions responsible for corollary policy action – an important criterion in establishing his own list (Raphael 2009:7; Mikkonen and Raphael 2010).

In this section I will review a number of SDH primarily taken from Wilkinson and Marmot's (2003; Marmot and Wilkinson 2006) and Raphael's (Raphael 2009; Mikkonen and Raphael 2010) lists for discussion purposes. These SDH include the social gradient, stress, social exclusion, employment and unemployment, the conditions of early life, food, education, access to health services, Aboriginal status, and housing conditions. Although additional SDH are described in detail elsewhere (see Table 1) this selection underscores the value of well established, core determinants and particularly those relevant to the case study presented in Chapter 4.

Table 1 illustrates, to some extent, the development of SDH over the last quarter century. As time progresses, the specific determinants tend to not only become less abstract but also more easily recognized as policy issues. Thus, our understanding of the SDH has developed from the scientific

WHO (1986)	Health Canada (1998)	Wilkinson and Marmot (2003)	Raphael (2008)
Income	Income and social status	The social gradient	Income and its distribution
	Employment and working conditions	Work	Employment and working conditions
		Unemployment	
		Stress	
	Healthy child development	Early life	Early life
Education	Education		Education
	Health services		Health care services
	Culture		Aboriginal status
	Gender		Gender
	Physical and social environments*	Social exclusion	Social exclusion
Shelter			Housing
Food		Food	Food security
	Social support networks	Social support	Social safety net
		Transport	
	Personal health practices and coping skills	Stress	
Stable ecosystem	Physical and social environments*		
		Addiction	
	Biology and genetic endowment		
Sustainable resources, Social justice, Equity, and Peace			

Table 1: Lists of SDH from 1986 to present

establishment of the link between income inequality and health, to detailed discussions of suspect social conditions, to today's lists of specific influences purposefully made germane to policy writers. In short, this approach to health promotion acknowledges (1) the role of day-to-day living conditions in the prevention of disease, and (2) that hugely problematic issues like income disparity – where the relationship with health is clearly visible – can be reduced to more manageable and practical conceptual units where research is guided by terms within frameworks already recognized by policy makers.

While each determinant is afforded its own neatly contained description here, it should also be noted that the SDH are highly interrelated and frequently overlap in terms of their composition, effects, and policy implications. Blas and Kurup's (2010) work in particular exemplifies this observation, as the book is organized by chapters on social and medical conditions which are non-exclusively linked to multiple social determinants; an appendix labeled "Social determinants occurring on the pathways of the priority public health conditions analytical framework" (Blas and Kurup 2010:281-283) directs the reader to specific chapters based on selected SDH (e.g. "social exclusion" is a relevant SDH in the chapters on alcohol, health and nutrition of children, neglected tropical diseases, and tuberculosis). Such an organizational approach illustrates most fluidly the intertwined and multidimensional nature of SDH, and in the following descriptions of SDH housing conditions are frequently highlighted to illustrate this labyrinthine character.

The social gradient

The social gradient (Wilkinson and Marmot 2003:10) is the embodiment of the early quantifications of the link between income and mortality. It refers to the social position of an individual or group of people and their corresponding access to and maintenance of resources, including the ability to

afford quality housing. This social positioning is largely the outcome of key transitions throughout life that may place the individual on more or less advantaged pathways. For example, graduating from high school and attaining employment promotions not only affect an individual in terms of their ability to command income, but advantageous transitions depend more strongly on the success of previous stages. Material and psychosocial disadvantages experienced earlier in life tend to preclude advantageous mobility. "These disadvantages tend to concentrate among the same people, and their effects on health accumulate during life. The longer people live in stressful economic and social circumstances, the greater the physiological wear and tear they suffer" (Wilkinson and Marmot 2003:10).

Stress

Unsurprisingly, the clinical health effects of disadvantageous positioning on the social gradient are closely tied to those of *stress*. As one of the first social determinants to be addressed in terms of its biological functioning (Brunner 1997), stress and its clinical manifestation were treated similarly to Tarlov's (1996) sociobiological translation of SDH: if humans evolved to respond biologically to short, dangerous episodes (i.e. "flight or fight"), then prolonged activation of those neuroendocrine responses may be maladaptive, including "depression, increased susceptibility to infection, diabetes, high blood pressure, and accumulation of cholesterol in the blood vessels" (Brunner and Marmot 2006:29) as well as growth impairment in developing children (Brunner and Marmot 2006; Widdowson 1951; Montgomery et al. 1997). Inadequate and unsuitable housing has also been associated with higher levels of stress (Martin et al. 1987; Hopton and Hunt 1996; Evans et al. 2000; Fuller-Thomson et al. 2000; Evans and English 2002; Shenassa et al. 2007). As one of the original SDH outlined by Wilkinson and Marmot (2003), stress remains one of the most biologically constituted and clearly imbricated determinants of health.

Social exclusion

Like the antithesis to equal opportunity, social exclusion describes inequalities among individuals or groups within society which "structure access to critical resources that determine the quality of membership in society and ultimately produce and reproduce a complex of unequal outcomes" (Galabuzi 2009:253). Such inequality may manifest as a result of prejudice against or stigmatization of marginalized groups who experience the stress of discrimination via labor market segregation and poor recognition of skills (Galabuzi 2009). These are groups who lack power (Mikkonen and Raphael 2010:32). Following Kieffer (1984) in theme but Tarlov (1996) in form, Laverack (2007:13) describes powerlessness as "the expectancy that the behavior of a person cannot determine the outcomes they seek" and includes notions and attitudes of self-blame, distrust, "a feeling of alienation from resources for social influence, an experience of disenfranchisement and economic vulnerability, and a sense of hopelessness in gaining social and political influence." Powerlessness is internalized as a barrier to action, and leads to the acceptance of "aspects of [the] world that are self-destructive to [...] health and well-being [as] unalterable features of what they take to be 'reality'" (Laverack (2007:13; see also Lerner 1986). Geographically isolated communities are often especially disadvantaged in this regard (Rissel 1994:44), and as Arthurson (2004:255) points out, social exclusion is also "an alternative to the use of poverty and inequality" in housing policy debates.

Employment, unemployment, and working conditions

Unemployment and employment instability are major hindrances to the command of the basic resources essential to wellbeing (e.g. income, quality housing) and are well recognized for their association with adverse physical and mental health outcomes and mortality (Bartley 1994; Morris et al. 1994; Jin et al. 1995; Jackson 2009; Bambra and Eikemo 2009; Bambra 2010). In addition to

environmental influences on health experienced at work (as expressed in section 122 of the Canada Labour Code), the "social organization of work, management styles, and social relationships in the workplace" are also understood as SDH (Wilkinson and Marmot 2003:18). Lewchuk and colleagues (2006) point out physical and mental afflictions arising with the perception of disparity between employees' efforts in the workplace and the degree to which they are rewarded. For employees with "little opportunity to use their skills [or] decision-making authority" (Wilkinson and Marmot 2003:18), the link between job stress[2] and cardiovascular disease has been made evident for some time (Schall et al. 1994) – although cardiovascular disease has recently been examined as an outcome of numerous interacting social circumstances, including the conditions of early life (Thomas and Power 2010).

Early life

Early life begins with maternal health in the prenatal years and continues through pregnancy, infancy, and childhood (Wadsworth and Butterworth 2006). These critical periods of development play a vital role towards establishing lifelong health and well-being, as "early childhood experiences have strong immediate and longer lasting biological, psychological and social effects upon health" (Milkkonen and Raphael 2010:23). Milkkonen and Raphael (2010) differentiate between three early life determinants that may influence adult health. Latency effects are the results of biological processes experienced during pregnancy and childhood that predispose individuals to better or worse health later in life – for example, low birth weight and poor growth in early life has been associated with a range of health problems in later life (Kuh and Ben-Schlomo 2004:3; Wadsworth and Butterworth 2006:32), as has childhood exposure to environmental stressors like overcrowding, damp and moldy housing conditions, and poor indoor air quality (Britten et al. 1987; Mann et al.

[2] The opposite conditions (i.e. boredom) appear to have a similarly detrimental effect (Britton and Shipley 2010).

1992; Coggon et al. 1993; Power et al. 1999; Dedman et al. 2001; Galobardes et al. 2004; Leventhal and Newman 2010; Anderson et al. 2013). Pathway effects are social circumstances that do not manifest at the time of exposure, but later in life – for example, poor integration into early education may lead to long-term diminishment of educational achievement and subsequent disadvantage (see above, *social gradient*). Finally, cumulative effects refers to detrimental conditions that increase long-term, largely psychosocial consequences proportionately with the length of time those conditions are experienced – for example, instilling a sense of powerlessness (see above *social exclusion*).

Education

Another SDH with early life implications is the amount and quality of education in an individual's life. Education is indirectly linked to other SDH like income (Weiss et al. 1994) and it allows its beneficiaries greater access to social and economic resources – including better capacity to maintain income in the event that their employment situation changes (Mikkonen and Raphael 2010). More generally, increased education also allows people better ability to evaluate how their actions may be harmful or beneficial to their health and it has, for example, been linked to depression and obesity (Feinstein 2002). The health disparity of Canadian Aboriginal people noted earlier may in part be explained by educational attainment levels. While significant strides in access have recently been made across Canada, only about one third of Aboriginal high school students complete grade 12 (Ungerleider et al. 2009) and in 2001 only 4% received a university degree (Waldram et al. 2006).

Access to services

Perhaps the clearest connection between the social determinants of health and the human right to health is revealed by the degree to which essential health services are available. Most simply, without affordable or available health care, the wellbeing of vulnerable populations quickly

deteriorates. The Canada Health Act (Government of Canada 1984) is intended to ensure that the "physical and mental well-being" of all Canadians is "protect[ed], promot[ed], and restor[ed] […] without financial or other barriers" (Canada Health Act 1984, c. 6, s. 3) through universal public insurance on all "medically necessary" services. However, due to the discretionary power of provincial governments in defining those services, some of the criteria set forth in the Act – particularly universality and accessibility – are not as present for some segments of the population as they are for others. For example, in highly isolated communities in northern Manitoba where it is not possible to provide the same physician or hospital services as are available in the south, "reasonable access is interpreted using the 'where and as available' rule" (Hudson 2010:227), and residents, as noted in the first chapter**,** have markedly poorer health outcomes. Moreover the Act does not insure Canada's residents against the cost of medicine, which results in those with below-average income to be three times less likely to purchase necessary medications as those with above average incomes (Mikkonen and Raphael 2010). Unsurprisingly, those with lower income are more likely to report unmet healthcare needs (Sanmartin et al. 2006, Sanmartin and Ng 2004).

Aboriginal Status

Numerous authors have discussed the social context of the health status of Aboriginal people (MacMillan et al. 1996; Young et al. 2000; Adelson 2005; Frohlich et al. 2006; PHAC 2008; Kirkpatrick and McIntyre 2009; Hart 2010). Often this is done with a decolonizing perspective (Smylie 2009), noting the fundamental effects of European colonization as a determinant of health additional to those regularly addressed elsewhere. In 2007, Indigenous representatives from around the world met as part of the WHO Commission on the SDH to discuss determinants of Indigenous health (International Symposium on the Social Determinants of Indigenous Health 2007). The continuing effects of colonization (e.g. displacement from and degradation of traditional lands,

cultural assimilation and linguistic suppression, and institutional racism) were acknowledged as crucial determinants of health for Indigenous peoples around the world, and self determination – in accordance with the UN Declaration on the Rights of Indigenous People (United Nations General Assembly 2007) – was identified as a key process through which health equity could be pursued. Canadian First Nations, Inuit, and Métis people are all thoroughly familiar with these issues, ironically residing in one of the four nations on earth who refused to endorse the Declaration for over 3 years following its introduction.

In the previous chapter the health disparity of Canadian Aboriginal peoples was reviewed and discussed. Recent economic research that is congruent with those indices of inequity as well as several of the aforementioned SDH in this chapter shows that Canadian Aboriginal men and women face a 10-50% earnings gap in comparison to Canadian-born majority workers even after controlling for numerous other variables, including age and level of education[3] (Pendakur and Pendakur 2011). This disparity in earnings is consistent with Canada's longstanding disposition towards its Aboriginal peoples. Despite our Prime Minister's statements at the 2009 G20 Summit in Pittsburgh (Harper 2009), our nation does indeed have a lengthy history of colonialism. The relocation of entire communities, the legacy of residential schools, the refusal of treaty rights, and the draconian legal framework set forth in the Indian Act of 1876 are all important elements in the country's colonial project. Some of these issues will be explored further in Chapter 3.

[3] More striking still is that the disparity is highest in Canadian Prairie cities with the largest urban Aboriginal populations, suggesting that "beneficial enclave effects noted for other ethnic groups in Canada's cities do not seem to apply to Aboriginal people and may even work to their harm" (Pendakur and Pendakur 2011:80).

Housing

Housing was not included explicitly in some earlier SDH overviews (e.g. Wilkinson and Marmot 2003) but is now regularly considered (Marmot and Wilkinson 2006; Blas and Kurup 2010) as has long been the case in Canadian SDH contexts (Tarlov 1996; Shapcott 2009; Bryant 2009). Although very much an environmental determinant of health with direct physiological impacts (e.g. living in a toxic environment is bad for you), housing conditions are largely outcomes of socio-economic circumstances. Poorly maintained, substandard housing is often the only option for low-income families or individuals (Dunn 2000; Dunn et al. 2006), exposing those individuals to greater health risks due to stress, insecurity, air quality problems, and other SDH (Brunner and Marmot 2006; Dunn 2002). Homelessness and shelter use, at the extreme end of the housing spectrum, subject people to the effects of food insecurity, social exclusion, and a significantly shortened life expectancy (Byrant 2009a) as well as myriad other health conditions (Bines 1994). Where shelter exists, it can hurt or hinder good health as well.

But how do specific housing conditions contribute to occupant health problems? The effects of poor ventilation, poor air quality, and mold exposure on the human body are a major component of this question. As a proxy for inadequate ventilation, the presence of mold in the home may indicate excessive humidity and condensation (Dales et al. 2008; Larcombe and Orr 2007; CMHC 2002). Household mold growth is primarily attributed to air leakage in the structure of the house and condensation, along with leaks in plumbing and other sanitary issues like unattended kitchen waste (Dales et al. 2008), and while "excessive indoor dampness is not by itself a cause of ill health, […] it is a determinant of the presence or source strength of several potentially problematic exposures" (Institute of Medicine of the National Academies 2004:1). That is, despite frequent association

between dampness and mold in the home and various human diseases (Kuhn and Ghannoum 2003; Gent et al. 2002; Dales et al. 1998; Andriessen et al. 1998; Verhoeff et al. 1995; Burrell 1991; Flannigan et al. 1991; Acheson 1991; Platt et al. 1989; Strachan 1988), specific pathophysiologic mechanisms indicating true causation have yet to be established (Holme et al. 2010; Dales et al. 2008; Bonnefoy 2007; Haverinen-Shaughnessy et al. 2006). While calls for more and better review on the association between home dampness and health have been made (Bornehag et al. 2004; Breysse et al. 2004), exposure to dampness and mold has been strongly linked to chronic immune system stimulation in children, effectively increasing individuals' susceptibility to local pathogens and slowing rates of recovery from insults to the immune system (Dales et al. 1998). The long-lasting effects of exposure to such conditions during childhood have also been made clear (Britten et al. 1987; Mann et al. 1992; Coggon et al. 1993; Power et al. 1999; Dedman et al. 2001; Galobardes et al. 2004; Leventhal and Newman 2010; Anderson et al. 2013), and the respiratory health benefits of efficient mechanical or passive air exchange or filtration systems have been established[4] (Kovesi et al. 2009).

A dimension of housing as a SDH not directly covered by the scope of this thesis is the effect of neighborhood socioeconomic status. Residents of socially and economically deprived communities experience poorer health due to access inequalities, the normalization of unhealthy behavior, and the longer term effects of exposure to harmful physical and social environmental conditions and the stress associated with living with limited resources (Ellen et al. 2001; Diez Roux 2001; Diez Roux et al. 1997; Yen and Kaplan 1997). An excellent example of "neighborhood effects" can be found in the results of the United States Department of Housing and Urban Development's (USHUD)

[4] However, as Fugler (2008) points out, mechanical ventilation systems requiring regular maintenance are often poorly understood by new owners, leading to reduced efficiency or total inoperation.

experimental *Moving to Opportunity* (MTO) program, which was implemented in 1994 to test whether growing up in more affluent environments would improve adolescents' physical and social well-being (Goering et al. 2003), effectively addressing the SDH of early life, education, housing, stress, and social support. Self reported health improvements were seen in families who were able to relocate to more affluent neighborhoods in New York and to some extent Boston[5] (Goering et al. 2003:28-29; Leventhal and Brooks-Gunn 2003a), and while the overall study guidelines (Newman et al. 2003:354-359) had little to do with health directly, its effects on its participants' health and well-being were generally promising (Kling et al. 2004; Anderson 2003; Katz et al. 2001).

The geographical focus of this thesis is northern Canada and more specifically Northern First Nations communities, where environmental and social conditions generate a specific range of structure and infrastructure-related housing issues. First, federally designed and delivered wood-frame reserve houses are prone to mold and air quality problems due to their design, lack of upkeep, and the inappropriate materials used in their manufacture (International Housing Coalition 2003). This is particularly noteworthy here in Manitoba, where 20-30% of houses on most First Nations reserves are in need of major repairs or complete replacement (Martens et al. 2002:169). Second, the harsh seasonal climate exacerbates housing-related health issues further by forcing people to spend a great deal of their time indoors, effectively increasing their exposure to harmful conditions sometimes present in the home. Understanding the role of housing in the pathogenesis of some diseases is therefore crucial to the prevention and treatment of conditions disproportionately

[5] The prevalence of asthma in children suspected to be due to dust mites and cockroach allergies "may have been reduced […] by a substantively important magnitude, but the estimate is not statistically significant" (Katz et al. 2003:196).

affecting Northern First Nations populations today (e.g. methicillin-resistant Stahylococcus aureus, tuberculosis, respiratory infections).

Another crucial issue in the maintenance of health in northern communities is that of water security and sanitation. Fecal-oral transmissions of diarrhoea, typhoid, cholera, infectious hepatitis and other diseases are all strongly linked to hygiene deficiencies around the world, which led to discussions for standards for quantities of clean water necessary for basic health requirements (Howard and Bartram 2003). While some argue that enhancing access to water (and thus increasing the quantity consumed) is more important than improving its quality (Esrey et al. 1991), the indirect health effects of the use of unclean water for nutrition, sanitation, and hygiene are widely recognized (Hunter et al. 2010). The two perspectives are complimentary and both provide direction to policy makers in areas with limited water resources (quantity and quality), such as Canadian First Nations communities.

Inadequate water supply has been strongly linked to poor health outcomes in Canadian First Nations communities – and even where water and sewage infrastructure are present, the availability of safe drinking water can be less then universal (Morin et al. 2010; Martin et al. 2007). However, basic water availability (as well as crowded housing conditions and decreased access to health services) are frequently cited as critical factors in the disproportionate occurrence of infectious diseases in First Nations communities, including community-acquired MRSA (Embil et al. 1994:650; Ofner-Agostini et al. 2006; Allen 2006:161; Larcombe et al. 2007; Dalloo et al. 2008). The established Canadian guidelines for the prevention and control of CA-MRSA (Barton et al. 2006) include meticulous hygienic practices, which require access to water – yet Aboriginal Canadians are 90

times more likely than non-Aboriginals to live without a piped water supply (Adelson 2005). Flu prevention guidelines are similarly reliant on water availability (Kumar et al. 2009), which is particularly alarming given the recent A/H1N1 epidemic that saw Canada's Aboriginal populations among the hardest hit in the world (Kermode-Scott 2009). Other infectious diseases resultant from poor water availability and inadequate sewage disposal that disproportionately burden Canadian Aboriginal people living on reserves include, but are not limited to, shigellosis (Rosenberg et al. 1997), Hepatitis A (Jin and Martin 2003), and *Helicobacter pylori* (Bernstein et al. 1999; Sinha et al. 2002). In Manitoba, the lack of access to modern plumbing in houses on reserves varies largely according to geographic isolation, with the northern-most reserves most lacking (Hallett 2006:76). Contributing to the provincial dilemma, 55.2% of First Nations communities in Manitoba are isolated (i.e. with seasonal road access for transporting building supplies), which is the highest percentage of isolated communities per province in the country (Clark et al. 2002).

In addition to a clear necessity for more suitable construction, more and/or larger houses in general are needed to improve health conditions throughout the circumpolar region where crowding and substandard housing conditions are far too common (Bjerregaard et al. 2004; Kovesi et al. 2007; Larcombe et al. 2011; Optis et al. 2012). Once again isolation is a factor, as high transportation costs for materials makes new construction and maintenance both expensive and technically demanding (CMHC 2005) although as Robson (1995) points out, not impossible. Occupancy rates among households across the arctic are consistently higher than the rest of Canada, with the average household size approximately twice the national average (CMHC 2008) and nearly 17% of homes being overcrowded compared to approximately 6% for the whole of Canada. Manitoba First Nations communities have some of the highest rates of crowding in the country, with 4.8 persons per total

housing unit compared to 2.6 persons for the rest of the province (Martens et al. 2002). When only habitable units are considered, that measure of crowding increases substantially to 7.6 persons per unit (Martens et al. 2002).

It is unsurprising that a strong association has been demonstrated between overcrowding and infectious disease in reserve communities (Rosenberg et al. 1997; Kovesi et al. 2007). Particularly alarming is the relationship between crowding and tuberculosis, and it has been shown that a minimal increase in community housing density is associated with a substantial increase in the risk of additional *Mycobacterium Tuberculosis* (TB) cases occurring (Clarke 2002). Considering that Canadian Aboriginal people are four times more likely than non-aboriginal people to live in crowded conditions (Statistics Canada 2008), and that rates of active TB among Canadian Aboriginal populations are nearly six times that of Canadians overall (PHAC 2008), identifying potential therapy alternatives beyond medicine and lifestyle choices (e.g. housing improvements or family-based treatment strategies in cases where patients are known to reside in crowded conditions) is imperative.

The role of interacting environmental and genetic factors in the health status of such communities is also becoming better understood. Genetic susceptibilities and resistances to disease have been established amongst diverse ethnic groups (Hoffman et al. 2002), and a higher prevalence of TB among Canadian Dené and Cree groups has been in part attributed to a diminished capacity for antimycobacterial activity related to critical gene variants (Larcombe et al. 2008; Larcombe et al. 2005). However, genetic susceptibility or resistance cannot alone account for higher TB rates, and ongoing work by Larcombe and colleagues (2011) has emphasized the dual disadvantage in such

communities of a phenotypic vulnerability to TB coupled with an already burdened immune system due to persistent exposure to damp and moldy environments (Larcombe et al. 2008; Larcombe et al. 2005; see also Lehmann et al. 2003; Berger 2000). The immune response mounted in individuals chronically exposed to mold and fungi allergens (where Th2-type cytokines direct the immune response) is not the same response needed to combat TB infection (Th1-type cytokines direct the immune response), thus helping to create the calamitously unhealthy merging of genetics, the environment, and social factors (e.g. income, access to services). Once again, in communities already experiencing increased burdens of health, such multifactorial impediments should be fundamental considerations for health improvement strategies.

Discussion and chapter conclusions

While the SDH are not easily reduced to any single constraint (e.g. wealth), there is substantial overlap in their definitions as well as in efforts to apply SDH knowledge in addressing health and social inequity. Social scientists are particularly well suited to identify and measure the forces that permit or constrain those SDH. Tarlov (1996) pointed specifically to anthropology, noting how its practicioners (e.g. archaeologists, paleopathologists, historical demographers) have long recognized health as an outcome of the interaction between humans and their social and physical environments. As mentioned earlier, SDH research is often openly applied to social justice concerns. If objective detachment from the subjects of research is no longer necessary, then political direction should inform the employment of results (Scheper-Hughes 1995; Speed 2006). Unlike more conceptual morality and rights-based appeals for social change, the SDH offer tangible, measurable parameters of both impetus and outcome, and successful epidemiological, economic, and social results are salient to academic interests and policy makers alike. No research subtext is required. Improving

standards of health is a robust primary objective on its own because the criteria are easily defined and understood, scientifically measurable, and lend themselves to the running dialogue on health care efficacy and efficiency.

As a SDH with broad and overlapping antecedents and consequences, housing is particularly situated in individualist Western dogma. As Byrant (2009a) points out, addressing housing at the policy level involves an unfortunate degree of ideological positioning. The notion of "deservedness" of social circumstance based on the "decisions, actions, and attitudes" (Jenkins 1982, quoted in Byrant 2009a:247) of social service recipients helps explain governmental responses to housing as well as other SDH despite political recognition of issues. This is why Raphael (2004) is particularly adamant in defining SDH in parameters germane to existing government offices and institutions (e.g. the CMHC). Thus, at the policy level, whether it is more effective to operate on a generally conceptual understanding of SDH with umbrella-like categories relevant to numerous health conditions, or on more specific, material terms that are more manageable but may be more vulnerable to ideology-based dismissal remains to be seen. The reception and successes of housing and other social determinants-oriented programs and policy will likely guide future focus and implementation; it is clear now only that we have far to go (Raphael et al. 2011; Raphael 2011a, b; Puska and Ståhl 2012).

Chapter 3: Towards understanding housing as an Aboriginal determinant of health

"That in the event hereafter of the Indians comprised within this treaty being overtaken by any pestilence, or by a general famine, the Queen, on being satisfied and certified thereof by Her Indian Agent or Agents, will grant to the Indians assistance of such character and to such extent as Her Chief Superintendent of Indian Affairs shall deem necessary and sufficient to relieve [them] from the calamity that shall have befallen them."

Treaty 6, 1876

Introduction

To better understand why Canadian Aboriginal people are typically subjected to inadequate living conditions, it is necessary to examine historical housing and settlement patterns. This chapter provides an overview of pre- and post-contact environmental and cultural contexts of housing as a social determinant of health, culminating with the institution of on-reserve housing. The discussion turns to legal and constitutional contexts, and the "treaty right to health" approach to improving the health status of Aboriginal Peoples (Boyer 2003, 2004; Favel-King 1993; Fumoleau 2004; Henderson 2008) is examined. In accordance with assertions that environmental dispossession (Richmond and Ross 2009) and relocation (Bartlett 2003) has marginalized Aboriginal people and deeply impaired their collective health status, it is suggested that both treaty and Aboriginal rights-based approaches to health include better consideration of the effects of housing and settlement pattern changes brought about by treaty negotiations and the Indian Act of 1876.

Housing and settlement patterns through history

As noted in the first chapter, the health of Aboriginal Canadians can be understood as a product of inequality. However, prior to contact and the eventual creation and inhabitation of reserves, life was

not necessarily pristine. These dated assertions of the 19th and 20th centuries, even when made cautiously (e.g. Young 1979), originated in part from health service professionals publishing endorsements of the "nomadic life" and "tents rather than…huts" (Rabinowitch in McCallum 2005:108). Such views reinforced depictions of Aboriginal people as distinct and primitive, and helped exacerbate the assimilationist priorities of a government uninterested in its obligations to its Aboriginal inhabitants.

Authors today, however, are quick to note the presence of disease prior to European contact. Soil and food-borne pathogens and parasites were undoubtedly present in populations living in such close proximity to the physical environment – especially given the "close contact with mammals (domestic and feral), birds, fish, and insects, as well as with their waste products" (Herring and Sattenspiel 2007:190-191). Although indices of disease from pre-contact times must always be assessed cautiously[6], it is possible to identify living conditions that served as risk factors in more temporally distant populations.

Regular exposure to natural wood and oil smoke at home would have contributed to respiratory illness in the past just as toxins in modern homes affect occupant health today. A 2000 year span of Aleutian Islander life histories provides an analogous illustration of how poorly ventilated living conditions led to serious health problems in the past (Zimmerman et al. 1971; Zimmerman and Smith 1975; Zimmerman 1998; Zimmerman and Aufderheide 1984). Spending time around interior

[6] Indices of health and illness derived from skeletal remains of past people offer a "paradoxical" account of past health. Skeletal evidence of infectious disease not only tends to be non-specific, but those lesions which are detectable in bone are normally attributed to longstanding, chronic conditions with which the individuals displaying those lesions lived. A major epidemic, on the other hand, with quick and devastating population outcomes, would not allow enough time before death for the disease to manifest in the skeleton (Wood et al. 1992).

fires for cooking and heating added physiological stress during the winter months, when more time was spent inside houses specifically designed to trap fire-heated air and its accompanying smoke. The increased exposure to smoke and soot is recognized in the mummified remains of Aleutian Islanders with severe anthracosis (i.e. "coal miner's lung" or "black lung") appearing at early ages, and other conditions like emphysema and bronchiectasis (Zimmerman 1998:151; Zimmerman and Aufderheide 1984:63; Zimmerman and Smith 1975:831-832). These discoveries help illustrate the enduring influence of housing conditions as determinants of health.

Much can also be taken from historical and ethnohistorical descriptions of life and living conditions. Some historical descriptions of life and living conditions can be limited, such as T.F. Drage's (1982:10) apathetic 1748 description of Northern Cree dwellings as "sufficiently wretched," although in other cases accounts of living conditions and their direct effects on health were carefully recorded. In some cases, "Indian Agents […] looked beyond racial and paternalistic explanations to locate the high rates of illness in environmental issues, singling out atrocious housing conditions in particular" (Moffat and Herring 1999:1829). Even after the introduction of and encouragement to live in sedentary housing, early 20th century accounts of disadvantageous hygiene and ventilation issues among those who made the transition from mobile to permanent housing exemplify conditions known to be detrimental today:

> All that the first remove from the wigwam, tepee or tent to the little one-storey log cabin or hut, with its roof and floor of mud, has to recommend it, is the fact that it forms the initial stage in that fixity of abode which is the first essential step towards civilization. In so far as concerns ventilation the change is distinctly disadvantageous and the superior cleanliness secured by more or less frequent change of site, over the accumulated filth of a stationary mud floor, is obvious.
>
> (Dominion of Canada 1910:xxiv)

Hallowell's (1991) ethnographic account offers a rich illustration of permanent and semi-permanent settlement types both in terms of descriptive detail and analytical relevance to settlement patterns

and land-use. His report of single and multi-family dwellings and their seasonal usage (Hallowell 1991:105) are particularly interesting – especially that of the Ojibway bark and canvas covered *cäbandawan*. Shaped like a triangular prism with doors at both ends, two families would keep a single fire on either side of them with up to ten families in the same *cäbandawan*. The social and economic patterns associated with this shared living arrangement were later transposed into multi-family log cabin use by First Nations Peoples in that region (Hallowell 1991:106-7).

But it is the fundamental changes in traditional land use and settlement patterns caused by the signing of treaties in the 19th century that led to (and continues to contribute to) the greatest impact on the health of Canadian Aboriginal people. Prior to European contact and the eventual permanent settlement patterns initiated by those treaty negotiations, Canada's Aboriginal populations often followed seasonal, semi-nomadic subsistence cycles. These seasonal subsistence cycles refer to "the means of systematic extraction of natural resources that are vital for the survival" of economies that rely on the surrounding environment, and vary from place to place (Larcombe 1994:4). In central Canada, Hallowell's (1992) work in particular illustrates the seasonal variation involved in those populations' land-use patterns still in use at the time of contact (see also Ray 1998, 1976; Meyer and Thistle 1995).

The persistence of these settlement patterns is apparent in historical records, as is the impact of such social organization on human health. Referred to as an "aggregation-dispersal" pattern (Carpenter and Sattenspiel 2009:292), population density and distribution varied according to season. During the harsh winters, when large groups could not be sustained due to food scarcity, smaller family groups remained on traplines and had infrequent contact with others. In the summers when food was

abundant and larger groups were sustainable, the opportunities to congregate in larger groups brought families back together. During the fur trade these congregations often occurred at trading posts. Depending on the region these groups varied in size:

> In all areas summer was the time when Indian groups came together to form larger villages. In the woodlands, fishing encampments of two or three hundred were common, whereas in the grasslands, bison camps of one to four thousand were frequently reported. In [these] areas, the Indians dispersed into smaller bands during the winter… In the woodlands they often consisted of twenty to thirty individuals; in the parklands some camps of up to a thousand people were reported, but most were probably much smaller.
>
> (Ray 1976:141)

Traffic between trading posts mostly occurred in the summer when mobility was facilitated by open water, whereas harsh winter weather and dispersed family groups tended to reduce contact with the post to a small number of trappers and mail couriers (Herring 1993:78). Using historic records, Ray (1976) described the relationship between seasonal migrations of Aboriginal people, white traders, and disease transmission. The possibility of transmitting infectious disease was naturally highest in the summer during times of congregation and intermixing (Ray 1976).

As people began to settle more permanently, different patterns in seasonal disease incidence become evident. Those at Fisher River, Manitoba were described by an Indian Agent in 1908 as being less healthy in the winter when they lived in poorly ventilated log cabins rather than their frequently-moved, well-ventilated summer tents (PAC 1908 in Moffat and Herring 1999), and the same conditions have also been linked to the seasonal variation in infant mortality (Moffat and Herring 1999). Without question, these social and physical community structures had a powerful role in determining the impact of an epidemic on a community. Over time, the transformation of land-use patterns as well as political rights brought about a shift in living conditions so powerful it is still a significant determinant of health today.

Treaties and the Indian Act

Treaty land claim negotiations of the 19th century permanently and fundamentally changed the settlement and land-use patterns of many Canadian Aboriginal people, subsequently impacting their health and well-being. Treaty documents, which established delimited geographical spaces to be recognized by non-Aboriginal governments as Aboriginal territory for permanent settlement, continue to be interpreted and negotiated today.

Today treaty agreements are viewed by some as politically and symbolically important documents providing support and acknowledging the sovereignty and rights of their signatories. As Boyer (2003:17) states, for Aboriginal signatories, the purpose of the treaties was not to surrender their traditions but to protect them during these difficult periods. Others point out the symbolic and material relinquishment of land and life that accompanied treaty negotiations, and link contemporary challenges of the signatories to the aging documents (McMillan 1995). The conditions under which individual treaties emerged also varied, with many agreements assembled under duress or other dubious circumstances. For example in western Canada, where Aboriginal populations relied heavily on bison herds for subsistence, the overhunting of settlers and newly introduced infectious diseases like small pox and scarlet fever in the 19th century took a toll on Aboriginal communities; (Waldram et al. 2006). Enticed by federal commitments to relief, leaders of increasingly destitute Aboriginal groups "treatied up" in acknowledgment of intensifying changes.

While no single explanatory factor can adequately sum up the current health disparities or the normalization of substandard living conditions of Canadian Aboriginal people, the long-term effects

of colonialism provide a framework for understanding their underlying causes. The federal statute that best embodies this disparity between stated intention and outcome is the Indian Act of 1876. On paper, the Act was meant to entitle Aboriginal people registered under the British North America Act to social benefits such as housing, education, and health care. It established Indian and treaty status under the Canadian government for those registered under and therefore entitled to the benefits of treaties. However, as MacMillan and colleagues (1996) note, it "infringed severely on the rights of Aboriginal people [by] specif[ying] that almost all decisions made by [Aboriginal] bands [require] approval by government" (1996:1571). Parliament was able to amend the Indian Act without consultation with (i.e. permission from) those affected by such amendments, and it did so frequently (Ray 1996:205). The paternalistic nature of the act is also apparent in many of its clauses, such as Section 89, which stipulates that all reserve land is under federal title and therefore cannot be used as collateral in financing development (e.g. housing). This has long created barricades to homeownership on reserve land, forcing many economically disadvantaged residents into volatile housing situations.

While Aboriginal status has been recognized as a SDH (Raphael 2009), it is important to emphasize that Aboriginal identity is not the determinant, but the accompanying status and history of social, political, and economic control and subjugation which has created far-reaching inequity and harm. When placed in historical and legal contexts, Canadian Aboriginal health disparity is in no small part a result of the systemic neglect of Aboriginal and treaty rights – and more to the point, of the people themselves. The Indian Act has allowed the Canadian Government to relocate Aboriginal people from their homelands to reserves or other locations which were ultimately controlled by Ottawa, effectively undermining livelihoods and economies (Smylie 2009:286). And as Aboriginal groups

settled permanently on reserves, the frequency of exposure to relatively new pathogens for which there was no effective immune response escalated morbidity and mortality rates (Smylie 2009). "Poor living conditions, coupled with the marginalization of many […] Aboriginal groups from political and economic power, ensured that chronic infections, like tuberculosis, reached epidemic proportions in the nineteenth century" (Herring and Sattenspiel 2007:191). Crowded living conditions were noted then as now for their role in the transmission of respiratory and other infectious disease although, as is too often seen today, the responsibility for those health outcomes was placed on the occupants rather than the providers of the houses (Moffat and Herring 1999).

In his brief introduction to colonialism as a SDH, Hart (2010) describes a range of elements contributing to the repression of Canada's Aboriginal peoples, beginning with the control of territory and overrule of indigenous governance; the dislocation of people from their physical and cultural environments is one of colonialism's many expressions. The attempted annihilation of languages and the legacies of abuse emerging from the Canadian Residential School experiment are becoming recognized as fundamental examples of such oppressive management (RCAP 1996); the intergenerational damage to Residential School survivors and their children continues to be exposed (Milloy 1999; Tait 2003; Chansonneuve 2005, 2007; Elias et al. 2012).

Similarly concealed in Canadian history is the long-term social, physical, psychological, and spiritual damage brought about by the forced relocations of entire communities (Brice-Bennett 1994; Bartlett 2003). Regardless of its justification in any instance, wholesale environmental replacements were also powerful mechanisms of assimilation undertaken by Canada in the 20th century. Expositions of the failure of relocation projects – even while framed in evaluations of adaptive

strategies (Bone 1969; Lal 1969a, 1969b; Koolage 1971, 1976) – reveal community destruction in many forms, including intragroup violence, alcohol abuse, and other social disturbances (Waldram 1987). The drastic changes in settlement pattern (e.g. from seasonal and temporary shelter to urban models) is a major cause of trauma for those who have endured expulsion from their home:

> [T]he residents of a particular community are usually not consciously aware of their proxemic patterns, i.e., use of space, and it is therefore not surprising that planners are also unable to grasp the significance and cultural appropriateness of an apparently haphazard settlement pattern. In the face of such a conceptual void, southern urban, and therefore culturally inappropriate, settlement patterns are developed. The impact of this process on the native population has been profound. (Waldram 1987:120)

The social disruption and material deprivation experienced in Aboriginal communities subjected to environmental dispossession and relocation will be discussed in the context of Tadoule Lake in the next chapter. Following the historical context of housing conditions as a determinant of health, the remainder of this chapter will focus on the implications of rights-based discourses on improving Canadian Aboriginal housing, health, and well-being.

Treaty right to health and housing

Since 1982, treaty rights and Aboriginal rights have been constitutionally guaranteed under Section 35 of Canada's *Constitution Act*. Although these rights have not always been acknowledged in a meaningful way (Henderson 2008), Canada's recent ratification of the UN Declaration on the Rights of Indigenous Peoples suggests progress may be forthcoming. Acknowledging and acting on such standards is identified by the WHO's Commission on Social Determinants of Health to be a requirement for reversing the impact of colonization and improving Aboriginal health status.

Despite Canada's troublesome record of interpreting Aboriginal and treaty rights (Boyer 2003; Henderson 2008), these acknowledgements remain important advances in the struggle to improve Aboriginal health and well-being in Canada. Laws pertaining to the rights of all people or specific groups "can help conceptualize and articulate in legal terms the assaults on human rights, dignity, and social inclusion that constituents who are affected experience [and] help give legal content to emerging advocacy goals" (Foscarinis et al. 2004:97).

Aboriginal rights refer to the protected status of activities and traditions established prior to European contact with First Nations peoples in Canada. They are not unique to any specific group: they refer to rights guaranteed to those identified in Section 35 of the *Constitution Act* as Aboriginal people. These are activities considered to be integral to distinct cultures – including, for example, the right to self-government and to the practice of traditional medicine. It is important to recognize the "complex and diverse medical and healing traditions [Aboriginal peoples used] to deal with health problems and the maintenance of good health" (Boyer 2003:15), and that such practices "must be considered at a general rather than specific level. They may be an exercise in modern form of a pre-contact practice, custom or tradition and the claim should be characterized accordingly" (R. v. Van der Peet 1996:4). As Boyer (2003:15-16) states, "Aboriginal rights to health care arise out of behavioural regularity and practices," and "the practice of healing and medicine in accordance with their own customs and traditions […] is integral to Aboriginal Peoples in Canada as a collective."

Treaty rights, on the other hand, are relevant only to the particular signatories of each treaty. Current efforts supporting the treaty right to health care have not been extinguished despite supreme court rulings favoring literal readings of treaty texts which do not recognize such interpretations (Boyer

2003). The treaty right to health is an important legal approach in efforts to improve the health and potentially the housing conditions of Aboriginal communities today. Establishing a firm link between housing conditions and health requires acknowledgment from the Crown of their fiduciary responsibility in providing not only medical care to treaty signatories but the responsibility to improve housing as well. Recognizing the health impact of the changes to settlement patterns brought about by agreements with Canada in the first place adds strength to the argument as it helps illustrate the Canadian government's longstanding role in shaping Aboriginal health.

Of the treaties signed between Canada and its Aboriginal peoples, only Treaty 6, signed in 1876 by Cree nations in Alberta and Saskatchewan, includes specific provisions for health care. In its "pestilence" and "medicine chest" clauses, the treaty states:

> That in the event hereafter of the Indians comprised within this treaty being overtaken by any pestilence, or by a general famine, the Queen, on being satisfied and certified thereof by Her Indian Agent or Agents, will grant to the Indians assistance of such character and to such extent as Her Chief Superintendent of Indian Affairs shall deem necessary and sufficient to relieve [them] from the calamity that shall have befallen them.

and continues,

> That a medicine chest shall be kept at the house of each Indian Agent for the use and benefit of the Indians at the direction of such agent.
>
> (DIAND 1964)

During negotiations leading up to the signing of other treaties, verbal assurances were also made by Commissioners regarding Canada's responsibility to provide health care although these promises were not included in treaty texts. For example, Treaty 11 Commissioner Conroy noted leaving supplies "for the sick and destitute" (Conroy 1921, in Fumoleau 2004:253). More compelling, however, were negotiations for Treaty 8 (1899), where Treaty Commissioners "promised that supplies of medicines would be put in the charge of persons selected by the Government at different

points, and it would be distributed free," and that "the Government would always be ready to avail itself of any opportunity of affording medical services" (Laird, Ross, and McKenna, in Fumoleau 2004:87). Similarly, between separate assurances to provide cattle and ammunition – and in the presence of a physician – Treaty 10 Commissioner JAJ McKenna (1909:42) reported promising to signatories

> ...that medicines would be placed at different points in the charge of persons to be selected by the government, and would be distributed to those of the Indians who might require them [and] that the government would always be ready to avail itself of any opportunity of affording medical service.

Boyer, following Supreme Court of Canada decisions regarding Aboriginal fishing rights in *R v. Marshall* (1999) points out that "where a treaty was concluded orally and then later drafted by the Crown's agents afterwards, *it is unconscionable for the Crown to ignore the oral terms agreed to by the parties*." Following decisions regarding Aboriginal hunting rights made in *Simon vs. The Queen* (1985), "ambiguities about the language in a treaty or the negotiations *must be resolved in favour of the Indian signatories*" (Boyer 2003:17, emphasis added).

Boyer's (2003) straightforward synthesis of how the medicine chest clause has been interpreted over time in Canadian courts provides the context for current efforts to acknowledge and act on the treaty right to health. In *Dreaver vs. The King*, the chief of the Mistawasis Band of Saskatchewan launched a suit in what is now the Federal Court of Canada to recover the band's medical supplies costs accrued between 1919 and 1935, arguing that under Treaty 6's medicine chest clause the provision of all medical services should be covered by the Federal government (Waldram et al. 2006:197; Boyer 2003). Dreaver was successful, and the ruling helped facilitate decisions in later cases, such as 1965's *Regina vs. Johnston* (Boyer 2003). The defendant in *R. v Johnston* was another

Treaty Six signatory who was charged for failing to pay tax under the *Saskatchewan Hospitalization Act* and the judge's ruling drew directly on the medicine chest clause. However, these judgements were appealed and overturned only a year later in the Saskatchewan Court of Appeal when a more literal interpretation of the clause was deemed appropriate and only a "first aid kit" was required to be made available to Treaty 6 signatories. Of particular significance regarding these decisions is their pre-*Constitution Act* emplacement, i.e. they predate the constitutional entrenchment of Aboriginal and treaty rights in Canada, when the principles of treaty interpretation were officially settled (Boyer 2003).

The power of rights-based approaches in efforts to improve health is apparent in these legal contexts – although so are the infrequent and slow moving nature of such approaches. Where interpretations of specific clauses or commissioner reports can be used to strengthen Canadian Aboriginal health and health care for the descendants of certain treaty signatories, many others remain excluded. Treaty texts contain no direct assurances for housing needs, but the control over land use and settlement patterns exercised by the federal government by means of treaty agreements has clearly altered traditional settlement patterns. Since historical and current housing conditions are a fundamental determinant of health, considerations of settlement patterns and housing as neglected Aboriginal rights (i.e. traditional lifeways which have been jeopardized to the detriment of people's health and well-being) could prove useful in extraneous and organic advocacy contexts. Much has changed since the 19th century; fiduciary obligations should be met or renegotiated.

Rights, responsibilities, action

As one of the most important outcomes of treaty negotiations (and the Indian Act) was the physical reorganization of Aboriginal populations on the landscape and the accompanying changes to their social organization, understanding and acting upon the known links between living conditions and health must take into account these historical and legal circumstances to effect real policy change. The specific acknowledgement of health care provision in written and oral treaty promises can be used to effect change, but the treaties themselves must also be recognized for their more absolute role in shaping the health of Aboriginal signatories through time: initially in reorganizing people on the landscape, exposing large numbers to increased risks of disease, and later through complex management of on-reserve housing programs and the normalization of substandard housing conditions.

The "cultural, social, economic, and political impacts of colonization [have subjected Aboriginal people to] extreme stress for multiple generations," and therefore the examination of "how culture has been affected by sustained contact between groups will result in the most appropriate design for culturally grounded … approaches that will increase [Aboriginal] health and well-being" (Bartlett 2003:166). Not only is the relationship between physical health and the social environment central to such analysis, but the restoration of the balance – or, equality – central to holistic Aboriginal healing philosophies rings clear as well (Waldram et al. 2006:131). As noted in the last chapter, while well intentioned universal human rights-based appeals for and approaches to improving the health of marginalized people provide important moral frameworks for addressing health equity in any community, they often remain as abstract ideals. Across Canadian Aboriginal communities, practical progress in both research and policy must address the multifaceted historical, legal, and

social inequalities that have impacted Aboriginal health since contact. Constitutionally recognized rights are an important part of this discussion for all Canadians.

The following chapter is an analysis of housing and health conditions in the northern Manitoba First Nation community of Tadoule Lake. Historical, social, environmental, and structural conditions are used in the assessment and analysis. The results suggest that combining these lines of evidence is necessary to better understand conditions present in unique communities, and that without such multifaceted analysis the policy results may overlook the distinct needs of the most vulnerable community members.

Chapter 4: Tadoule Lake community background and housing and health survey overview

Community geography and demographic background

Tadoule Lake, home to the Sayisi Dené First Nation Band (*the Dené from the east*), is one of the northernmost communities in Manitoba. Located on an esker on the northwestern boundary of Tadoule Lake, the settlement is divided between the mainland and a small island (< 1km^2), which is connected to the mainland by a low-lying sandy isthmus. The community has a recent and lengthy history of social and health-related problems, much of which stems from their forced relocation to Churchill, Manitoba in 1956. The events leading to the relocation are numerous and intertwined but are largely attributable to unequal power relationships between the Sayisi Dené and the federal and provincial governments of the day. Accounts from both sides illustrate this injustice.

Before turning to the details of the 2010 health and housing project, this section provides a brief background to the 1956 relocation of the Sayisi Dené, their time in Churchill, and their eventual return to their traditional territory. While many of these details are available in the pages of a community memoir, *Night Spirits: The Story of the Relocation of the Sayisi Dené* (Bussidor and Bilgen-Reinart 1997), some of the following is also informed by stories and discussion from September, 2010.

The people of the eastern sun

Although it is now considered a derogatory term denying the group their true ethnicity (Petch 1998:56), members of the Sayisi Dené First Nation became known as the Fort Churchill Chipewyan Band from their signing of an adhesion to Treaty 5 in 1910. The adhesion was meant to officially

recognize the traditional lands of the Sayisi Dené, which spanned from the west side of the Churchill River northwards, beyond what was to become the northern boundary of Manitoba a year later. This new political boundary had little to no effect on the Sayisi Dené as they continued to practice a traditional "hunter-traveler" lifeway (Petch 1998), following the annual migrations of the barren-ground (Qaminuriak) caribou herd. The years leading to and following the signing of the Treaty 5 Adhesion was considered a time when "all the people and all the animals understood each other and spoke the same language" (Tadoule Lake Elder Betsy Anderson in Bussidor and Bilgen-Reinart 1997:9).

Ottawa and the provinces' interest in northern Canada increased substantially throughout the first half of the 20th century as its mineral and oil prospects became clearer, and governments requiring infrastructure in the resource-rich north pursued treaties with its inhabitants. In northern Manitoba, rather than drafting and signing new treaties, the government included formerly unsigned bands into pre-existing treaties by allowing adhesions to those agreements. This provided an expedited process and was likely a cheaper option for the government. By signing an adhesion to the 35 year old Treaty 5, the Sayisi Dené were allotted 160 acres per family as opposed to the 640 acres per family granted to bands in Saskatchewan and Manitoba who signed adhesions 1906's Treaty 10. The negotiations were completed "solely at the convenience of the government" after 30 years of denied requests to enter treaty (Tough 2000:99). The government duplicity inherent in these negotiations is clear:

> [T]he terms of the Treaty Five Adhesions represented minimal obligations on the part of the government to assist Indians with post-1870 conditions. The procedures [were] sloppy and irregular. As in other treaty areas, the adhesions to Treaty Five illustrate that economic circumstances shaped Indian attitudes and approaches towards treaties. Despite Indian desires for a treaty to cover area north of Treaty Five (1875), the timing of the adhesions and, consequently, the scope of the treaty were controlled by the government. This transparent case of a one-sided use of authority during this phase of treaty-making challenges the conviction that Indian policy was generally well-meaning and just.
>
> Tough 2000:99

A *Toronto Star Weekly* journalist covering this historic event proposed that despite being assured that their hunting and fishing rights would not be challenged "for many years to come," the interpretation between the two groups remained "unsatisfactory and nebulous" (A.V. Thomas in Tough 2000:109). The Sayisi Dené are similarly critical of the negotiation process, noting that many words contained in the treaty text had no Dené language equivalent (Bussidor and Bilgen-Reinart 1997:26). Elders confirm the poor communication: "If we had been told that we were signing away our land for the amount of five dollars a person, there was no way our people would have agreed" (Betsy Anderson in Bussidor and Bilgen-Reinart 1997:27).

Not being assigned reserve land in the treaty process, the Sayisi Dené enjoyed a relatively unchanged way of life in the years following their signing of the Adhesion. However, it was not long before the rights guaranteed to them in the dubious treaty negotiations were compromised. In 1917 the North West Game Act set hunting seasons and prohibited altogether the hunting of certain species, confusing treaty signatories who believed their rights to their traditional lifeways were absolute (Bussidor and Bilgen-Reinart 1997). In 1928, as the railway to Churchill was completed, more white trappers and traders began arriving in the region. These men had a very different approach to harvesting wildlife than the Dené. Phillip Godsell described the impact of these trappers in his memoir of his 30 years with the HBC:

> [I]n the course of a single season will accumulate three or four times as much fur as an entire Indian family has been in the habit of taking out of the same territory over a period of years. […] [F]ur bearing animals are now becoming scarce in many sections of the Northland, and […] it has even been necessary for the Government to furnish help to needy Indians who, until quite recently, had always been entirely self-supporting, for, when the Indian saw these strange white men take casual possession of his hunting grounds, his dogs poisoned, and his trapping lines dotted with the usurpers' traps and poison baits, he deliberately trapped all the furs he could to prevent the hated "Big Knives" from getting it.
>
> Godsell 1934:197

Restrictions to hunting and trapping rights continued to trouble treaty signatories after 1930 as Canada turned jurisdiction of crown land and natural resources to prairie provinces under the Natural Resources Transfer Agreements (NRTA). These agreements, sometimes referred to as the "Forgotten Constitution" (O'Byrne 2007), were negotiated between the federal and provincial governments of Alberta, Saskatchewan, and Manitoba, and included no consultation with First Nations people. The NRTA transferred rights to land and resources in band territories (i.e. as recognized in treaty texts) to the provinces, where provincial game laws would apply. As Abel (2005:210) points out, "the long list of prosecutions for infractions at places like Fort Chipewyan demonstrates conclusively that the police were enforcing those laws." In two short decades, treaty promises were broken.

Another factor ultimately leading to the relocation was the Sayisi Dené's reduction of mobility over time. In 1930, to better compete with free traders in Dené territory; the Hudson's Bay Company (HBC) moved their 250-year-old Churchill trading post to Caribou Lake. Ongoing Dené and free trader contact in Churchill over the next decade coupled with poor firewood availability forced the HBC to move their post further into Dené territory, 128km northwest at Duck Lake, where the Fort Churchill Chipewyan trappers began building log cabins for winter settlement. The location, on the narrows to the north of Duck Lake, were on the migration path of the Qaminuriak herd, and the people continued to pursue those caribou as usual until the mid 1950s.

Relocation and return

In 1956, the Sayisi Dené were forcibly relocated to Churchill, where they became known as the Churchill Band of Caribou-eater Chipewyan. While "conflicting reports" regarding their relocation

emerged from local residents who reported that the band was starving and needed government assistance (Koolage 1971:53), the official explanation for the requirement to relocate the community was heavily based on Canadian Wildlife Service and Manitoba Game Branch misunderstandings of their traditional caribou hunting practices. Caribou were regularly harvested en masse by exploiting bottlenecks in their migration route, and what was not used immediately was preserved in the freezing environment for use throughout the winter and thaw. However, photographs of caribou carcasses at Duck Lake and accusations of "wanton slaughter" (Banfield 1954) were spun as the leading explanation for the perceived decline in barren-ground caribou populations (Campbell 2004; Sandlos 2007). Although discussions about the terms of the relocation agreement were recorded before the move occurred, the Dené at Duck Lake spoke no English and Indian Affairs officials spoke no Dené; elders do not recall an agreement (Bussidor and Bilgen-Reinart 1997:44-45).

At the time of the relocation, the Sayisi Dené population was estimated to have been between 250-300 people (Bussidor and Bilgen-Reinart 1997). Between August 17th and 21st, 1956, fifty-eight people were taken from Duck Lake to a tent settlement on the exposed northeastern shore of the Churchill River (see Figure 1 for map of locations) with little more than their portable possessions and their dogs. Homes, hunting equipment, and food were abandoned (Petch 1998). Band members on traplines or at nearby camps, or those already in Churchill for work were all to be affected by the displacement as their community had suddenly, and without warning disappeared (Bussidor and Bilgen-Reinart 1997). For those who made the harrowing journey on the Canso flying boat little can be recalled of the first days and weeks of the relocation. Those on the plane were assured by Indian Affairs that their hunting and trapping equipment would be replaced, although those promises were never fulfilled (Koolage 1971:53). The few who made the trek by dog team were able to retain those

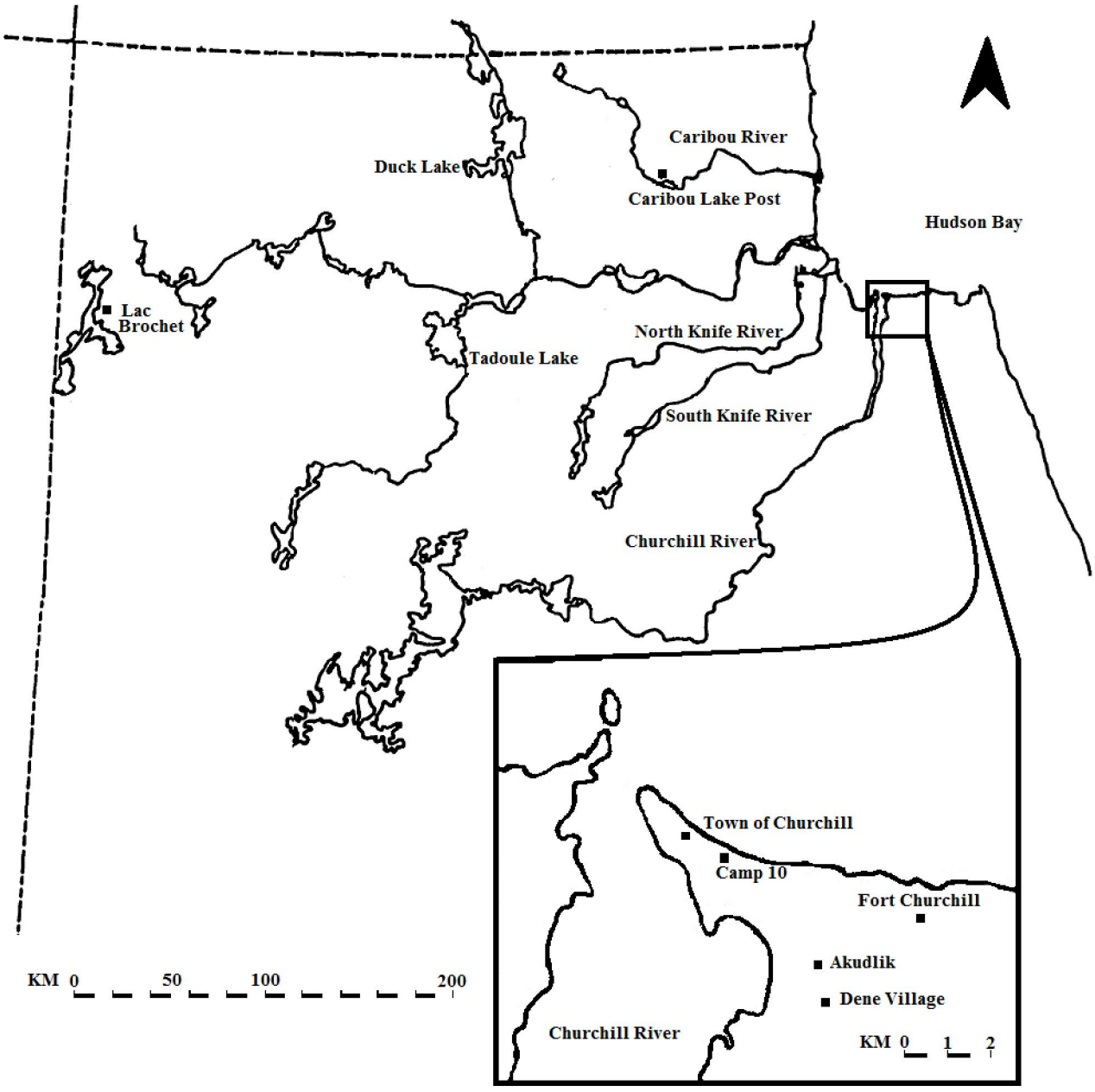

Figure 1: Map of locations.

items and continued hunting and trapping provided the RCMP did not shoot their dogs for being a nuisance or a rabies threat (Koolage 1971:53; Bussidor and Bilgen-Reinart 1997:57). Within a

month of their initial landing, the people were moved again with few supplies to the North River settlement, 75 km west of Churchill, where they quickly found traditional practices like hunting caribou to be impossible.

For the first few years, the families who had been airlifted to Churchill spent their time wintering at North River and spending summers trading or working in Churchill (Bussidor and Bilgen-Reinart 1997). Within a year of the initial relocation, some 300 band members had congregated in Churchill, many behind the grain elevator on the east shore at the mouth of the Churchill River and others still across the river on its western shore. While some lived in canvas tents, others built shacks upon arrival, using materials scavenged from the local landfill (Bussidor and Bilgen-Reinart 1997). White locals in the town found these lodgings unacceptable (Hlady 1960) and pressured Indian Affairs to provide a specific location for the Sayisi Dené. This pressure was intensified by the National Harbours Board's decision to build an oil storage facility near the elevator, where many families were located (Bussidor and Bilgen-Reinart 1997:47). The RCMP were asked to evict the families residing there and with seemingly nowhere to go, the solution was to relocate families yet again to Camp 10, an abandoned army tent site where Indian Affairs erected tiny prefabricated homes initially for those displaced by the Harbours Board construction.

Those who were able to retain hunting equipment favored living at North Knife River in the winter or across the river in the summer rather than Camp 10 (Koolage 1971:54) for several reasons. The houses at Camp 10 were situated immediately adjacent to the Churchill cemetery. The Sayisi Dené's powerful apprehension and respect for the dead accorded burial grounds never to be occupied or

used for hunting and to do otherwise was to tempt the night spirits, causing severe psychological stress (Petch 1998; Bussidor and Bilgen-Reinart 1997). The houses in Camp 10 were also situated on an unprotected ridge which exposed Camp 10 to harsh wind and weather from the Hudson Bay, and its occupants struggled to insulate their houses from the elements. During the long winters, even when it was not snowing the north wind brought drifting snow over the houses, submerging them entirely (Bussidor and Bilgen-Reinart 1997). Houses were poorly designed and constructed with no water or sewage infrastructure, and although water was delivered by truck, the drivers occasionally refused to take water to a house, claiming the houses were unhygienic and they risked damaging their equipment (Koolage 1971:56). There was no source of fresh water near Camp 10, and even after Indian Affairs installed two spigots in the community connected to the Churchill water main, there was seldom enough pressure to provide water (Bussidor and Bilgen-Reinart 1997:60).

Throughout their years in Churchill the Sayisi Dené were socially and economically marginalized compared to white, Inuit, Cree, and Metis or other Aboriginal groups in Churchill (Koolage 1971:82-90). Indian Affairs promoted seasonal labor jobs to the Dené (e.g. dog sled taxis, Christmas tree cutting, cargo hands at the shipping yard), but with few band members able to speak English, other jobs were more difficult to find or keep (Koolage 1971). The Sayisi Dené fell victim to discrimination by other community members who considered them to have poor hygiene and lower intelligence (Koolage 1971:170), even becoming "prey to elements in the community which found sport in driving into Camp 10, throwing bottles and trash at its inhabitants, running them off the road, or mugging them" (Koolage 1971:56). With difficulty maintaining the basic necessities of life, the inhospitable conditions of Camp-10 generated a desperation that by all accounts culminated with the painful disintegration of their social fabric (Bone 1969; Lal 1969a, 1969b; Dickman 1969). The

greatest catalyst to destruction came in 1960, when liquor laws changed to allow "Indians" the legal purchase of alcohol (Virginia Petch in Bussidor and Bilgen-Reinart 1997:61).

Detailed in the pages of *Night Spirits* are the first-hand recollections of the social and psychological consequences of alcoholism, violence, hunger, and fear at Camp-10 (Bussidor and Bilgen-Reinart 1997). While it is beyond the scope of this thesis to reiterate those stories justly, they do reveal the real impacts of the relocation. There is no shortage of grim imagery in those recollections and the brutal housing conditions of Camp 10 are mentioned periodically. The absence of plumbing, the use of refuse from the landfill to make repairs, and the terrible cold felt in their minimally insulated homes throughout the winter are clearly recalled by contributors.

But like their initial arrangements in Churchill, Camp-10 was not to be permanent. By 1966, in part responding to complaints of Churchill residents about the unsightly settlement, and in part responding to the pleas of the band, Indian Affairs made plans to move the Sayisi Dené again, 5km southeast of the town (Bussidor and Bilgen-Reinart 1997). The new site bore resemblance to carefully planned suburban neighborhoods of the south, complete with water and sewer service along gravel streets freshly claimed from the northern muskeg. The houses to line those streets were a combination of Camp 10's previously inhabited structures plus a selection of newly constructed yet similarly austere residences. The sewer system was never completed, the shelterbelt was quickly used as firewood, and the permanent muskeg helped enclose the houses in stagnant catchalls for uncollected garbage. Electricity was a short-lived luxury, cut short when Manitoba Hydro bills could not be paid (Bussidor and Bilgen-Reinart 1997). Hardly a window remained unsmashed, but now the charming, street-facing picture windows featured in the new homes cost 100-200x more to

replace than the small panes in their first houses (Dickman 1969). Inhabitants of the new settlement quickly found conditions mirroring those they had attempted to leave behind at Camp 10 – physically and psychologically (Bussidor and Bilgen-Reinart 1997). And like the community's recollections of Camp 10, other accounts of the day note the "doom" (Dickman 1971:27) and "shock[ing] […] social disorder" (Lal 1969a:5) of a "[mal]adjusted," "frustrated, despairing" (Bone 1969:1), and "sick community" (Dickman 1969:22). Despite the antiquated syntax, their appeals for solutions expose a crisis in no uncertain terms.

Phil Dickman summarized the relocation of the Sayisi Dené:

> Every decision that has been made, beginning with the move from Duck Lake and ending with the construction design of the houses, has been based on two false premises: the first, that outside experts know better than the people; and the second, that a political structure created by the government, the band council, expresses the will of the people. […] Today, the people live in a village which they believe they did not choose, and live in houses for which they did not originally ask.
>
> Dickman 1969:23

But Dickman also used his platform to suggest an alternative arrangement – one which came to fruition in the fall of 1969 when Dickman, acting as the Department of Health and Social Services Community Development Officer, accompanied a small group of Sayisi Dené nearly 200km west to North Knife Lake, where community members recalled spending winters in the years before the relocation (Dickman 1971). The group fished and trapped, living for the first time in 13 years a traditional lifestyle. Within two years, over two dozen people had moved to North and nearby South Knife Lakes, seeking refuge from Dené Village and hoping to re-establish their connection to the land and its offerings. It was soon apparent that the resources in those locations could not sustain the rest of the community and a more suitable location had to be sought. That winter, Tadoule Lake was scouted by a handful of band members, and by the next winter houses were erected. Dené Village was soon after abandoned.

Today, Tadoule Lake, still known as "Churchill 1" officially (Statistics Canada 2012), is accessible year-round by air or seasonally by winter road. Although the nearest hospital is in Thompson, 330km south, essential medical services are provided at the nursing station and a doctor is available once weekly for consultation. Two water treatment plants service the community: one for select homes on the mainland with water service and a second for Peter Yassie Memorial School (K-12) and its adjacent teacherages. Small, Euro-Canadian style homes dot the landscape – some dating back to the founding of the community in the 1970s. Since their return to ancestral land, a grand resolution has not been wholly experienced by community members. While largely beyond the parameters of this thesis and its ethical parameters (see Appendix 1 and 2), the lasting effects of relocation have shadowed families in Tadoule Lake (Bussidor and Bilgen-Reinart 1997), and, as evidenced in the following chapters, there has been no shelter from the housing crisis affecting Canadian First Nations people today. In the 2010 housing and health survey, 115 households were counted in the entire community; according to the 2011 Census, 321 individuals live in Tadoule Lake, and there were 112 private dwellings occupied by permanent residents.

Chapter 5: Tadoule Lake Housing and Health Survey, Methods and Results

Survey Methods

In September 2010, at the request of the Sayisi Dené First Nation Chief and Council and upon approval of both the Sayisi Dené First Nation Chief and Council and the University of Manitoba Research Ethics Board, a research team consisting of Sayisi Dené band members Ms. Sarah Cheekie and Mr. Daniel Bighead, as well as Dr. Linda Larcombe, Mr. Matthew Singer, Mr. Chris Whaley, and myself of the University of Manitoba undertook an 18 day housing and health survey in Tadoule Lake. All households in the community were approached and asked to take part in the survey.

Community-based research in action

Despite being well established by researchers in this country, there remains an apparent deficiency of political will to act on well-established SDH (Raphael 2010; Lavis et al. 2003). However, community-based research initiatives have been acknowledged as an effective link between study and policy implementation (Israel et al. 1998). These initiatives democratize the research process by transforming subjects into partners, and communities are empowered through partnerships which produce results informing action for change. The establishment and prioritization of research questions by partner communities expedites the development and implementation of constructive solutions. Given the growing recognition that individual-level risk factors for disease often overlook social, cultural, or environmental determinants of health, as well as the incapacity of any single

agency to have "the resources, access, and trust relationships to address the wide range of community determinants of public health problems" (Green et al. 2001:21), these partnerships have become increasingly necessary.

Generalized social policy risks overlooking environmental, historical, and cultural idiosyncrasies of individual communities – even when they are culturally and spatially proximal. The 2010 Tadoule Lake housing and health survey was organized and implemented as a direct response to a request by Chief Jimmy Thorassie and Tadoule Lake Band Council, addressed to Dr. Larcombe, seeking

1) appraisal of the housing conditions in the community,
2) the health conditions related to inadequate housing, and
3) ownership of the data produced (see Appendix 1).

Specifically, the Band requested a community-wide assessment of housing materials, ventilation, insulation, heating, plumbing, water, and the presence of mold, and to have that assessment take place alongside detailed interviews about occupant heath status (see Appendix 2). The Band has since received all data collected, which is being used to prioritize community housing maintenance schedules. A preliminary descriptive report was provided to the community, and posters presented at conferences have been received by the Band for public display. The results from this thesis will also be presented to the community upon completion.

Survey overview

The survey consisted of two components: an interview with the homeowner and a structural assessment of the house. The interview served to provide data regarding infectious diseases

prevalence and the general health condition of the occupants. The frequencies of activities contributing to moisture-generation in the home (e.g. boiling food, bathing, hanging laundry, drying meat) were also recorded, and questions about air quality, moisture, and mold in the home were administered. Participants were asked about the number of people regularly staying in their houses and they were encouraged to discuss their perceptions of the physical condition of the house and their health.

Quantitative data were collected in the structural component of the survey to record the condition of specific features of the houses, including insulation and heating systems; water and sewage systems; size of rooms and size of the overall structure; temperature and humidity; mechanical and passive ventilation systems; presence of mold; and the general condition of the building envelope from the foundation to the roof. Problematic areas were digitally photographed on the interior and exterior of each house. All data were entered into a Microsoft© Excel spreadsheet for descriptive analyses and SPSS 15 for Windows© was used for statistical analyses.

To evaluate how structural conditions and certain occupant behaviors at Tadoule Lake might serve as risk factors for disease, odds ratios (ORs) were calculated to evaluate measures of risk. In this retrospective study, ORs were used to calculate the likelihood that a particular binary outcome (e.g. the presence of mold) was associated with a particular binary risk factor (e.g. the presence of damaged windows). For example, ORs greater than 1, when statistically significant, suggest that exposure to certain housing conditions increase risk for certain health conditions, and less significant ORs with large confidence intervals could suggest the effects are still reasonably possible. To explore the effects of conditions recorded in continuous, interval data (e.g. degree of crowding

measured as square foot per person) on houses and their occupants, tests of significance were carried out to measure the differences between houses with and without binary conditions recorded (e.g. mold presence).

My responsibilities in the survey primarily involved undertaking the structural assessment of the houses, often with the homeowner or a survey participant who lived in that home guiding me through their house at every step, eagerly pointing out their own concerns, which was informative and beneficial to the survey overall. This thesis – and in particular this chapter – is necessarily reflective of my time in Tadoule Lake, and as a result the majority of these analyses focus on housing conditions and their physical origins and outcomes. My role within the parameters of the overall project is to report these conditions, and I have attempted to do so as extensively and unexclusively as possible.

Data collection, statistical, and other study limitations

Sampling strategy:

It was not considered appropriate by the community to randomly select houses for inclusion. Instead any household that chose to participate was enrolled in the study. Forty-one houses were not enrolled due to the survey team's inability to contact the homeowner, the homeowner's desire for privacy, or an otherwise unexplained refusal to participate. As a result, those who chose to participate may represent a biased sampling of the entire community (e.g. those households choosing not to participate may not have had structural or health problems they wished to communicate with the band). Furthermore, the results cannot be used to make generalized recommendations about other First Nations communities as the community itself was not randomly selected.

Sample size per variable:

The sample size *(n)* varies between the analyses of variables across this case study as individual surveys in this project often contained missing values. Complete data collection for each survey was not always possible for a number of reasons, including respect for the privacy of survey participants (e.g. avoiding bedrooms while residents slept) or our own physical inability to access certain areas of the house (e.g. inaccessible attics or foundations). The interviews were similarly affected – at times abridged at the request of the participant or truncated due to sudden interruptions.

Nature of data:

Due to the occasionally coarse nature of the data collected, correlations between health conditions and housing conditions recorded at the time of survey should be considered exploratory. It cannot be established from these data whether occupants developed any specific illness since assuming occupancy of the houses in which they were. Likewise it cannot be determined how long any structural problem has existed in the home or how long any mold or moisture-related damages have existed. The amount of mold present in any house is also measured only as far as its presence or absence, thus any correlation between mold or other structural conditions and occupant health should be noted as an exploratory description.

Statistical limitations:

Other study limitations include the statistical tests employed in this case study. The OR is sometimes an imperfect statistical measure to detect risk factors when they are virtually homogeneous in the community. Rose (1985:33) explained the problem with ubiquitous risk factors in epidemiology, stating that "the hardest cause to identify is the one that is universally present, for then it has no influence on the distribution of disease." In some cases "proof" may only become apparent if the probable risk factors are remedied and the assumed resulting conditions improve. For

the purposes of this case study, such widespread problems present an alarming result on their own, regardless of statistical significance.

Many results in this study are also not statistically significant. However, when the null hypothesis cannot be rejected at $p < 0.05$, as is often the case in this study, it is useful to determine whether study design related factors (e.g. sample size, distributions, reliability of measurement) may be affecting the outcome. Non-significant results are not necessarily a reflection of the null hypothesis being true, but instead only mean that the null hypothesis cannot be ruled out with certainty. Post hoc tests of statistical power with power $(1 - \beta) < 0.80$ and $\alpha = 0.05$ (following Cohen 1988) help to reveal alternative factors to explain such occurrences. In this case sample size is often quite low and may have a limiting effect on the statistical power of the comparisons conducted. In the following sections tests of power are applied in many structural analyses to aid in the clarification of less conclusive results, and to help inform direction of future study design.

Survey observations

In Tadoule Lake, 321 people live in 112 houses. A total of 79 households (70.5% of all households in the community) were enrolled in the study with informed consent. An adult representative from 74 of those households provided complete or partial responses to interview questions, and partial or complete structural data are available for 76 houses.

The houses at Tadoule Lake were similar to other Northern First Nations houses in Manitoba (Larcombe et al. 2011), and were most commonly configured as wood-framed, wood-sided, asphalt-shingled bungalows with a pressure-treated wood-framed crawlspace set on a shallow concrete footing course. Sixty survey participants (80%) lived in this type of bungalows with crawlspaces,

and ten participants (13%) lived in "split-level" or "bi-level" on-slab structures (comprised of 2 levels, of which the lower level contained living space and had a poured concrete floor). The houses varied considerably in size, floorplan, and general condition (see Figures 2-4). Of the 46 houses where data were available, the average reported age of the houses in Tadoule Lake was 16.8 years, with reported construction dates ranging from as far back as 1972 to as recently as 2007.

During both interviews and structural surveys, the majority of homeowners (78%) reported major problems with their homes. This figure – 58 households – is 29% higher than the 2001 Household and Dwelling Census Statistics report of 45 homes in need of major repair. While the problems identified by homeowners and survey administrators varied from cosmetic to structural, the two major themes identified were poor water and sanitation availability, and structural issues largely resulting from drainage problems. These issues will be discussed in the context of the survey results which relate to moisture generation in the home. Secondary issues such as cosmetic problems were also detailed, as well as the frequency of other activities that might have affected occupant health.

Crowding

Household crowding can be measured in many ways. In accordance with international standards, Statistics Canada considers a house to be crowded when the occupancy exceeds one permanent occupant per room, which is based on the number of persons per room (ppr) in the home – excluding bathrooms, halls, vestibules, and rooms dedicated for business purposes (Statistics Canada 2008).

Figure 2: Multiunit homes in Tadoule Lake. Photo © Larcombe 2010.

Figure 3: Single detached home in Tadoule Lake showing various common structural conditions. Photo © Larcombe 2010

Figure 4: Roof repairs on one house in Tadoule Lake. Photo © Larcombe 2010

The houses in Tadoule Lake were generally small, two-to-three bedroom family residences with an average of 909 square feet (Ft^2) (n=65). In the 74 households surveyed, a range of 1 to 10 individuals occupied each home, with an average of 3.52 persons per house (pph) (Table 2). The average number of rooms per house was 5.6 (n=73) and the average number of persons per room (ppr) was 0.61 (n=71).

Number of permanent residents in the home	Households	Total number of residents
1	7	7
2	19	38
3	12	36
4	14	56
5	11	55
6	8	48
7	1	7
8	0	n/a
9	0	n/a
10	1	10
Total:	73	257
	Average pph:	**3.52**

Table 2: Household occupancy

During interviews, seventy-two (72) participants responded to the question about whether or not they felt that their houses were crowded. Forty-two (58.3%) people felt that their house did not feel crowded while 30 (41.7%) felt that they lived in crowded conditions.

Of note to crowding in Tadoule Lake is the familial unit residing in each housing unit. Of 69 questionnaire responses, 60.9% lived in single family units (with an average of 3.5 persons per house) and 39.1% lived in multi-generational households (with an average of 3.9 persons per house). Of questionnaire participants living in single family units, 26 (63.4%) reported feeling crowded, whereas in multi-generational houses 15 (55.6%) reported feeling crowded.

Exterior structural conditions

The exterior building envelope for each house was examined during the survey, and consists of roofing, drainage systems, siding, windows and doors, and foundation wall conditions. As indicated previously, damage to these exterior structural elements can lead to moisture ingress, water damage, and mold growth. See Table 28 (page 114) for a list of features recorded during the survey.

Exterior siding material types were very consistent in Tadoule Lake, but their conditions were variable. Seventy-three houses surveyed (97.3%) were equipped with wood siding on their exteriors, while two had aluminum siding (2.7%). Of the 73 houses with wood siding, 47 (64.4%) were in good condition, while 25 (34.2%) had damaged, loose, or rotten boards, or had exposed sections.

Roofs were inspected from the ground only, although many problem areas were still evident from that distance. Of the 74 houses where roof conditions were recorded, 33 houses (44.6%) had vulnerable areas on their roofs (e.g. damaged or missing shingles, sagging sheathing, and repair patches). Three of these roofs with vulnerable areas were clearly leaking. Chimney stacks were another common area of disrepair on the exteriors of houses in Tadoule Lake, with 30.6% cracked or leaking.

Gutters and downspouts were inspected for cracks and leaks, missing sections, and overall functionality. Only nine of the 62 houses (14.5%) where data are available have gutters that both did not leak and were properly attached to functioning downspouts to drain rainwater away from the house. Thirteen houses (17.1%) had sections missing from their gutter system or had no gutters at all. Although 30 houses (39.5%) had the advantage of a lot grading that sloped away from the foundation, only 4 also had fully functioning gutters and downspouts (Figure 5).

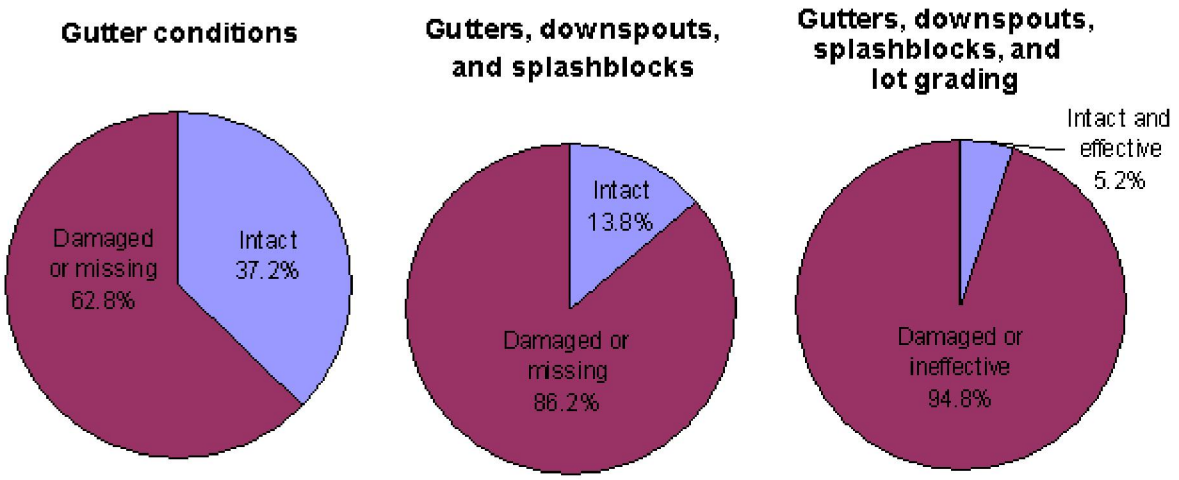

Figure 5: Drainage problems in Tadoule Lake. Without a completely functional drainage system (i.e. gutters, downspouts, splashblocks, and negatively sloped lot grading) rainwater can pool around the foundation, damaging its walls and allowing moisture to penetrate the crawlspace.

All foundations of the houses at Tadoule Lake were comprised of pressure-treated, timber frame frost walls set on concrete footing courses of variable depths (these were unmeasured but from the few exposed footings we can assume they likely ranged from 6" to 16"). Upon examination of the exteriors of foundation walls, 50 (76.2%) contained cracked or fully exposed areas of internal framing.

Windows and doors

In Tadoule Lake, 22 of 26 survey respondents (85%) reported opening windows to aid in air exchange. However, when windows were broken or had unsealed casings, airflow would occur at an uncontrolled rate. Of the 75 houses where door and window conditions were recorded, 46 houses (63.0%) had at least one damaged door and 53 houses (70.7%) had at least one broken window (i.e. with broken glass, punctured casements, or damaged or missing seals).

The total number of windows per house in Tadoule Lake ranges from 1-12 with a community average of 4.4 windows per house. While 21 houses (28.0%) had intact windows, 17 houses (22.7%) had one broken window and 36 houses (48.0%) had 2 or more broken windows (Figure 6). Among the homes with broken windows there is an average of 3.0 broken windows per house; for the entire community there is an average of 2.2 broken windows per house.

Interior surface conditions

To understand the provenance of mold and moisture in the home, numerous interior conditions were examined in each house, including ceiling, wall, and floor materials and their conditions (e.g. containing damp or moldy areas), heating and ventilation systems, water supply and plumbing, and insulation quality and condition (where possible). Temperature and humidty was also recorded. See Table 28 (page 114) for a list of features recorded during the survey.

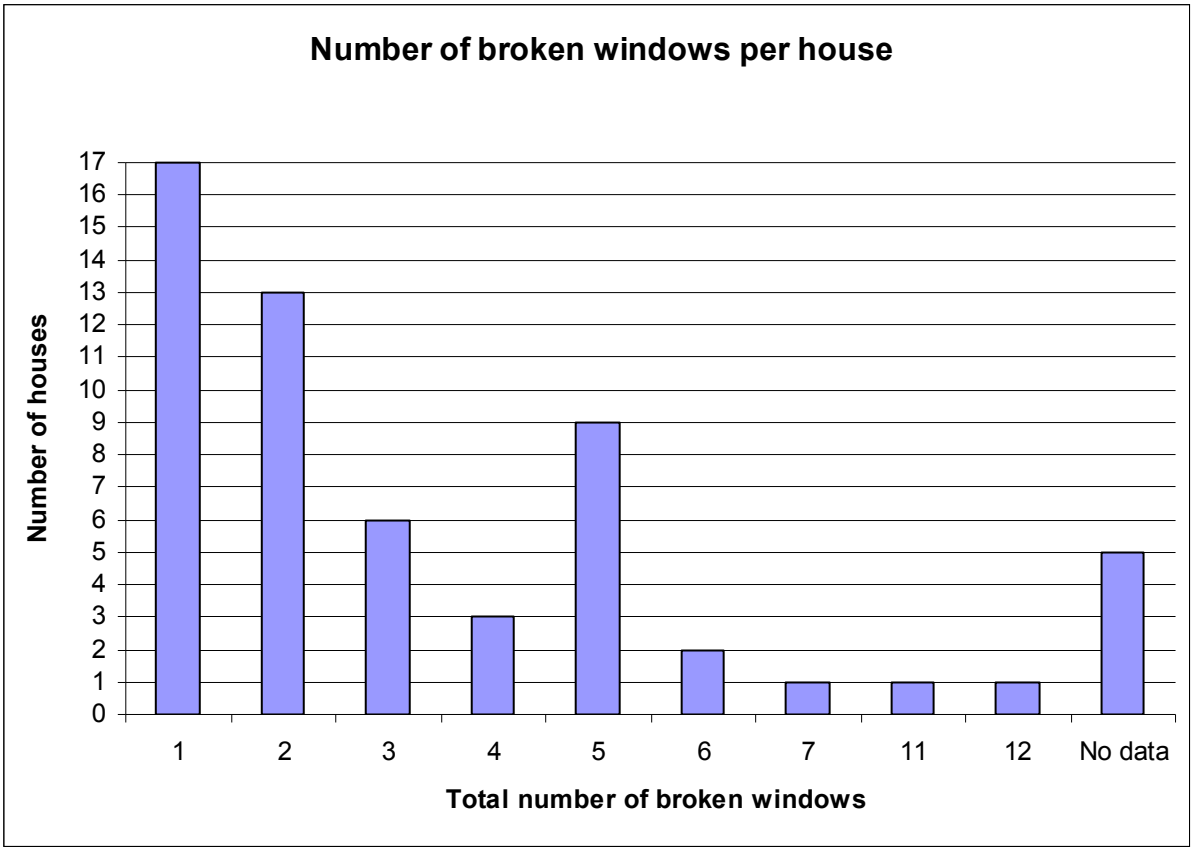

Figure 6: Number of broken windows per house

Interior surfaces (i.e. walls, ceilings, and floors) were examined for cosmetic and structural defects, and water damage and mold. Of the 76 houses where data was available, 41 (53.9%) had plaster wall finishes, 24 (31.6%) had paneling wall finishes, and 11 (14.5%) had a combination of plaster and paneling. Forty-one of the houses (53.9%) had damaged wall finishes – the most common problems were cracks and holes. Twenty-six houses (34.2%) had cracks in the walls and seven (9.2%) had holes. Water staining was apparent on the walls of five houses (6.6%), and two houses (2.6%) had rot and mold in the walls.

Ceilings were another common area to see moisture-related damage. Most houses (73.6%) had drywall or primarily drywall ceiling finishes (including stucco, wood, and drywall combinations), although wood (16.7%) and acoustic tile (9.7%) made up a substantial portion of the ceiling finishes in the community as well. Of the 72 houses where ceiling conditions were recorded, 36 (50%) houses contained damaged ceilings. The most common type of ceiling damage noted was sagging or water-stained surfaces, with 30 houses (41.7%) exhibiting such damage. Three houses (4.2%) had mold visible in the ceiling.

Linoleum flooring was present in all houses in Tadoule Lake (n=76), although 15 (19.7%) also had carpeted areas. Floors were assessed for damage which included cracking and shifting surfaces and water damage. Fifty-eight houses (76.3%) had damaged floors, with the most commonly recorded problem being cracked surfaces (63.2%). Water damage was evident on the floors of 10 (13.2%) of the houses.

Heating systems

Heating sources varied little in Tadoule Lake. Of the 71 houses where data on heat sources was available, 64 (90.1%) relied on diesel oil furnaces for heat, two (2.8%) relied on electric heaters, and two (2.8%) relied on wood stoves only. One (1.4%) of the houses included in the survey had no heat source at all.

Passive and mechanical ventilation systems

Adequate ventilation is crucial in controlling moisture in the house. Passive ventilation refers here to windows and doors, which can simply be opened and shut to aid in ventilation although

technically an air-leaky building envelope is passively ventilated (i.e. the term includes uncontrolled air exchange in the home). Mechanical ventilation refers to powered (i.e. electrical) systems installed in the home to assist in air exchange.

Mechanical ventilation systems

In Tadoule Lake, 53 houses (79.1%) had heat recovery ventilators (HRVs) installed to help exchange air and control humidity. HRVs are designed to exchange indoor air for outdoor air (i.e. fresh air) without cooling the building in the winter or warming it in the summer. In newer homes where the building envelope is more tightly sealed, and especially in colder environments, such forms of mechanical ventilation are necessary for the maintenance of air quality. Despite the high percentage of houses in Tadoule Lake with HRV units installed, 17 of those units (32.1% of all HRVs) were non-functioning either due to damage or from being turned off.[7] Other types of mechanical ventilation systems assessed in Tadoule Lake included those common in the kitchen and bathroom, where moisture was often generated from cooking and washing. Two types of mechanical ventilation systems existed: dedicated systems and HRV exhausts (Table 3).

	Dedicated vent		HRV system		No ventilation	No Data
	Functioning	Non-functioning	Functioning	Non-functioning		
Bathroom	13	3 Total: 16	16	11 Total: 27	26	5
Kitchen	43	9 Total: 52	1	2 Total: 3	18	5

Table 3: Mechanical ventilation systems

[7] During the survey, once it became clear that HRV disuse was a systemic issue in the community, the user manuals were often removed from atop the units (where they have most likely remained since unit installation) and were given to homeowners.

In Tadoule Lake bathrooms, HRV exchanges were the most common type of ventilation system installed, with 27 houses (36.5%) relied on HRVs for bathroom ventilation and humidity control. However, 11 of the 27 (40.7%) were not functional. Of the 16 houses (21.6%) with dedicated bathroom vents (i.e. electric fans), only 3 (18.8%) were non-functioning. Twenty-six (26) houses (34.7%) had no ventilation systems in the bathroom.

In Tadoule Lake kitchens, 43 houses (57.3%) had dedicated vents (e.g. range hood vents in the kitchen and/or electric fans) and only 9 (20.9%) of those were non-functioning. Three homes (4.0%) had HRV exchanges installed in the kitchen, two of which were non-functioning. Eighteen houses (24.0%) had no kitchen ventilation. There was no data available for five houses.

Insulation

The quality of insulation was assessed where possible in the structural survey and participants were asked about the degree to which their houses were insulated in the questionnaire. It was often not possible to assess insulation in walls and attics as it was usually permanently covered with drywall or other paneling systems in the living space, and even where damage to such sheathing occasionally revealed the materials beneath, a complete assessment could not be undertaken. However, insulation condition was regularly examinable underneath the houses, in unsheathed crawlspace walls. Of the crawlspaces where data was available, 23 (45.1%) contained damaged, incomplete, or otherwise inadequately installed insulation and/or vapor barrier.

Survey participant responses regarding the insulation in their houses reflected a similar pattern. Of the 34 responses, 21 (61.8%) reported having poorly insulated homes, while nine (26.5%) reported having adequately or well insulated houses. Four respondents (11.8%) were unsure.

Humidity in the home

Humidity and temperature readings were collected inside and outside of every home during data collection using a General Tools© PTH8708 digital temperature and humidity pen. Indoor measurements were recorded by leaving the instrument with survey participants during the interview and allowing it to acclimatize. Humidity was not recorded in crawlspaces.

The average humidity for all houses in the community where humidity data was available was 44.1% (n=75). Table 4 illustrates the average humidity readings for houses with and without mold and mold-prone areas in their living spaces and crawlspaces.

	Crawlspace	Living space
Average % with mold present	46.25 (n=8)	48.80 (n=7)
Average % with no mold present	44.69 (n=56)	43.65 (n=68)
Average % with mold-prone areas present	49.15 (n=11)	41.40 (n=20)
Average % with no mold-prone areas present	43.92 (n=54)	45.03 (n=47)

Table 4: Humidity in homes with and without mold/mold-prone areas

For outdoor measurements, the instrument was left in one location (usually the front step) while the exterior structural assessment was completed, again allowing the reading to stabilize. Weather conditions, including current precipitation status, were also recorded; these data are available in Table 5.

	TOTAL (ALL WEATHER)	ALL CLOUDY/ RAINY	RAIN	CLOUDY	CLEAR
Average temperature outside (°C)	(n=2) 13.43	(n=28) 11.82	(n= 5) 11.3	(n= 22) 11.93	(n=29) 15.77
Average humidity outside (%)	(n=73) 41.66	(n=28) 47.62	(n= 5) 55.94	(n= 22) 45.64	(n=29) 35.47
Average temperature inside (°C)	(n=73) 22.31	(n=27) 21.31	(n= 4) 20.95	(n=23) 21.37	(n=29) 22.92
Average humidity inside (%)	(n=75) 44.13	(n=29) 45.43	(n= 6) 47.23	(n= 23) 44.96	(n=29) 45.01

Table 5: Humidity, temperature, and weather measurements.

Moisture and mold in the home

Problematic moisture and mold growth were observed visually during the structural assessment and recorded according to their location in the building (e.g. ceilings, living-space or crawl-space walls, under sinks). In 76 houses where data are available, mold growth was directly observed in 15 houses (19.7%), and mold prone areas (i.e. moisture damaged surfaces like sagging ceiling tiles) were observed in 43 houses (56.6%).

Survey participants were also asked whether they had mold or moisture problems in their homes, including condensation on their windows. While 50 people (69.4%) mentioned seeing condensation on their windows at some point during the year, condensation was only directly observed on windows in 5 (6.8%) homes. Homeowners reported the presence of window condensation in all five of those instances. However, water damage, mold, or rot was observed around the windows in 16 homes (21.6%), with homeowners reporting the presence of condensation in 12 of those instances. This pattern suggests that window condensation may have been a problem in the colder parts of the year, but as the survey took place in the fall the conditions were not visible.

Survey participants were also asked about the sources of mold in their houses (Table 6). Almost half (48.3%) of the responses indicated leaks and moisture as the main source of mold in the home, followed by house design and structural materials (17.2%). The other two most common responses were "unsure" (17.2%) and "no cause" (13.8%).

	Response	*n*=	%
What causes the mold growth? (Multiple responses accepted, n=29)	Leaks and moisture	14	48.3
	House design and structure, including building materials	5	17.2
	Other	3	10.3
	No cause	4	13.8
	Not sure	5	17.2

Table 6: Occupant explanations for causes of mold in the home

Water supply and plumbing

One of the most significant impediments to healthy living in Tadoule Lake was the unstable supply of clean water for drinking, bathing, and cleaning. Of 76 houses where data was available, only 54 (71.1%) were connected to the public water supply (Figure 7). Of the remaining houses, 18 (23.7%) relied on cisterns or tanks below or adjacent to the house, and four (5.3%) – including a home that relied on a rain barrel – had no supply.

When asked about water supply, 61.4% of survey participants responded that water was not always available (n=70), and 63.9% reported issues with the taste, smell, or appearance of their water (n=61). Combining data from the structural survey and the interview, 57 houses (73.1%) had some type of problem with the availability or quality of their water (including the presence of water supply, piping conditions, and homeowner responses regarding the availability and quality of their water supply).

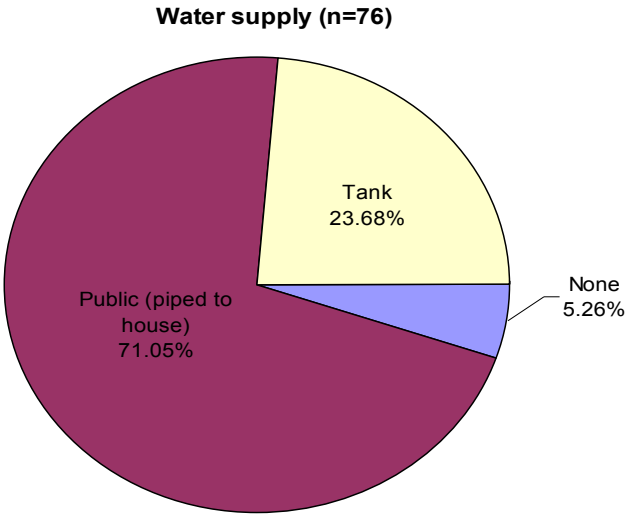

Figure 7: Water supply

The availability or functioning of plumbing amenities (e.g. sinks or toilets) in the house was also assessed. Deficiencies were commonly – but not exclusively – noted in homes with no water supply. Of the four houses in the community with no water supply, one had no bathroom, two had no toilet, two used a bucket as a toilet, one had a kitchen sink that drained directly outside through the kitchen wall, and one had a kitchen sink that drained to a bucket. Of the 18 houses relying on a cistern refilled by the band, three had no plumbing under their sink, three had no toilet, two had inoperative toilets, and three had no shower or tub. Finally, of the 54 houses with piped water supply, one had no kitchen sink, one had no tub or shower, and four had inoperative toilets.

Damaged, leaking pipes and plumbing fixtures were another major source of moisture and water damage in many homes in Tadoule Lake. Eight houses (10.5%) had leaking toilets (all of which were supplied water by the public system), 12 houses (15.8%) had leaking sinks, nine houses (11.8%) had leaking faucets, seven houses (9.2%) had loose faucets, three (3.9%) had dripping

faucets, and 18 houses (23.7%) had leaking shower or bath fixtures or loose or suspect caulking on the bath/shower surrounds.

Leaking pipes or improperly functioning plumbing in crawlspaces, where much of the plumbing in each house was located, can lead to serious problems as well. In these spaces, three houses (4.8%) had leaking pipes in the crawlspace (n=62), three houses (6.3%) had leaking water main shut-off valves (n=48), two houses (3.6%) had leaking waste piping (n=55). Sump pumps were regularly installed in crawlspaces and were particularly important as they were connected to the drain tile around the base of the foundation and helped to expel water from in and around the structure. In Tadoule Lake, 30 houses (41.7%) had no sump pump (n=72), and eight houses (19.0%) had non-functioning sump pumps (n=42).

Non-structural survey results

Self-reported occupant health

Survey participants were asked a number of questions about their health during the interview process, including questions regarding the presence of conditions known to be associated with crowding, water availability, and air quality (Table 7). While most respondents did not report the presence of allergies (74.2%) or MRSA (79.12%) among the residents in their homes, twenty-eight (28) households included in the survey (49.1%) reported individuals who had been diagnosed with active or latent TB.

Survey question	Response	*n* =	%
Is active or latent TB present in the house? (n=57)	Yes	28	49.1
	No	29	50.9
Are there allergies in the house? (n=66)	Yes	10	21.2
	No	49	74.2
	Only to food	4	6.1
	Not sure	3	4.5
Does anyone in the house have MRSA or chronic eczema? (n=67)	Yes	14	20.9
	No	53	79.1

Table 7: Self reported health conditions

Potential occupant activity contributing to moisture generation

Food preparation

To explore any association between cooking methods as moisture-generating activities in the home, survey participants were asked questions regarding their preferences in food preparation methods and the frequencies at which those methods are employed (Table 8). In particular, the frequency at which people boiled water to prepare food was recorded. Of the 37 responses, 20 (54.1%) reported boiling water daily, and 17 (45.9%) reported boiling water to prepare food less frequently (1-3 days a week) or a different primary method for cooking altogether (e.g. grilling, baking).

	Response	*n* =	%
How often do you eat country food? (n=61)	Daily or weekly	37	60.1
	Monthly	7	11.5
	Seasonally	5	8.2
	Rarely	10	16.4
	Never	2	3.3
Do you regularly *process* meat here? (n=46)	Yes	7	15.2
	No	39	84.8

Table 8: Food preparation

Questions regarding the frequency of consuming country foods (e.g. caribou) were also administered to survey participants (n=61), as was the frequency of processing country foods (e.g. drying meat) in the home (n=46). Survey responses are listed in Table 8. While consuming country foods was common (n=37, 60.1%), fewer households processed country food indoors (n=7, 15.2%).

Dish drying

The preferred method of drying dishes among community survey participants was recorded. Responses are listed in Table 9. Many community members (37.5%) reported using dish racks to let their dishes drip dry (i.e. air dry), and 12.5% reported both hand drying and air drying.

	Response	*n* =	%
How do you dry your dishes? (n=40)	Hand dry	19	47.5
	Air dry	15	37.5
	Both hand/air	5	12.5
	Dishwasher	1	2.5

Table 9: Dish drying

Bathing

The frequency at which community survey participants use their bathtubs or showers was recorded. Responses are listed in Table 10. Most people (42.4%) ran hot showers or baths on a daily basis.

	Response	*n* =	%
How often is the tub used? (n=33)	Every day	14	42.4
	Every 2 days	7	21.2
	Every 3 days	3	9.1
	Once a week	4	12.1
	Tub is not used	5	15.1

Table 10: Bathing frequency

Laundry

The frequency at which people washed and dried their clothes was recorded in interviews. Responses are listed in Table 11. Of the 23 people who responded to the question, almost half (47.8%) reported washing and drying clothes twice a week, although "every 1-2 days" was the second most common response (26.1%).

	Response	*n* =	%
How often do you do laundry? (n=23)	Every 1-2 days	6	26.1
	Twice a week	11	47.8
	Once a week	5	21.7
	Every 2 weeks	1	4.3

Table 11: Laundry frequency

Smoking

Survey participants were asked whether they smoked and whether they allowed smoking in their house. While not necessarily a moisture-generating activity, cigarette smoking would contribute to air contamination, and in homes with HRVs it would contribute to the strain on the mechanical filtration of indoor air. Smokers may also be less likely to notice the smell of mold in the home, and it could therefore develop for a greater period of time before being found and, ideally, removed. Of the 65 survey responses, 30 (46.15%) responded that they or others smoked in the house, and 35 (53.85%) responded that smoking was not permitted indoors.

Other interview results

To better gauge community member perceptions of how housing conditions could be improved, survey participants were asked how, in the most ideal circumstances, they would change the design of the house. Responses (Table 12) were largely straightforward, with most respondents suggesting more space would make the greatest improvements. When asked who is responsible for upkeep of

the house, most survey participants responded that it was an obligation of the band or the government to repair and provide housing (Table 13).

	Response	*n* =	%
How would you change the design of the house? (n=59)	Make it bigger	37	62.7
	Make it more accessible (i.e. for disabled family members)	2	3.4
	Make it smaller	1	1.7
	Fix the problems	6	10.2
	Wouldn't change anything	7	11.9

Table 12: Survey responses regarding ideal home improvements

	Response	*n* =	%
Whose responsibility is it to fix the house? (n=59)	The homeowner	12	20.7
	The band/government	39	67.2
	Not sure	7	12.1

Table 13: Upkeep responsibility

Analysis

Age of house:

To test the hypothesis that the age of the house had no effect on the presence of mold, independent samples t-tests were carried out. Insufficient data precluded houses with mold in the crawlspace from analysis, but the average age of houses with mold in their living spaces ($M = 26.00$, $n = 4$) was found to be significantly higher ($p = 0.04$) than the age of houses without mold in their living spaces ($M = 15.43$, $n = 42$). Fourteen (30.43%) of the houses with ages reported were built before 1990, and the ages of the four houses with mold recorded in the living space were 14 (built 1996), 21 (built 1989), 32 (built 1978), and 37 (built 1973) years. Despite the statistical significance this sub-sample may be an indicator of the generally short lifespan of on-reserve houses in northern communities.

Given not only the missing data reducing the total units available for analysis here, but also the complete lack of information on the conditions of houses that were removed or destroyed (e.g. by fire) since the founding of the community – including basic numbers and ages of houses no longer present – these results should be considered cautiously.

Crowding:

The average number of rooms per house in Tadoule Lake was 5.6 (n=73), which is less than both provincial (6.3 rooms) and national (6.4 rooms) averages. The average ppr (n=71) was 0.61, which exceeded the provincial average ppr of 0.51. Only five homes (7%) contained more than one ppr, qualifying those residences as crowded according to Statistics Canada (2008).

Another measure of crowding similarly conflated by the size of the total house is the total number of persons per house (pph). The average pph in Tadoule Lake is 3.5. Of the 47 homes (64%) had more than three permanent residents, which exceeded the national average of 2.5 pph. Ten households (14%) surveyed had 6 or more pph.

Houses in Tadoule Lake were 32% smaller than the provincial average but 47% more crowded. The average house in Tadoule Lake was 909 Ft^2 (n=65) with 3.52 occupants (or 258.24 Ft^2/person), compared to the Manitoban average of approximately 1200 Ft^2 and 2.4 occupants (or 500 Ft^2/person) (Manitoba Hydro 2010). Only 11 of the 61 houses where square footage was calculated met or exceeded that average. For statistical analysis I have elected to use square footage per person (Ft^2pp) as the primary measure of crowding.

The effects of crowding on the material conditions of the house and occupant health can be examined in several ways. When the presence of mold is examined according to the degree to which a house was crowded, the distribution was not immediately indicative of a relationship between crowding and mold (Table 14).

Occupants per house	n=	Avg. sq.ft. per person	Avg. PPR	Mold present in living space	Mold present in crawlspace	Mold-prone areas in living space	Mold-prone areas in crawlspace
1	8	593.93	0.23	1	1	3	2
2	20	463.14	0.40	1	4	8	1
3	12	308.51	0.51	2	0	6	3
4	13	277.68	0.71	3	2	3	1
5	11	182.72	0.83	0	0	3	2
6 or more	10	150.46	1.16	1	0	3	1

Table 14: Crowding and mold presence

To test the hypothesis that the degree of crowding (Ft^2pp) had no effect on the presence of mold in the house, independent samples t-tests were carried out. The average square feet per person (sqftpp) in houses with mold in their living spaces ($M = 365.81$, $n = 6$) was found to be not significantly higher ($p = 0.798$) than the Ft^2pp in houses without mold in their living spaces ($M = 346.28$, $n = 55$). A similar relationship exists for houses with mold in their crawlspaces, where the sqftpp ($M = 466.10$, $n = 7$) is not significantly higher ($p=0.08$) than the Ft^2pp in homes with no mold in their crawlspaces ($M = 341.83$, $n = 47$). In each case, the relationship between crowding and mold presence is contrary to what has been observed elsewhere (e.g. Larcombe et al. 2011). However, post-hoc tests of statistical power indicate that the study may have lacked sufficient power ($1 - \beta$) to detect any significant effects between the houses with and without mold in the living space ($1 - \beta = 0.08$) and in houses with and without mold in the crawlspace ($1 - \beta = 0.50$), and rather the lack of significance is most likely due to the small sample size of houses where mold was observed ($n=6$).

It is also worth noting here that due to the nature of data collection (i.e. mold was measured by its visual presence and not by collection of ambient air samples for laboratory testing) that mold may have been overlooked during the survey.

The effect of crowding on health conditions was also examined. To test the hypothesis that the degree of crowding is not related to occupant reported occurrences of MRSA, allergies, and TB in the house, independent samples t-tests were carried out. The Ft^2pp of houses where occupants reported MRSA ($M = 325.47$, $n = 12$) was found to be not significantly lower ($p = 0.80$) than the sqftpp in houses where MRSA was reported ($M = 341.02$, $n = 42$). A similar relationship exists in houses where allergies are present, where the Ft^2pp (257.60, $n = 7$) was not significantly lower ($p = 0.18$) than the houses with no allergies reported ($M = 358.19$, $n = 42$). Conversely, the sqftpp in houses where TB was reported ($M = 345.09$, $n = 23$) was not significantly higher ($p = 0.86$) than for houses with no TB ($M = 335.59$, $n = 25$). Again, post-hoc tests indicate that the study may have lacked sufficient statistical power to detect differences between the houses reporting MRSA ($1 - \beta = 0.08$), allergies ($1 - \beta = 0.48$), and TB ($1 - \beta = 0.07$). The lack of significance is once again probably due to the small sample sizes of houses where those conditions were reported.

Despite the lack of statistical significance, the presence of mold and crowded housing conditions should not be dismissed as negligible. When odds ratios are calculated to establish the risk of the presence of health conditions in houses with mold (Table 15), the odds for both allergies and MRSA or related skin infections are higher in homes with mold in the living space although only the values are not significant at the $p < 0.05$ level. In no case does the odds for TB increase in houses with mold present. As noted earlier, these results are likely an outcome of sample size and survey design.

		Allergies	MRSA/skin infections	TB
Condition	***n***	10	14	28
	%	21.2	20.9	49.1
Mold anywhere	OR	4.3	1.65	0.458
	95% CI	0.812 - 22.770	0.370 - 7.351	0.102 - 2.058
	p	0.07	0.51	0.30
Mold in the living space	OR	5.111	4.9	0.667
	95% CI	0.705 - 37.061	0.861 - 27.884	0.102 - 4.339
	p	0.08	0.054	0.67
Mold in the crawl-space	OR	0.756	0.864	0.426
	95% CI	0.136 - 4.185	0.234 - 3.196	0.041 - 4.447
	p	0.75	0.83	0.47

Table 15: Mold and health

Structural conditions contributing to mold

Odds ratios were calculated to examine the degree to which structural conditions contribute to the presence of mold in the house. A number of problem areas are assessed.

Roofs and ceilings

The most common area in which water damage and mold was observed was the ceiling. Of the 72 houses with data available on ceiling conditions, 30 showed signs of water damage on their ceilings. Of the 30 houses with water damaged ceilings, 19 (63.3%) had visible problems with their roofs, including damaged shingles and leaks. Of those same homes with water damaged ceilings, 13 (43.3%)[8] also had chimneys that were damaged.

[8] This figure comprises 18.1% of the entire community as 30.6% of the community is recorded as having damaged chimneys.

The odds of having mold in homes with damaged roofs and chimneys was calculated using odds ratios. Houses with a visibly damaged chimney or roof were 3.007 times more likely to have water damage, mold, or mold-prone areas on their ceilings than in homes with new or well maintained roofs (n=42; OR = 3.007, 95% CI = 1.100, 8.221, p=0.030). However, having damaged roofs and chimneys may have less influence on the development of mold anywhere in the living spaces: houses with damaged roofs and chimneys were only 1.018 times more likely to contain mold in the living spaces than houses with good roofs and chimneys, although the value is not statistically significant (n=42; OR = 1.018, 95% CI = 0.211, 4.906, p=0.983).

Due to the inability to access attic spaces during the structural survey, it remains unclear whether water damaged ceilings were attributable to leaking roofs. In the winter if heated air is allowed to escape through unsealed penetrations in the ceiling (e.g. improperly vented bathroom fans, unsealed light fixtures or chimney stacks) into a poorly ventilated or poorly insulated attic (i.e. warm air cannot escape, or it only does so through the roof sheathing), the warm air can melt rooftop snow, which then refreezes as it reaches the unheated edges of the roof. This melt water often forms an ice dam, allowing interstitial water on top of the dam to re-enter the building underneath shingles, causing serious water damage inside the attic or to exterior walls when the dam forms at the edge of the roof. Similarly, the escaping condensate can simply build up on the inside of the roof, freeze, and later melt to cause water damage to the area directly below. Given the low slope of the roofs in the community and the common reports of poorly insulated houses, both of these explanations remain strong possibilities for ceiling damage.

Drainage

Moisture and mold problems were also common in crawlspaces. Of the crawlspaces accessible for survey (n=59), 16 (27.1%) had wet or moldy interior foundation walls – half of which were visibly damaged around their exterior. Only 4 houses had foundations that were damaged on the outside and not observed to be wet and/or moldy on the inside, again indicating the importance of exterior conditions in maintaining a dry home. Houses with visibly cracked, exposed, or otherwise damaged foundations were 4.452 times more likely to have mold in their living spaces, although the figure is not statistically significant (n=37; OR = 4.452, 95% CI = 0.501, 39.563, p=0.149). The same houses with foundation damage were 14.000 times more likely to have mold anywhere than in homes with undamaged foundations (n=37; OR = 14.000, 95% CI = 1.698, 115.415, p=0.003), although the OR for houses with damaged foundations to contain mold in their crawlspaces was less than 1, implying the exposure decreases risk (n=34; OR = 0.765, 95% CI = 0.635, 0.921, p=0.014). In this case, given the incongruous results, other risk factors must be considered.

Of the eight houses with crawlspaces where mold was directly observed (13.6%), the gutters, downspouts, and splashblocks were missing and/or damaged in every case (see below). While ineffective drainage around the outside of the house only slightly increased odds for mold in the living space (n=70; OR = 1.111, 95% CI = 1.028, 1.021, p=0.506) or crawl spaces (n=59; OR = 1.157, 95% CI = 1.046, 1.280, p=0.494), only 4 houses surveyed out of the entire community (5.4%) had properly functioning gutters, downspouts, splashblocks, and lot grading to direct water away. In this case the OR may not be a useful statistical measure to detect poor drainage as a causative factor

since it is virtually homogeneous in the community although its ubiquitous occurrence is a vitally important condition to report on its own.

Doors and windows

Broken and unsealed windows and doors are a common problem in Tadoule Lake. Windows are especially problematic in isolated, northern communities since their panes expensive to replace, and those broken windows present challenges to heating the house, keeping out water and snow, and even home security. Uncontrolled passive ventilation (i.e. air leakage) from damaged windows and doors is also a major source of condensation, which contributes to mold growth. For many people in Tadoule Lake, plywood sheathing was the only available solution to broken windows but such remedies were rarely sealed effectively.

The relative risk of developing mold in houses with at least one broken window or at least one broken door was calculated using ORs. Houses with at least one broken or unsealed window were 2.681 times more likely to contain mold in their living spaces than those with sealed windows, although the figure is not statistically significant (n= 53; OR = 2.681, 95% CI = 0.303, 23.683, p=0.358). Houses with at least one damaged door were 3.9 times more likely to have mold in their living spaces than houses with properly sealed, undamaged doors, although the figure is also not statistically significant (n=46; OR = 3.90, 95% CI = 0.444 – 34.288, p=0.191). Combining all window and door conditions, the odds of having mold in the living space in houses with damaged or unsealed doors and windows was no greater than for houses with properly sealed windows and doors, although again the value was not statistically significant (n=72; OR = 0.885, 95% CI = 0.809, 0.969, p=0.237).

An independent samples t-test was used to test the differences in indoor air humidity for houses with and without broken or unsealed windows and doors. The results indicate little significant difference between houses with either condition. The average humidity in houses one or more broken windows (M = 44.1, n = 52) was found to be not significantly lower (p = 0.96) than the average humidity in houses with undamaged windows (M = 44.2, n = 22). Indoor humidity in houses with broken or unsealed doors (M = 44.3, n = 45) was not significantly higher (p = 0.89) than in houses with undamaged doors (M = 44.0, n = 27).

Once again there is difficulty assigning common issues status as risk factors. Most houses surveyed have one or more broken or otherwise unsealed window (72%) or door (63%), and like the case of effective drainage, although the relationship is not statistically strong we know these conditions contribute to moisture ingress, and air leakage and condensation in the home. Every house with mold in the living space had at least one broken window and, like drainage issues, that damaged windows and doors are so common is a hugely problematic finding on its own.

Exterior siding

Mold and water damage was also apparent on interior walls in 9.6% of the houses. The odds of having mold or water damaged areas on the interior walls of houses with damaged exterior wall surfaces (e.g. siding) was 2.857 times greater than houses with undamaged siding, although the value is not statistically significant (n=67; OR = 2.857, 95% CI = 0.586, 13.927, p=0.179). Similarly, the odds of having water damage on the surfaces of interior walls in houses with damaged exterior siding are 2.667 times greater than for houses with intact, undamaged siding, although the figure is not statistically significant (n=67; OR = 2.667, 95% CI = 0.544, 13.080, p=0.214).

Mold reporting vs. observation

The relationship between mold observations during the structural assessment of the house and survey participant reporting of mold in the house is illustrated in Table 16. Of the 57 houses where interview and structural data are available, 12 houses (21.1%) exhibited mold during the structural survey. However, participants reported its presence in only half of those houses.

Structural survey	Homeowner reports for mold in house		
	Yes	No	Not sure/no response
Houses with mold observed (n=12)	6	5	1
Houses with no mold observed (n=45)	16	28	1

Table 16: Homeowner mold reporting vs. mold observation during structural survey

Perhaps most striking about the mold recorded in the structural survey and the questionnaire responses regarding mold growth in the home was the apparent disparity between the presence of mold and occupant awareness of its presence, as well as occupant perceptions of its causes. While it is possible that during the structural assessments mold growth was not captured (i.e. it could be underreported), in 41.7% of cases where mold was observed the survey participant was unaware of its presence. Similarly, 13.8% of survey participants responded that there was no specific cause(s) of mold growth in their houses, and 17.2% were not sure of its cause(s). Given the potential health impact of mold exposure in communities already facing a disproportionate health burden (cf Larcombe et al. 2011), in a community where (at least) 26.3% of all houses contain visible mold, and where 56.6% have mold-prone areas (Figure 8), one of the most straightforward initiatives for health improvements could include strategies aimed at identifying and combating mold in the home.

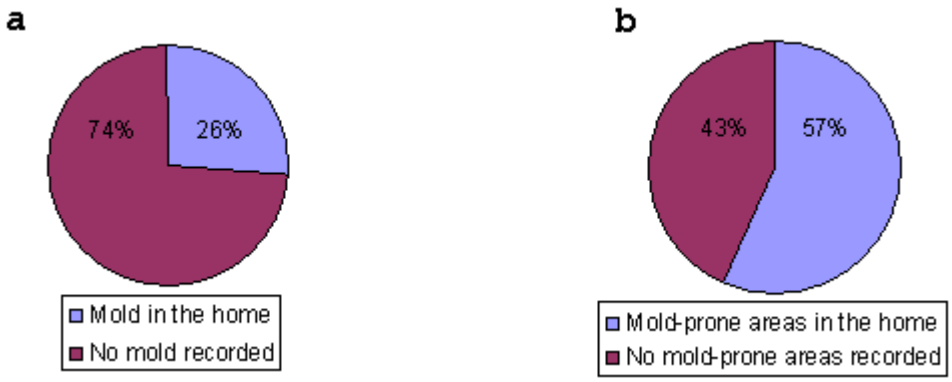

Figure 8: Homes in Tadoule Lake with mold (a) and mold-prone areas (b) recorded during survey.

Mechanical ventilation (HRVs) and airflow

Ventilation and adequate airflow are crucial to controlling humidity and curbing the growth of mold in the home, and controlling the flow of air is necessary for the efficient operation of HRVs. When air is permitted to enter or escape through non-HRV regulated openings (i.e. when the house is not "tight"), an HRV will not properly regulate the exchange of air and moisture (Figure 9).

HRV data are available for 67 houses. Of the 36 houses with functioning HRVs (53.7%), mold was recorded in 5 living spaces (13.9%) and 3 crawlspaces (9.7%). Of the 31 houses with no or with a non-functioning HRV (46.3%), mold was recorded in 2 living spaces (6.5%) and 5 crawlspaces (20.0%). Mold was recorded anywhere in 8 (25.8%) houses with functioning HRVs and 7 (28.0%) houses with no or non-functioning HRVs. The odds of having mold anywhere in a house without a functioning HRV was 1.021 times greater than for houses with functional HRVs, although the figure is not statistically significant (n=67; OR = 1.021, 95% CI = 0.323, 3.229, p=0.972). The odds for having mold in the living space of houses with a non-functioning HRV were lower than for houses with functional HRVs although the figure is not statistically significant (n=67; OR = 0.428, 95% CI = 0.077, 2.379, p=0.321).

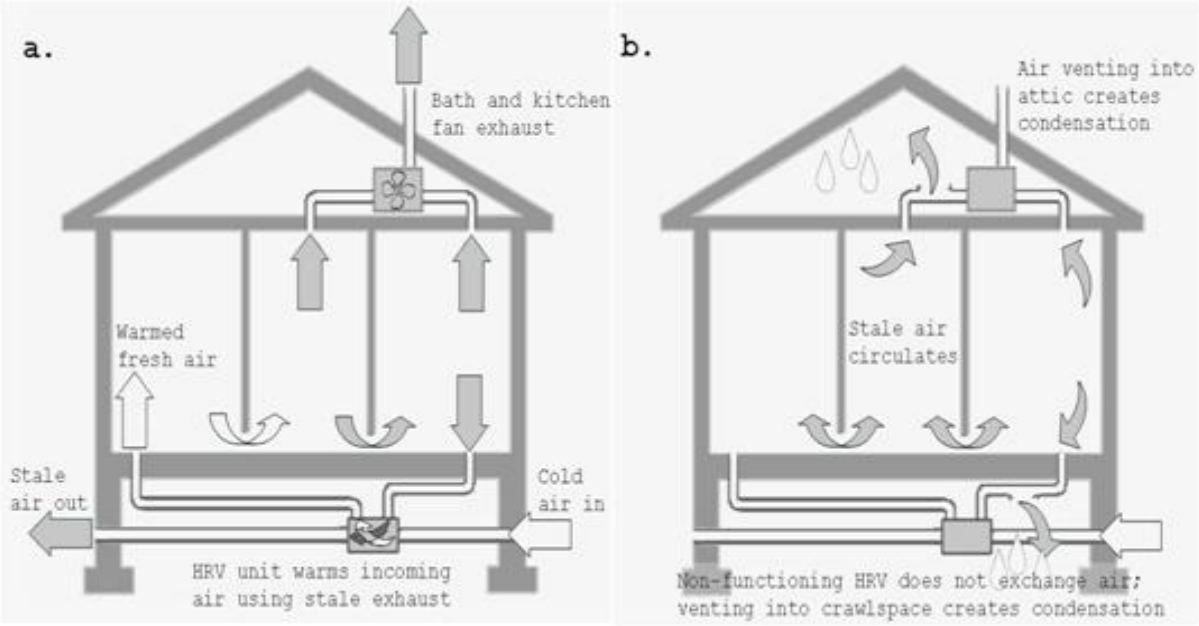

Figure 9(a): Functioning and (b) no or non-functioning mechanical ventilation systems. Diagram is intended to illustrate both dedicated and integrated mechanical ventilation systems and does not necessary represent the systems employed at any location(s).

Independent samples t-tests were used to test the differences in indoor air humidity for houses with and without functioning HRVs. While not statistically significant, the results are not surprising (Figure 7). The average humidity in houses without functioning HRVs ($M = 45.7$, $n = 31$) was found to be not significantly higher ($p = 0.17$) than average humidity in houses with functioning HRVs ($M = 42.5$, $n = 36$).

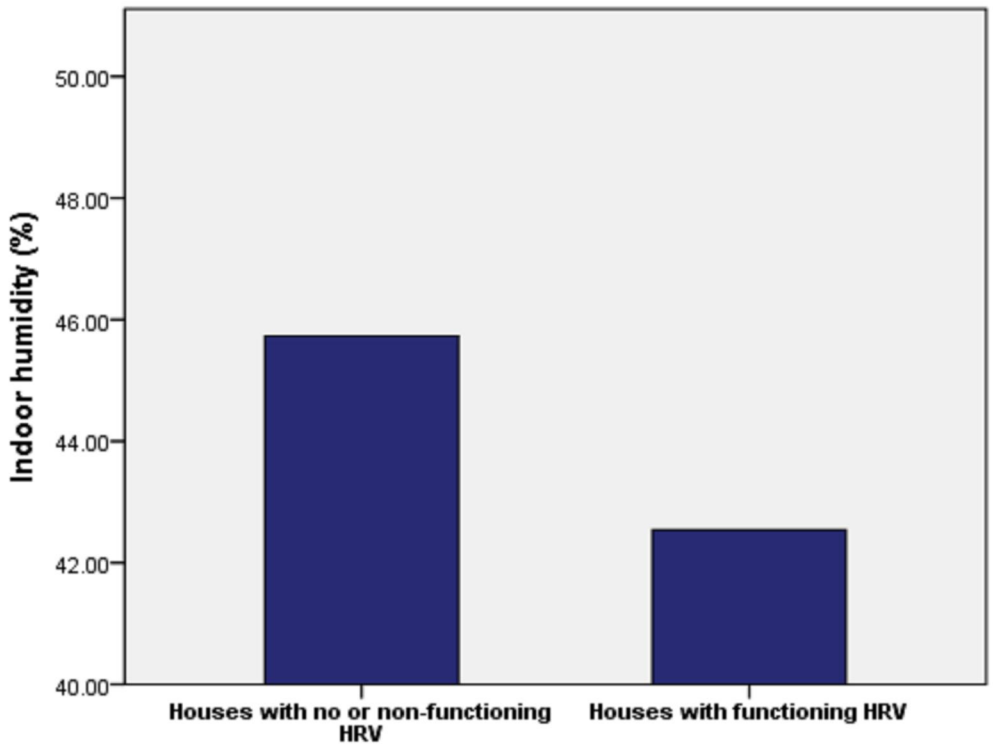

Figure 10: Indoor humidity in houses with no or non-functioning HRVs

Two caveats should be addressed regarding household mold and HRV presence and function. First, HRVs were recorded as operational if the unit was plugged in and turned on. Assessing the actual performance of each unit was not part of the survey and the interior compartments of the units (e.g. filters, ductwork connections, or mechanical elements such as fans) were not regularly accessed for examination. Regular maintenance is critical to the efficacy of HRV function, but it was not until the survey was partially completed that it became apparent that units were often not maintained. While survey participants were not systematically asked about HRV maintenance, through visual inspection and unstructured conversation it became clear that HRV units were not routinely inspected and cleaned (e.g. filters were not being cleaned). This is unsurprising as units were almost unanimously installed in crawlspaces, where they were difficult to access by homeowners –

especially by elderly or disabled people. Many respondents also did not know how the units worked and had never been instructed on maintenance procedures.

Second, HRV function is dependent on tightly controlled airflow in the house. Broken windows, missing vent covers, or other unsealed entrances (e.g uncaulked cable bores, overstressed seams in exterior sheathing, broken windows) allow uninhibited airflow in the house, forcing the HRV to operate endlessly towards a task it cannot complete. Even in houses where units were in good working order the efficacy of the HRV was compromised if the house was not properly sealed. Further, more detailed investigation into the mechanical operation and maintenance of HRVs as well as of air leakage across the building envelope would hopefully identify manageable issues for homeowners and the community alike. Post-hoc tests of statistical power of the differences in means between houses with and without funtioning HRVs ($1 - \beta = 0.35$) further emphasize such cautious considerations.

Humidity and mold growth

As a supplement to structural conditions examined elsewhere as potential risk factors for mold growth in the home, independent samples t-tests were used to test the differences in indoor air humidity for houses with and without mold in the living space and crawlspace. Figure 11 illustrates the results from houses with or without mold recorded. Indoor humidity was not significantly ($p = 0.171$) higher in houses with mold present in the living space ($M = 48.80$, $n = 7$) than in houses with mold in the crawlspace ($M = 43.65$, $n = 68$). Similarly, in houses with mold present in the crawlspace ($n = 8$), indoor humidity was not significantly higher ($M = 46.25$, $p = 0.677$) than in houses without mold recorded in the crawlspace ($M = 44.69$, $n = 55$). Post-hoc tests of statistical power suggest the study may have lacked sufficient power to detect any statistically significant differences between the houses with and without mold in the living space ($1 - \beta = 0.40$) and in

houses with and without mold in the crawlspace ($1 - \beta = 0.11$), and rather the lack of significance is most likely due to the small sample size of houses where mold was observed (n=7 and 8, respectively).

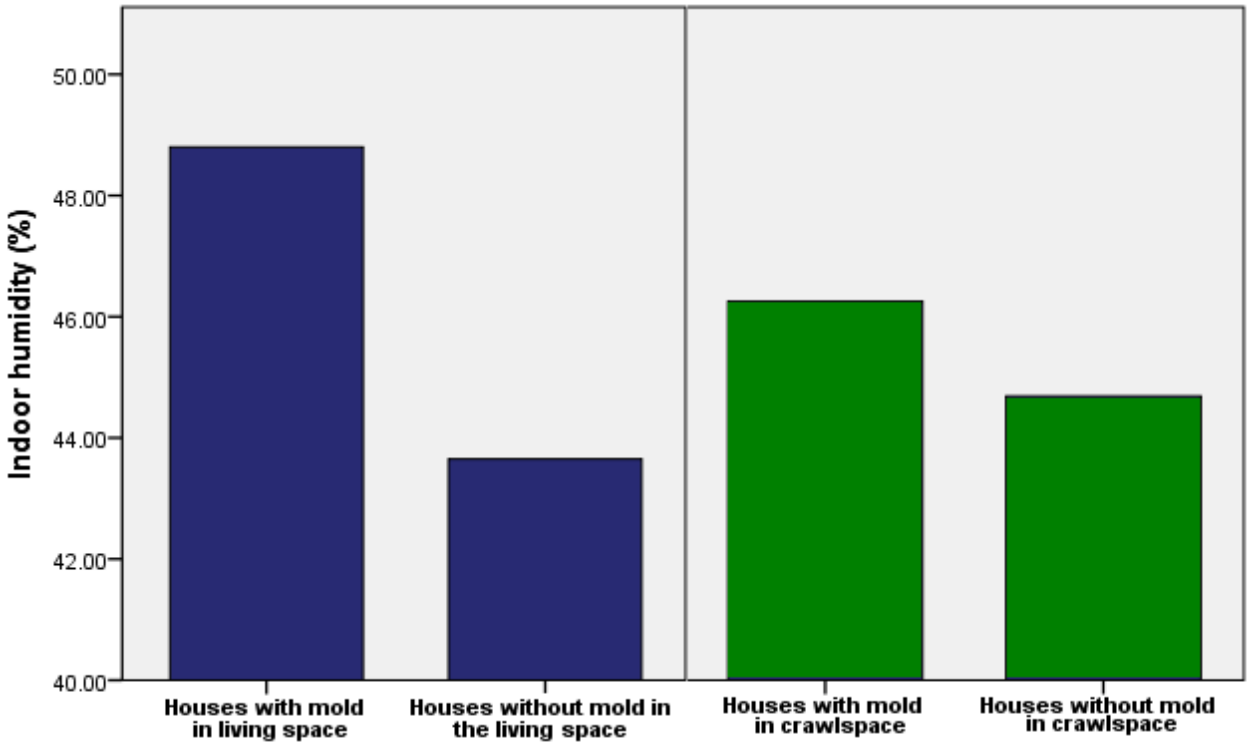

Figure 11: Humidity in houses with and without mold observed

Humidity was also considered relative to exterior weather conditions using paired-samples t-tests. There was a significant difference between indoor (M=34.04, SD=9.87) and exterior (M=44.37, SD=6.61) humidity readings when the weather was clear; $t(24)=1.413$, $p < 0.001$. However, there was no significant difference between indoor (M=44.50, SD=9.41) and exterior (M=45.35, SD=8.15) humidity during overcast conditions; $t(22)=0.305$, $p = 0.763$, nor was there a significant difference between indoor (M=46.48, SD=7.64) and exterior (M=55.94, SD=11.36) humidity while it was raining; $t(4)=2.413$, $p = 0.073$. The pattern illustrated in these results suggests that the houses in Tadoule Lake were air-leaky. During clear and sunny weather conditions, barometric pressure tends

to be high, which would help ventilate houses as air tends to flow from areas of high pressure to areas of low pressure. Conversely, during more humid weather (typically occurring during lower pressure weather systems), the airflow would be more limited and the houses would tend to ventilate more poorly. Without data on barometric pressure such explanation remains speculative but the available data and these limited analyses do support a hypothesis that air leakage in Tadoule Lake is contributing to humidity problems in the houses.

Insulation

As was noted earlier, insulation was only regularly accessible for assessment in the crawlspaces of some houses in Tadoule Lake. However, as adequate insulation includes correctly sealed vapor barrier, the 45.1% of houses with damaged or inadequate crawlspace insulation provide excellent data to evaluate insulation quality as a risk factor for mold in the home. Five of those houses had mold in their crawlspaces, and 4 had mold in the living space.

Houses with inadequate insulation in their crawlspaces were 7.222 times more likely to have mold in their crawlspaces than houses with properly insulated foundations (OR = 7.222, 95% CI = 0.777, 67.136, p=0.050). Those same houses were 5.684 times more likely to have mold in their living spaces (OR = 5.684, 95% CI = 0.588, 54.940, p=0.099) and 8.357 times more likely to have mold anywhere in the house (OR = 8.357, 95% CI = 1.582, 44.140, p=0.006).

Given the importance of having a properly insulated crawlspace, it is useful to also compare observed and reported insulation quality. While only crawlspace conditions could be observed, the available data may serve as a proxy for insulation quality for the entire house as well as survey

respondent familiarity with their housing conditions. Table 17 illustrates survey participant responses regarding the degree to which their houses were insulated relative to the conditions observed during the structural survey. While sample sizes are limited, the trend in responses suggests that community members were unsatisfied with insulation quality. Overall, only 26.5% of survey respondents reported having well insulated homes.

	Good insulation reported	Poor insulation reported	Not sure how well house is insulated
Crawlspace insulation is adequate (n=28)	1	12	2
Crawlspace insulation is inadequate (n=23)	2	4	1

Table 17: Reported vs. observed insulation values

Further examining insulation quality as a risk factor for mold growth in the home, the odds of developing mold in houses with reportedly inadequate insulation was calculated using odds ratios. Table 18 displays these results for living space, crawlspace, and both locations combined.

Insulation and mold	Odds of mold in living space			Odds of mold in crawl space			Odds of mold anywhere		
	OR	95% CI	p=	OR	95% CI	p=	OR	95% CI	p=
Insulation reported to be adequate	1.143	0.982, 1.329	0.266	1.133	0.953, 1.348	0.343	1.263	1.029, 1.551	0.137
Insulation reported to be inadequate	0.850	0.707, 1.022	0.143	0.867	0.711, 1.057	0.253	0.750	0.582, 0.966	0.050
Unsure of quality or amount of insulation	1.115	0.986, 1.262	0.500	1.100	0.964, 1.255	0.656	1.208	1.023, 1.427	0.367

Table 18: Reported insulation adequacy as a risk factor for mold in the home

In each location, there was no increase in risk when insulation was reported to be inadequate. However, that the risk is roughly equivalent when insulation was reported to be adequate as well as

when respondents were unsure suggests problematic disparity between structural conditions and occupant familiarity with those conditions.

Water and plumbing

The impact of water availability in Tadoule Lake was evident when access to water was assessed as a risk factor for mold growth and disease presence. Although the total number of homes with no water supply was low, there is evidence suggesting that as access to water decreases the odds of having mold in any location increase as do the odds for some health conditions.

For those with reduced or no access to potable water in their homes, the well-established health repercussions to living in such conditions are both apparent and significant. As access to water decreases, the odds of mold presence increases in houses regardless of location (Table 19), further amplifying any extant or potential burdens of health in affected houses. A significant decrease in the odds for having mold anywhere is noted for homes with a stable water supply. For mold in the living space alone there is a significant increase in odds for mold among cistern-supplied houses (Table 20), and in crawlspaces there is a significant increase in odds among houses with no water supply (Table 21).

Supply type	OR	95% CI	p=
Public (piped)	0.261	0.080, 0.846	0.020
Cistern	2.722	0.811, 9.135	0.097
No water	4.538	0.584, 35.251	0.118

Table 19: Odds of having mold anywhere based on water supply

Supply type	OR	95% CI	p=
Public (piped)	0.265	0.054, 1.299	0.084
Cistern	5.238	1.049, 26.148	0.029
No water	1.108	1.027, 1.195	0.513

Table 20: Odds of having mold in the living space based on water supply

Supply type	OR	95% CI	p=
Public (piped)	0.436	0.097, 1.950	0.268
Cistern	0.833	0.152, 4.571	0.834
No water	18.333	1.440, 233.408	0.004

Table 21: Odds of having mold in the crawlspace based on water supply

Despite the clear need for further investigation with greater sample size, the patterns shown here consistently illustrate the problematic effects of living without a stable supply of water. In this case, access to water may be a proxy for access to other amenities, including the abilitiy to organize and afford regular maintenance and repair in the home. Similarly, a lack of running water would make it exceedingly difficult to undertake even the simplest cleaning tasks in the home.

The effects of water supply on occupant health are similarly affected by sample size. The odds of allergies being reported (Table 22) increases with a decrease in access to water, although the only statistically significant OR is the odds against allergies in houses with the most stable water supply (p=0.029). MRSA (Table 23) and TB (Table 24) appear less affected by water availability. No significant increase in odds for either condition was calculated as access to water decreases, although there was a non-significant increase in odds for TB in houses with cistern supplies (OR=1.882, 95% CI = 0.552, 6.423, p=0.309).

Supply type	OR	95% CI	p=
Public (piped)	0.195	0.040, 0.938	0.029
Cistern	3.900	0.828, 18.380	0.071
No water	3.357	0.268, 42.076	0.323

Table 22: Odds of having allergies present based on water supply

Supply type	OR	95% CI	p=
Public (piped)	1.351	0.326, 5.607	0.678
Cistern	1.000	0.236, 4.231	1.000
No water	1.265	1.113, 1.438	0.375

Table 23: Odds of having MRSA present based on water supply

Supply type	OR	95% CI	p=
Public (piped)	0.702	0.254, 2.516	0.702
Cistern	1.544	0.454, 5.248	0.485
No water	0.574	0.043, 5.860	0.574

Table 24: Odds of having TB present based on water supply

These results suggest that water availability is less of a risk factor for TB and MRSA presence than it may be for allergies. The increased odds noted for allergy presence in homes with limited access to water is consistent with complications in household hygiene practices, as allergens present in the home can be better controlled with regular access to water. Improved hygiene would not only reduce the rates of illness by interrupting the transmission of pathogens between individuals, but it would also help to reduce the total number of pathogen carriers and thus restrict exposure in the most vulnerable. Again, due to the low sample size of only 4 houses without a water supply it is difficult to draw strong conclusions from these data.

Issues with plumbing (e.g. leaking pipes and other fixtures) were assessed as potential risk factors for mold growth in the home. Leaking plumbing in the living space did not increase the odds for mold in the living space (OR = 0.144, 95% CI = 0.016, 1.311 p=0.052), although it did non-significantly increase the odds for mold in the crawlspace (OR = 1.891, 95% CI = 0.291, 12.284, p=0.499). Similarly, leaky crawlspace plumbing did not increase the odds for mold in the living space (OR = 0.880, 95% CI = 0.092, 8.384 p=0.911) but it did non-significantly increase the odds

for mold in the crawlspace (OR = 1.233, 95% CI = 0.115, 13.174 p=0.862). One possible explanation for these findings is that leaking fixtures or piping on the living floor of a single storey house – in which 80% of families in the community reside – were likely to drain into the crawlspace, which acts as a catch-all for moisture until enough water has accumulated to trigger the sump pump. Houses without functional sump pumps were 6.581 times more likely to have mold in their living spaces than houses with functional sump pumps (OR = 6.581, 95% CI = 0.750, 57.764, p=0.056). Those same houses were 1.379 times more likely to have mold in their crawlspaces than houses with functional sump pumps (OR = 1.379, 95% CI = 0.299, 6.371, p=0.680).

One reason why a feature of the crawlspace might have such influence on conditions in the living space is likely due to the geology of the community. As noted earlier, most houses in Tadoule Lake are situated on a sandy esker and their foundations are constructed from pressure-treated timber walls on concrete footing courses. Like the minimal use of concrete in foundation walls, crawlspace floors remain earthen for logistical and cost-effectiveness purposes. Not only do wind and undeflected rain cause the sand to fluctuate around the exterior of the foundations – exposing those surfaces to elements which they are not intended to withstand – but poor drainage can also alter the subfoundation from within and below the house. In extreme cases (e.g. when drain-tile becomes blocked or a failed or absent sump pump cannot expel rain or ground water) the excess water can shift the sandy foundation floor and subfooting (Figure 12), causing major strains on the entire structure.

Figure 6: Unstable sub-foundation. Note cavity below footing

In these cases, the house can be weakened substantially as one or more sections of the house are asymmetrically sunk into the stratum below. This literal pulling apart at the seams will invariably cause air and moisture leakage in the structure above ground, which then leads to mold growth. Although such extremes are rare in the community, they highlight the importance of each critically connected element of the housing system.

Occupant Activity

In an attempt to measure the potential relationship between occupant behavior and the deterioration of housing and/or health (e.g. occupant-induced mold growth), several survey responses regarding household occupant activity were analyzed vis-à-vis housing conditions as risk factors for mold

growth – including indoor humidity levels as a possible indicator for mold potential. These results are not intended to account absolutely for the relationship between occupant behavior and mold growth, but simply point to the possibility that reported behaviors may have an indirect effect on mold growth or the conditions fostering that growth in the home.

Cooking methods

Independent samples t-tests suggest the average humidity in houses where water is boiled every day for cooking (M = 44.87, n=21) was not significantly lower (p = 0.122) than the average humidity in houses where food was less frequently boiled (M = 50.44, n=13). There were small increases in odds for having mold in the crawlspace or the entire house where water is boiled daily for cooking, although the values are not significant; there was no increase in odds for mold in the living space (Table 25).

Processing meat in the house

Independent samples t-tests were used to test the significance between the average humidity in homes where survey participants reported processing meat indoors (M = 44.83%, n = 7) and the average indoor humidity for homes where meat is not processed indoors (M = 45.60%, n = 38). The slightly lower average in houses where meat was processed was not significant (p = 0.856). Processing meat in the house does increase the odds for mold growth in both the living and crawlspace (Table 25), but the values are not statistically significant.

Dish drying

Independent samples t-tests were used to test the significance between the average indoor humidity in houses where survey participants reported letting their dishes drip-dry (M = 43.97, n = 14) and

those who reported hand drying their dishes (M = 46.01, n = 17). The slightly lower average was not significant (p = 0.122). The odds for having mold in the living space, crawlspace, or entire house when dishes are allowed to drip dry are higher than for immediate hand or towel drying, although not statistically significant in any case (Table 25).

Smoking

An independent samples t-test was used to test the hypothesis that smoking had no effect on indoor humidity. The average indoor humidity in houses where occupants reported smoking inside (M = 42.20, n = 30,) was not significantly lower (p = 0.075) than in houses where smoking was not permitted indoors (M = 45.01, n = 35). There is no increase in odds for mold growth in the crawlspace in houses where occupants reported smoking inside; the odds for having mold in the living space or the entire house when occupants smoke inside are higher than in houses where smoking inside is not permitted indoors, although the values are not statistically significant in any case (Table 25).

Occupant activity	Risk of mold in living space			Risk of mold in crawl space			Risk of mold anywhere		
	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p
Boil food daily	0.579	0.071, 4.709	0.606	1.765	0.161, 19.340	0.639	1.042	0.203, 5.343	0.961
Dishes drip dry	3.000	0.459, 19.592	0.239	2.889	0.226, 36.868	0.399	3.500	0.682, 17.965	0.124
Process meat inside	1.188	1.035, 1.363	0.259	2.13	0.184, 24.761	0.54	0.54	0.057, 5.071	0.58
Smoke inside	1.85	0.287, 11.889	0.51	0.73	0.111, 4.768	0.74	1.21	0.312, 4.672	0.78

Table 25: Moisture generating occupant activities as risk factors for mold growth

The higher odds for mold presence in the crawlspaces of households reporting more frequent meat processing and food boiling could be understood as a result of occupant-generated moisture being

improperly vented into crawlspaces, where it cannot escape and ultimately contributes to mold growth. While data were not systematically collected on the pathways and efficacy of ventilation, it was noted anecdotally as an occasional problem in crawlspaces. This issue may also be related HRV system installation and maintenance.

Bathing

Of those who report using their bathtub or shower every day (n = 14), the average humidity inside is 43.72%, whereas those who use their tub or shower every 2-3 days (n = 7), every 7-14 days (n = 4), or have no tub at all (n = 3) have average indoor humidity readings of 41.67%, 40.23%, and 39.67%, respectively. One way ANOVA was performed to test the hypothesis that the mean humidty readings were not significantly different based on reported bathing frequency; the average humidity was found not to be different $F(3, 24) = 23.020$, $p = 0.837$. A Mann-Whitney test was used to test the hypothesis that the frequency of bathing in houses with mold in the living and crawlspaces were the same as those with no mold recorded. The occurence of mold in the living space was not significantly different given the different reported laundry frequencies (Mann-Whitney $U = 35.50$, $p = 0.375$), nor was it significantly different for crawlspace occurences given reported frequencies (Mann-Whitney $U= 23.50$, $p = 0.694$).

Laundry

The average indoor humidity among respondents reporting doing their laundry most frequently (every 1-2 days, n = 4) was 45.43%, whereas those who reported doing their laundry twice a week (n = 11) or once every 7-14 (n = 6) days had an average indoor humidity of 42.19% and 40.47%, respectively. One way ANOVA was used to test the hypothesis that mean humidity readings were

equal across all houses; the average humidity was found not to be different $F(2, 18) = 0.311$, $p = 0.737$. A Mann-Whitney test was used to test the hypothesis that the frequency of laundry in houses with mold in the living and crawlspaces were the same. The occurence of mold in the living space was not significantly different given the different reported laundry frequencies (Mann-Whitney $U = 19.00$, $p = 0.325$), nor was it significantly different for crawlspace occurences given reported frequencies (Mann-Whitney $U=7.50$, $p = 0.764$).

Community comparisons

Not all First Nations communities are homogenous in terms of their housing and infrastructure needs. Comparable data on crowding, structural and sanitary conditions, and health from two other First Nations communities in Manitoba (Larcombe et al. 2011) are useful in illustrating this point. In terms of crowding, Tadoule Lake has slightly larger and less crowded houses than nearby Northlands Denesuline First Nation at Lac Brochet, where a significant association between TB and crowding was found (Larcombe et al. 2011). At the more southerly located Tootinaowaziibeeng First Nation in Valley River, while the houses are slightly larger, other measures of crowding are more severe than those recorded at Tadoule Lake (Table 27). Crowding was not correlated with TB in Valley River. However, the average house size and occupancy measures in all three communities fall below provincial and national standards.

	Tadoule Lake	Lac Brochet (Larcombe et al. 2011)	Valley River (Larcombe et al. 2011)
Population size	321	606	302
# houses	112	135	95
average house size (Ft^2)	909	882	970
ppr	0.6	1.1	0.9
pph	3.5	5.2	3.9
Ft^2pp	347	212	300

Table 26: Crowding compared across three communities

The general physical condition of the houses in each community is evident in these data as well (Table 27). At first glance, there is little distinction between the appearance of the houses in each location: most have damaged siding and damaged or missing gutters and downspouts, and roofs are often in disrepair as well. Although this alone is cause for concern, upon closer inspection substantial differences appear which help to define the unique needs of each community.

Structural condition observed in house	Tadoule Lake (n=79)	Lac Brochet (n=72)	Valley River (n=57)
Missing or damaged gutters	39 (62.9%)	63 (88%)	27 (47%)
Missing or damaged downspouts	58 (84.1%)	68 (94%)	42 (74%)
Lot grading that slopes toward the house or is flat	46 (60.5%)	42 (58%)	19 (33%)
Damaged exterior wall covering	26 (64.4%)	51 (71%)	34 (60%)
Damaged or exposed exterior foundation walls	50 (72.6%)	68 (94%)	16 (28%)
Crawlspace foundation configuration	61 (80.3%)	46 (64%)	23 (40%)
Visible mold in the foundation	8 (10.5%)	25 (35%)	7 (12%)
Damaged interior foundation walls	23 (36.5%)	38 (53%)	12 (21%)
Damaged/missing vapor barrier in the crawlspace	25 (41.7%)	12 (17%)	2 (4%)
Visible mold in ceilings, walls, or floors	7 (9.2%)	32 (44%)	11 (19%)
Damaged roof	33 (44.6%)	61 (85%)	26 (46%)
Damaged chimneys	22 (30.6%)	28 (39%)	2 (4%)
Damaged toilets	18 (24.3%)	27 (38%)	5 (9%)
Problems in the water supply and/or quality	57 (73.1%)	44 (62%)	40 (70%)

Table 27: Structural conditions compared across three communities

These descriptions are an inevitable outcome of non-random selection and therefore cannot be wholly representative of each of the communities included in the study, nor can they represent all First Nations communities in the province or country. However, they do reflect the material circumstances of those surveyed. These representations will be discussed further in the concluding chapter.

Chapter 6: Conclusions

> The health effects of inadequate housing and sanitation have long been recognized and the means to control them available. Yet in Aboriginal communities, although substantial progress has been made over the years, survey after survey has indicated that such community infrastructure continues to lag behind that provided for the rest of the population.
>
> Waldram et al. 2006:115

Key points from this thesis include:

1) The social determinants of health (SDH) are the structural circumstances behind health and illness,
2) Canadian Aboriginal people suffer a disproportionate burden of health compared to the rest of the country,
3) The housing crisis currently occurring in First Nations communities across the country has enormous health consequences,
4) Canada's reorientation of its Aboriginal people across the landscape has created health inequity for hundreds of years,
5) In Tadoule Lake, detrimental housing conditions are largely a result of unsuitable building materials and design rather than occupant activity, and
6) The housing problems facing the Sayisi Dené are not identical to even their closest neighbors, let alone all other First Nations communities in the country; strategies to improve such conditions should consider these variable needs to effect positive change.

Housing conditions as determinants of health in Tadoule Lake

Good health depends on a number of factors. Seeing a good doctor, eating good foods, and exercising regularly are all important in the creation and maintenance of good health. However, growing up and living in unhealthy and inequitable physical and social conditions also make a healthy life profoundly difficult to attain.

Major risk factors for increased burdens of health in Tadoule Lake include crowded conditions, poor ventilation and the presence of mold, and the lack of water availability. Mold exposure and other air contaminant concerns resulting from overcrowding and poor ventilation have been strongly associated with poor respiratory health outcomes, allergies, and other long-term effects (Gent et al. 2002; Dales et al. 1998; Andriessen et al. 1998; Verhoeff et al. 1995; Burrell 1991; Flannigan et al. 1991; Acheson 1991; Platt et al. 1989; Strachan 1988) and chronic exposure to such conditions has been linked to the type of immune system stimulation that effectively lowers individuals' abilities to combat TB (Larcombe et al. 2008; Larcombe et al. 2005; Lehmann et al. 2003; Berger 2000). With Manitoba First Nations occupancy rates nearly double that of the rest of the country (Martens et al. 2002), and with strong associations made between overcrowding and infectious disease in reserve communities in particular (Rosenberg et al. 1997, Clarke 2002, Kovesi et al. 2007, Larcombe et al. 2011), no degree of overcrowding is unproblematic.

The hazardous impacts of crowded living conditions in Tadoule Lake are both present and potential, with a higher than average number of individuals living in each house (3.52pph) and below average house size (909 Ft^2). Despite having more crowded conditions relative to national or provincial standards, crowding does not appear to be associated with mold growth in the home – nor could the presence of mold be correlated with certain health conditions present in the community, as has been

seen elsewhere (Larcombe et al. 2011). Nevertheless, these findings do not deny the need for additional housing units and improved building and ventilation standards in the community, as airborne disease transmission is strongly linked to these factors. The TB rate for Aboriginal Canadians is 38 times greater than the rate for non-Aboriginal Canadians (PHAC 2012), and as healthy individuals need only inhale <10 aerosolized TB bacteria from an infected person's cough or sneeze to become infected themselves (Nicas et al. 2005), overcrowding could have easily measurable epidemiological implications should communicable disease incidence spike or should the number of available units be decreased even minimally (Larcombe et al. 2011; Clark 2002).

A final consideration regarding crowding in Tadoule Lake is its cultural and economic circumstances: multigenerational households are common in Tadoule Lake (39.1% of all houses), and with fewer multigenerational households than single family units desiring to expand the size of their homes, financial restrictions may not be the only determinant in making the decision to live with extended family. However, with the high costs of constructing new or repairing existing buildings in northern and isolated communities like Tadoule Lake, the costs of living separately may be too high for many in a community with an unemployment rate of 30.4% (Aboriginal Affairs and Northern Development Canada 2012).

The consequences of these fragile conditions are exacerbated by the lack of access to one of our most essential human needs of all: water. An adequate water supply and sanitation system are as necessary for disease control as basic medicines the world over (Howard and Bartram 2003; Hunter et al. 2010), and a lack of access to safe water is linked to 1.4 million child deaths from diarrhea and 860,000 child deaths from malnutrition annually (WHO 2008). Water availability has been

recognized in diminishing the transmission of respiratory pathogens (Hennessy et al. 2008; Fung and Cairncross 2006; Luby et al. 2005; Ryan et al. 2001; Carabin et al. 1999) as well as MRSA and skin and soft tissue infection) (Hennessy et al. 2008). Various health effects of inadequate water availability have been highlighted in Canadian First Nations communities (Adelson 2005; Eggerton 2006, 2008a, 2008b; Patrick 2011, Spence and Walters 2012) and in Manitoba in particular (Hallett 2006). In First Nations communities already disproportionately burdened by poor health, access to water must be acknowledged alongside housing conditions as crucial components of healthcare management strategies.

Given the low number of houses with no water supply in Tadoule Lake ($n = 4$) it is difficult to draw strong conclusions on its health effects in the community. Decreased water availability may increase the odds for mold growth in Tadoule Lake, further amplifying any extant or potential burdens of health in affected houses and, like crowding, it contributes to the underlying conditions of greater community health risks. A large portion of the community (23.7%) also rely on cisterns which require regular refilling, and a total of 73.1% of the community reported some problem with their water supply or quality. Although small sample size likely precluded the statistical significance of an increase in health risk found in homes with reduced access to running water, the potential for water-related health issues to present in the future is a serious concern. That Canada continues to remain home to people who do not have running water – no longer a privilege but a universal human right (United Nations General Assembly 2010) – is an alarming reality entirely on its own.

Structural issues known to lead to the development of mold in the home are common across the three communities. Specific housing conditions which this study has identified as risk factors in Tadoule Lake include:

1) Poor drainage systems (including roofs, gutters, downspouts, and lot grading, as well as operational sump pumps and drain tile), which should work in combination to transfer rain and groundwater away from the house. Too often in Tadoule Lake damaged or missing elements of drainage systems jeopardize the integrity of the building envelope by allowing water to penetrate exposed materials or the cracks which form as those materials break down. In extreme cases the local geology of the community presents additional problems as many houses are constructed on the easily shifting natural substrate.
2) Broken and unsealed windows and doors and the accompanying uncontrollable airflow. The 72% of the community with broken windows averaged 3 broken windows per house, and 63% of the community had at least one door that did not seal properly. Despite the survey taking place at a time of year when open doors and windows are not serious problems, their presence throughout the long and harsh winter undoubtedly leads to condensation and mold, as well as the direct entry of water and snow.
3) HRV inoperation in the 79% of houses with units installed. This is a combination of inappropriate engineering (i.e. air-leaky houses are not conducive to optimal HRV function) and occupant disuse (due to impracticable housing improvement strategies). Although the subject requires more detailed study, the evidence presented here suggests that HRVs are not running efficiently or effectively, and they are not being properly maintained.

Finally, although no data were systematically collected to examine the role of geographical isolation on conditions in Tadoule Lake, it is important to note its effects here. In such northern locations where building materials are flown in or hauled on seasonal roads, even basic repairs are complicated and expensive. Not only is the cost of transporting materials to isolated communities inordinately higher than in more southern communities with year-round truck access, but the distribution of those materials once in the community is complicated by complex management processes. Even those who can afford such supplies independently are only able to do so slowly and at great expense. This enormous problem is coupled with the nature of the materials used to construct the houses in the first place (i.e. those most economical and easily-transported), which reduce the longevity of houses due to their climate-inappropriate characteristics and ultimately make normal housing maintenance extraordinarily difficult.

Perhaps the most significant conclusion to be drawn is that not all First Nations communities are the same in terms of need. Locally-determined approaches are necessary to systematically identify the most significant issues affecting any community; generalized policies intended to address heterogeneous issues across multiple communities may not be effective. In the case of Tadoule Lake, the lack of readily available water in some houses presents a more pressing issue than in the other communities. More generally, for community members to have participated in the design of the study and in the collection of study data, the specific concerns of the community are more effectively addressed.

Non-structural influences

A separate dimension of the problematic housing conditions as observed in these data is the influence of the occupant, both directly and indirectly. Occupant behavior (i.e. direct influences) does not appear to significantly advance the deterioration of the houses, although its assessment here

serves as a first step in acknowledging common household activities for future First Nations housing plans. Since, for example, in-home meat processing may increase the odds for mold growth in the home, it is useful to consider space for this activity while drafting more culturally appropriate designs.

The lack of correlation between occupant activity and mold growth is a positive finding given the persistent antagonism directed at First Nations people in Canadian media. Despite the RCAP (1996) conclusions about damaging stereotypes cultivated in public discourse, Canada's Aboriginal people are still often portrayed as being in constant crisis and are often typified as victims of incompetent or dubious local management (e.g. Fleras 2011). These biased representations inform their audience's understandings about Canadian Aboriginal people and help to perpetuate apathetic opinions towards critical issues affecting communities across the country (Harding 2005). Yet here we see that living conditions and corollary health issues are in large part a result of unsuitable building materials and designs – circumstances largely dictated by external forces. The Sayisi Dené have overcome adversity in the past, and because this study is an initiative of the community involving Band members at all levels, it serves as an example of the type of resourceful leadership required to improve conditions for all residents in the community.

Yet the subtle indications of less tangible forces (i.e. indirect influences) at work in Tadoule Lake can also be noted in the survey data. Particularly evocative were the number of survey participants who reported relying on the band or government for home maintenance, and the disparity noted between occupant perceptions of housing conditions and what was recorded during the structural survey. While moldy conditions could have been overlooked in our assessments, recorded HRV disuse and other anecdotal evidence gleaned from informal discussions with community members about their HRVs help to illustrate this concern.

At the surface, some of the conditions in the community today parallel those described in the past (e.g. Bone 1969) with troubling coincidence: broken windows, repurposed plywood, impermanence. What cannot be plucked with significance from these data are explanations for the tendencies to perceive living conditions with frustration, or to rely on external agents for maintenance. In reading and hearing about housing conditions in Churchill, these dimensions of contemporary life and living in Tadoule Lake hint at the ongoing impacts of relocation in the community.

How does the past inform how people live in their homes today? It is a dangerous oversimplification to imply a community has taken the passive role as recipients of endless inequity when, for example, their return to traditional territory was internally devised and independently orchestrated. To meaningfully evaluate what can be mitigated or ameliorated in order to affect positive change, these questions allude to a powerful interaction between how houses are lived in – physically and otherwise – and how all conditions discussed in this study are influenced by the history of the community. As abstract as these concepts can appear, they are the most practical and ordinary incarnations of colonialism and inhibited Aboriginal governance, social exclusion, income inequality, diminished access to health services and social support, stress, and other social determinants of health.

Idle no More **and the future**

> No other human rights challenge in Canada is as consistently and strenuously raised by [the UN] and other independent human rights bodies as the rights of Indigenous peoples. By every measure, be it respect for treaty and land rights, levels of poverty, average lifespans, violence against women and girls, dramatically disproportionate levels of arrest and incarceration, or access to government services such as housing, healthcare, education, water and child protection, Indigenous peoples across Canada continue to face a grave human rights crisis.
>
> Amnesty International 2012

The appeal for meaningful discourse on Aboriginal inequality subject is growing, as Canada is the center of a now global movement demanding respect for and productive discussion of Treaty rights and, more generally, a reevaluation of the country's relationship with its First Peoples. This movement, *Idle no More*, is increasingly recognized as the long overdue reaction to Ottawa's autocratic and controverted Aboriginal policies, and its directive has become electrified by the increasingly reiterated fact that "[Canada has] never admitted we are – we were and still are – a colonial power" (former Canadian Prime Minister Paul Martin, quoted in Kennedy 2012).

Chapter 3 is a discussion of historic settlement patterns and the "treaty right to health" approach to improving the health and the delivery of health care to Canada's treaty signatories. It is clear that living conditions have always had an impact on human health, and it is also clear that our federal government has long had a profound, formal influence on those conditions as experienced by Aboriginal communities. In addition to failing to protect its Indigenous peoples by upholding a commitment to the right to health evident in international law, Canada has also slighted commitments entrenched in Aboriginal and treaty rights, which are protected by the Constitution of Canada. Whether a treaty right to health approach is practical today and whether housing conditions will be recognized as an integral component of that commitment remains to be seen. Not all treaties contain the same provisions for their signatories, and although ambiguities must be interpreted in the favor of Aboriginal peoples their contemporary interpretation is complex and contested. If a straightforward solution existed for this ostensibly economic problem then a sensible government would act accordingly – but so far the burdens of health emanating from inadequate and unsuitable housing have yet to be afforded realistic consideration in the federal budget. However, in efforts to

pressure Ottawa to fulfill obligations in relation to Aboriginal and treaty rights to health and housing, extensively detailed studies such as this one are useful advocacy tools. With *Idle no More*'s current momentum there perhaps has never been more political impetus to redress these and many other issues.

How housing conditions affect the health of First Nations people varies from community to community, but all is attributable in part to these volatile historical arrangements. A contemporary example and outcome of the social and cultural marginalization of these groups is documented in the previous chapter through an exploration of housing conditions as experienced on one First Nations reserve in northern Manitoba. This case study is a point of convergence for the scientific and social background laid out in the second and third chapters, and while the conditions recorded there are not universally applicable to all Canadian Aboriginal communities, the inequalities come as no surprise. It is therefore critical to note that every community is unique in terms of housing and health conditions and to effect positive change using generalizations may not be productive. As contemporary housing conditions in Tadoule Lake have not been systematically described elsewhere, the results of this work will hopefully inform community strategies to combat overcrowding and unsuitable conditions by:

1) Helping to maximize the use of annual housing budgets by prioritizing spending and by encouraging sustainability in healthy housing development initiatives (e.g. improved HRV programs),
2) Identifying target areas for maintenance,
3) Cultivating better informed decision making through the use of the database and reports created during this project,

4) Promoting autonomy through the continual maintenance and adaptation of the data as required to address ever-changing community needs,
5) Fostering local housing sector capacity development through the consideration of cultural and technical elements, and
6) Creating additional resources to utilize in political efforts aimed at improving housing and infrastructure.

Broadly, this thesis is an explanation of housing conditions as a determinant of health, the historical derivation and systemic orientation of those conditions for Aboriginal Canadians, and an example of that history and of previously undescribed conditions from one community in northern Manitoba. The single most significant conclusion of this work is to illustrate that despite the overarching statistics indicating nationwide deficiencies in housing conditions, health inequity, and a multitude of other economic and social issues, every community is different. Policy developed to be broadly implemented may not reflect or address the needs of every community upon which it is actualized. Homes designed for southern Canadian climates may offer no advantage for the Sayisi Dene, just as public health campaigns requiring running water might prove ineffective in a community where many homes lack adequate plumbing. And finally, while many similarities exist in the conditions experienced at Tadoule Lake and nearby Lac Brochet, the variation in mold presence, crowding, and water availability indicate the need for local-level assessments and subsequent improvement strategies. Community-based initiatives steered by those most acquainted with the needs at hand are a powerful and direct approach to such interventions provided the community has the autonomy to act on their findings.

What can be said about housing design and construction materials that hasn't already been said? Little, but it is important. Emphasizing the simple material approaches to improving housing conditions may be one of the most important takeaway messages here. This is not to say that complex funding mechanisms do not encumber the home building process on reserves, but as long as the same materials are used and the same designs are employed in the construction of homes in northern First Nations communities, the housing crisis will undoubtedly continue.

Improved and culturally relevant designs for houses and other buildings in First Nations and Inuit communities have been lauded as successes, as have environmentally oriented solutions for regional or community-specific housing problems. Designs that consider and accommodate traditional lifestyles have included the creation of spaces for traditional food processing (e.g. larger cutting surfaces, sinks, and storage options for bulkier game like caribou or seal) both in family homes (Gareau and Dawson 2004; Marshall 2005, 2006; CMHC 2013b) and in shared-access buildings available to all community members (Mackin 2004; Gareau 2005). By creating more meaningful spaces, these advancements in culturally appropriate design not only coincide with valuable community-based heritage preservation goals, but – as suggested in the preceding chapter – they may also be a factor in the promotion and maintenance of health. Similarly community derived and implemented building solutions for local environmental conditions also continue to unravel as invaluable counterbalances to the varying needs of communities across the country e.g., housing designs for settlement on a flood plain like Roseau River Anishinabe First Nation, Manitoba, include slab-on-grade foundations rather than partially or fully excavated basements to prevent interior flooding (CMHC 2001). That being said, the CMHC continues to advocate for the use of prefabricated building technologies which reduce both cost, waste, and construction activity impact

(CMHC 2001; CMHC 2013c, d); despite advancements in the factory-built industry (Lehmann 2013; Jieru 2012; Ward 2009) little is recorded about its application in northern environments or Aboriginal communities (see Decker 2010 for interesting yet economically impractical alternative concepts). While most of these recommendations seem largely commonsense, that heterogeneous solutions are being acknowledged and implemented should at least be observed as steps in the right direction.

Improved design is only part of an on-the-ground strategy to effectively improve housing conditions in First Nations or any community. The building materials used to construct and repair homes are integral to the long-term value of the building. Like investing in social programs and education to reduce health care expenditures over time (i.e. approaching health via its social determinants), to construct a house with sub-standard materials or materials unsuited to the environment ultimately shortens both its own lifespan and that of its occupants. Alternative solutions exist, although they are uncommon in application. Lightweight, fire and mold resistant construction materials with excellent insulating properties have been developed to create more suitable homes in remote, northern locations, but until they can be made more economically salient by means of mass production and market acceptance, the standards of oriented strand board and similarly cheap, unsustaining, and irresilient materials will undoubtedly remain champion in northern First Nations housing projects (e.g CMHC 2011b). A house is a system and functions only as well as its components are able. In Tadoule Lake, the failure of one component (e.g. drainage system, envelope seal, ventilation system) often had a direct and detrimental impact on other components of that system. Quantifying the long-term financial cost of using cheap materials to build such ephemeral homes would provide an interesting dimension to this quantity vs. quality discussion; determining

the corollary health care costs associated with living in houses built to neither adequate nor suitable standards would likely amplify such results substantially.

Moving forward on Aboriginal housing and health will undoubtedly be politically and socially constructed. Although in its infancy, *Idle no More* brings hope for such political and social change. Initially a reaction to legislative changes to the Fisheries, Navigation Protection, and Indian Acts brought about without adequate consultation in the Harper government's Bill C-45, the movement quickly transformed into a widespread, grassroots protest against Ottawa's "assimilationist agenda" (Palmater 2013; see also Palmater 2011). One of the movement's strongest themes is education, and its creators and supporters are unyielding in their efforts to cultivate better understandings of Canadian history and the current status of the country's Aboriginal people. This includes dispelling common myths about Canadian Aboriginal people, communities, and governance structures that have consistently formed the opposing commentary to *Idle no More* and many other Canadian Aboriginal issues. The online commentary on Canadian Aboriginal issues may not be the most scientifically accurate barometer of public opinion or Canadian social expression, but it highlights a disturbing tendency towards overtly and incontrovertibly racist generalizations being held as established truths rather than misguided opinion (Newland 2012; Chabot Gaspe 2013; Mallick 2013; see also Vowel 2012). If anything is to be taken from such disturbing displays of prejudice it is that *Idle no More* has its work cut out as long as Ottawa legislates the day-to-day conditions experienced by Canada's First Nations, Inuit, and Metis peoples.

In the future this period might be recalled as a time marked by inequalities (Statistics Canada 2013b) but also when increasing interest in tackling those inequalities will have hopefully led to real

improvements. *Idle no More* is symptomatic of this desire for change. Changes to the Canadian health care system may be on this same horizon, as the Canadian Medical Association recently announced its intentions to elicit nation-wide dialogue on the social determinants of health with a series of public forums on the issue (Canadian Medical Association 2013). How this will unfold remains to be seen but the high level interest in transforming health care speaks to the maturing consciousness of what makes people sick and how the current system falls short by addressing only the symptoms of ill health in lieu of its causes. Like the First Nations housing crisis there are no easy answers, but the will to recognize and act on the underlying causes of poor health is a step in the right direction. And like official recognition of and policy development based on the social determinants of health, a more respectful and informed relationship between Canada and its Aboriginal populations will be good for the country.

References

Abel K. 2005. Drum Songs: Glimpses of Dene History. McGill-Queen's University Press. Montreal and Kingston.

Abelson P, Taylor R, Butler J, Gadiel D, Clements M, Mui SL. 2003. Returns on investment in public health: an epidemiological and economic analysis prepared for the Department of Health and Ageing. Canberra: Department of Health and Ageing.

Aboriginal Affairs and Northern Development Canada. [Internet]. 2012. Workforce Statistics for Sayisi Dene First Nation. Ottawa: aandc-aadnc.gc.ca; [cited 2013 May 26]. Available at: http://pse5-esd5.ainc-inac.gc.ca/fnp/Main/Search/FNWorkforce.aspx?BAND_NUMBER=303&lang=eng

Acheson D. 1991. Health and Housing (Annual Lecture). Journal of the Royal Society of Health 111: 236-243.

Adelson N. 2005. The embodiment of inequity: health disparities in aboriginal Canada. Canadian Journal of Public Health 96(S2):45-61.

Allen UD. 2006. Public Health Implications of MRSA in Canada. Canadian Medical Association Journal 175(2):161.

American Public Health Association 1938. Basic Principles of Healthful Housing. New York: American Public Health Association.

Amnesty International. [Internet] 2012. Matching international commitments with national action: a human rights agenda for Canada. Amnesty.ca; [Cited 2013 May 25] . Available from: http://www.amnesty.ca/sites/default/files/canadaaihra19december12.pdf

Anderson HR, Favarato G, Atkinson RW. 2013. Long-term exposure to air pollution and the incidence of asthma: meta-analysis of cohort studies. Air Quality and Atmospheric Health 6:47–56.

Anderson LM, Charles JS, Fullilove MT, Scrimshaw SC, Fielding JE, Normand J. 2003. Providing Affordable Family Housing and Reducing Residential Segregation by Income: A Systematic Review. American Journal of Preventative Medicine 24(S3):47-67.

Andriessen JW, Brunekreef B, Roemer W. 1998. Home dampness and respiratory health status in European children. Clinical and Experimental Allergy 28: 1191–1200.

Ågren G. 2003. Sweden's New Public-Health Policy. Stockholm: Swedish National Institute of Public Health.

Armstrong P, Boscoe M, Clow B, Grant K, Pederson A, Willson K, Hankivsky O, Jackson B, Morrow M. 2003. Reading Romanow: The Implications of the Final Report of The Commission on the Future of Health Care in Canada for Women. Toronto: National Coordinating Group on Health Care Reform and Women.

Assembly of First Nations. [Internet]. 2010. First Nations Guide to Housing Policy. afn.ca; [cited 2013 May 25]. Available from: http://www.afn.ca/uploads/files/housing/housing-policy-guide.pdf

Arthurson K. 2004. From stigma to demolition: Australian debates about housing and social exclusion. Journal of Housing and the Built Environment 19:255–270.

Bambra C. 2010. Yesterday once more? Unemployment and health in the 21st century. Journal of Epidemiology and Community Health 64:213-215.

Bambra C, Eikemo TA. 2009. Welfare state regimes, unemployment and health: a comparative study of the relationship between unemployment and self-reported health in 23 European countries. Journal of Epidemiology and Community Health 63:92-98.

Banerji A, Bell A, Mills EL, McDonald J, Subbarao K, Stark G, Eynon N, Loo VG. 2001. Lower respiratory tract infections in Inuit infants on Baffin Island. Canadian Medical Association Journal 164:1847–1850.

Banfield AWF. 1956. The Caribou Crisis. The Beaver (spring):3-7.

Bartlett JG. 2003. Involuntary Cultural Change, Stress Phenomenon and Aboriginal Health Status. Canadian Journal of Public Health 94(3):165-166.

Bartley M. 1994. Unemployment and ill health: understanding the relationship. Journal of Epidemiology and Community Health 48(4):333-337.

Barton M, Hawkes M, Moore D, Conly J, Nicolle L, Allen U, Boyd N, Embree J, Van Horne L, Le Saux N, et al. 2006. Guidelines for the prevention and management of community-associated methicillin-resistant Staphylococcus aureus: A perspective for Canadian health care practitioners. Canadian Journal of Infectious Diseases & Medical Microbiology:17(SC):4C-24C.

Bégin M. 2010. Foreward. In: Mikkonen J, Raphael D, editors. Social Determinants of Health: The Canadian Facts. Toronto: York University School of Health Policy and Management. p. 5.

Beggs CB, Noakes CJ, Sleigh PA, Fletcher LA, Siddiqi K. 2003. The transmission of tuberculosis in confined spaces: an analytical review of alternative epidemiological models. International Journal of Lung Disease 7(11):1015-1026.

Bennet C. 2009. Foreword to the Second Edition. In: Raphael D, editor. Social Determinants of Health: Canadaian Perspectives. 2nd edition. Toronto: Canadian Scholars' Press Inc. p.xii-xiv.

Ben-Shlomo Y, White IR, Marmot M. 1996. Does The Variation In The Socioeconomic Characteristics Of An Area Affect Mortality? British Medical Journal 312:1013-1014.

Berger A. 2000. Th1 and Th2 responses: what are they? British Medical Journal 321:424.

Bernstein CN, McKeown I, Embil JM, Blanchard JF, Dawood M, Kabani A, Kliewer E, Smart G, Coghlan G, MacDonald S, Cook C, Orr P. 1999. Seroprevalence of Helicobacter pylori, incidence of gastric cancer, and peptic ulcer-associated hospitalizations in a Canadian Indian population. Digestive Diseases and Sciences 44(4):668-74.

Bezruchka S. 2010. Health Equity in the USA. Social Alternatives 29(2):50-56.

Bines W. 1994. The health of single homeless people. York: Center for Housing Policy, York University.

Birdsall N, Ross D, Sabot R. 1995. Inequality and Growth Reconsidered: Lessons from East Asia. World Bank Economic Review 9(3):477-508.

Bjerregaard P, Young TK, Dewailly E, Ebbesson SOE. 2004. Indigenous health in the Arctic: an overview of the circumpolar Inuit population. Scandinavian Journal of Public Health 32:390-395.

Blas E, Kurup AS. 2010. Equity, social determinants, and public health programmes. Switzerland: WHO.

Bone RM. 1969. The Chipewyan Indians of Dene Village: an editorial note. The Musk-Ox 6:1-4.

Bonnefoy X. 2007. Inadequate housing and health: an overview. International Journal of Environment and Pollution 30(3/4):411-429.

Bornehag CG, Sundell J, Sigsgaard T. 2004 Dampness in buildings and health (DBH): Report from an ongoing epidemiological investigation on the association between indoor environmental factors and health effects among children in Sweden. Indoor Air 14(S7): 59–66.

Boyer Y. [Internet]. 2003. Aboriginal Health: A Constitutional Rights Approach. Discussion Papers in Aboriginal Health: Legal Issues 1. Saskatoon: National Aboriginal Health Organization (Native Law Center, University of Saskatchewan); [cited 2013 May 25]. Available from: http://www.naho.ca/documents/naho/english/publications/DP_rights.pdf

Boyer y. [Internet]. 2004. First Nations, Métis, and Inuit Health Care: The Crown Fiduciary Obligation. Discussion Papers in Aboriginal Health: Legal Issues 2. Saskatoon: National Aboriginal Health Organization (Native Law Center, University of Saskatchewan); [cited 2013 May 25]. Available from: http://www.naho.ca/documents/naho/english/publications/DP_crowns_obligation.pdf

Breysse P, Farr N, Galke W, Lanphear B, Morley R, Bergofsky L. 2004. The Relationship between Housing and Health: Children at Risk. Environmental Health Perspectives 112(15):1583-1588.

Brice-Bennett C. 1994. Dispossessed: the eviction of Inuit from Hebron Labrador. A Report to North Program, Royal Commission on Aboriginal Peoples. St. John's: Labrador Institute, Memorial University.

Britten N, Davies JM, Colley JR. 1987. Early respiratory experience and subsequent cough and peak expiratory flow rate in 36 year old men and women. British Medical Journal (Clinical Research Edition)294(6583): 1317–1320.

Britton A, Shipley MJ. 2010. Bored to death? International Journal of Epidemiology ;39(2):370-371.

Brunner E. 1997. Socioeconomic determinants of health: Stress and the biology of inequality. British Medical Journal 314(7092):1472-1476.

Brunner E, Marmot M. 2006. Social Organization, Stress, and Health. In: Marmot M, Wilkinson R, editors. The Social Determinants of Health. 2nd edition. New York: Oxford University Press. p.6-30.

Bruno M, Ravallion M, Squire L. 1996. Equity and Growth in Developing Countries: Old and New Perspectives on the Policy Issues. In Tanzi V, Chu K. Editors. Income Distribution and High-Quality Growth. Cambridge: MIT Press. p. 117-146.

Bryce PH. 1910. History of Public Health in Canada. The Canadian Therapeutist and Sanitary Engineer 1(6):287-291.

Burrell R. 1991. Microbiological Agents as Health Risks in Indoor Air. Environmental Health Perspectives 95:29-34.

Bussidor I, Bilgen-Reinart Ü. 1997. Night Spirits: The Story of the Relocation of the Sayisi Dene. Manitoba: University of Manitoba Press.

Byrant T. 2003. The Current State of Housing in Canada as a Social Determinant of Health. Policy Options 24(3):53-56.

Byrant T. 2009a. Housing and Health. In: Raphael D, editor. Social Determinants of Health: Canadian Perspectives. Toronto: Canadian Scholars‘ Press Inc. p. 235-250.

Byrant T. 2009b. An Introduction to Health Policy. CSPI: Toronto.

Bryant T, Raphael D, Schrecker T, Labonte R. 2011. Canada: a land of missed opportunity for addressing the social determinants of health. Health Policy 101: 44–58.

Campbell C. 2004. A Genealogy of the Concept of ‘Wonton Slaughter’. In Anderson DG, Nuttall M. Editors. Cultivating Arctic landscapes: knowing and managing animals in the Circumpolar North. New York: Berghahn. p. 154-171.

Canadian Medical Association. [Internet]. 2013. Media Alert - CMA launches New National Dialogue on Health Care Seeks views on social factors behind ill health. Newswire.ca; [cited 2013 May 25]. Available at: http://www.newswire.ca/en/story/1107393/media-alert-cma-launches-new-national-dialogue-on-health-care-seeks-views-on-social-factors-behind-ill-health

Canada Mortgage and Housing Corporation. 2002. Moldy Houses: Why They Are and Why We Care and Additional Analysis of Wallaceburg Data: The Wallaceburg Health and Housing Studies. Technical Series 02-103. Ottawa: CMHC.

Canada Mortgage and Housing Corporation. 2005. Aboriginal Housing: Local Materials and Design Preferences. Socio-economic Series 05-001. Ottawa: CMHC.

Canada Mortgage and Housing Corporation. 2008. Canadian Housing Observer 2008. Ottawa: CMHC.

Canada Mortgage and Housing Corporation. 2011a. 2006 Census Housing Series: Issue 13 - On-Reserve Housing Conditions. Socio-economic Series 11-007. Ottawa: CMHC.

Canada Mortgage and Housing Corporation. [Internet] 2011b. First Nations molod remediation case study: Membertou First Nation. CMHC; [cited 2013 May 25]. Available at: http://www.cmhc-schl.gc.ca/odpub/pdf/67294.pdf?fr=1362514336786

Canadian Population Health Initiative. 2002. Canadian population health initiative brief to the commission on the future of health care in Canada. Ottawa: Canadian Institute for Health Information.

Carabin H, Gyorkos TW, Soto JC, Joseph L, Payment P, Collet JP. 1999. Effectiveness of a training program in reducing infections in toddlers attending day care centers. Epidemiology 10(3):219-227.

Carpenter C, Sattenspiel L. 2009. The design and use of an agent-based model to simulate the 1918 influenza epidemic at Norway House, Manitoba. American Journal of Human Biology 21(3):290-300.

Chabot Gaspe S. [Internet]. 2013. Racism, hunger and laziness: A First Nations youth perspective on Idle No More media coverage. Rabble.ca; [cited 2013 May 25]. Available from: http://rabble.ca/news/2013/01/racism-hunger-and-laziness-first-nations-youth-perspective-idle-no-more-media-coverage

Chansonneuve D. 2005. Reclaiming connections: Understanding residential school trauma among Aboriginal people. Ottawa: Aboriginal Healing Foundation.

Chansonneuve D. 2007. Addictive behaviours among aboriginal people in Canada. Ottawa: Aboriginal Healing Foundation.

Clark M, Ribena P, Nowgesicb E. 2002. The association of housing density, isolation and tuberculosis in Canadian First Nations communities. International Journal of Epidemiology 31:940–945.

Coggon D, Barker DJ, Inskip H, et al. 1993. Housing in early life and later mortality. Journal of Epidemiology and Community Health 47:345–8.

Cohen J. 1988. Statistical power analysis for the behavioral sciences (2nd ed.). Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Commission on the Social Determinants of Health. 2008. Closing the gap in a generation: health equity through action on the social determinants of health. Final Report of the Commission on Social Determinants of Health. Geneva, World Health Organization.

Dales RE, Zwanenburg H, Burnett R, Franklin CA. 1991. Respiratory Health Effects of Home Dampness and Molds Among Canadian Children. American Journal of Epidemiology 134:196-203.

Dales RE, Miller D, McMullen E. 1997. Indoor Air Quality and Health: Validity and Determinants of Reported Home Dampness and Moulds. International Journal of Epidemiology:26: 120-125.

Dales R, Liu L, Wheeler AJ, Gilbert NL. 2008. Quality of Indoor Residential Air and Health. Canadian Medical Association Journal 179(2):147-52.

Dalloo A, Sobol I, Palacios C, Mulvey M, Gravel D, Panaro L. 2008 Investigation of Community Associated Methicillin-Resistant\ Staphylococcus Aureus in a Remote Northern Community, Nunavut, Canada. Canada Communicable Disease Report 34(5):1-25.

Decker J. 2010. Modern North: Architecture on the Frozen Edge New York : Princeton Architectural Press.

Dedman D, Gunnell D, Davey Smith G, Frankel S. 2001. Childhood housing conditions and later mortality in the Boyd Orr cohort. Journal of Epidemiology and Community Health 55:10–15.

Department of Indian Affairs and Northern Development. [Internet]. 1964. Copy of Treaty No. 6 between Her Majesty the Queen and the Plain and Wood Cree Indians and other Tribes of Indians at Fort Carlton, Fort Pitt and Battle River with Adhesions. Ottawa: IAND Publication No. QS-0574-000-EE-A-1; [Cited 2010 October 14]. Available from: http://www.ainc-inac.gc.ca/al/hts/tgu/pubs/t6/trty6-eng.asp

Dickman P. 1969. Thoughts on Relocation. The Musk-Ox 6:21-31.

Dickman P. 1971. North Knife Lake. The Musk-Ox 8:27-30.

Diez Roux AV. 2001. Investigating neighborhood and area effects on health. American Journal of Public Health 91(11):1783-1789.

Diez-Roux AV, Nieto FJ, Muntaner C. 1997. Neighborhood environments and coronary heart disease: a multilevel analysis. American Journal of Epidemiology 146:48-63.

Dominion of Canada. 1910. Annual Report of the Department of Indian Affairs for the Year Ended March 31 1909. Ottawa: C.H. Parmelee.

Drage TF. 1982. An ethnographic account of the northern Cree, 1748. Manitoba Archaeological Quarterly 6(1):1-40.

Dreaver v. The King. 1935. 5 CNLC 92. Exchequer Court of Canada.

Duke v. Puts. 2001. SKQB 130 (CanLII); [cited 2013 May 26]. Available from: http://www.canlii.org/en/sk/skqb/doc/2001/2001skqb130/2001skqb130.pdf

Dunn JR. 2002. Housing and Inequalities in Health: A Study of Socioeconomic Dimensions of Housing and Self Reported Health From a Survey Of Vancouver Residents. Journal of Epidemiology and Community Health 56:671–681.

Dunn JR. 2000. Housing and health inequalities: review and prospects for research. Housing Studies 15:341-66.

Dunn JR, Hayes MV, Hulchanski JD, Hwang SW, Potvin L. 2006. Housing as a Socio-Economic Determinant of Health: Findings of a National Needs, Gaps and Opportunities Assessment. Canadian Journal of Public Health 97(S3):511-515.

Eggerton, L., 2006. Safe drinking water standards for First Nations communities. Canadian Medical Association Journal 174 (9), 1248.

Eggertson L. 2008a. Despite federal promises, First Nations' water problems persist. Canadian Medical Association Journal 178(8):985.

Eggertson L. 2008b. Investigative report: 1766 boil-water advisories now in place across Canada. Canadian Medical Association Journal 178(10), 1261-1263.

Elias B, Mignone J, Hall M, Hong SP, Hart L, Sareen J. 2012. Trauma and suicide behaviour histories among a Canadian indigenous population: an empirical exploration of the potential role of Canada's residential school system. Social Science and Medicine 74(10):1560-1569.

Ellen IG, Mijanovich T, Dillman KN. 2001. Neighborhood Effects on Health: Exploring the Links and Assessing the Evidence. Journal of Urban Affairs 23(3-4): 391–408.

Embil J, Ramotar K, Romance L, Alfa M, Conly J, Cronk S, Taylor G, Sutherland B, Louie T, Henderson E, Nicolle LE. 1994 Methicillin-Resistant Stahylococcus aureus in Tertiary Care Institutions on the Canadian Prairies 1990-1992. Infection Control and Hospital Epidemiology 15(10):646-651.

Esrey SA, Potash JB, Roberts L, Shiff C. 1991. Effects of improved water supply and sanitation on ascariasis, diarrhoea, dracunculiasis, hookworm infection, schistosomiasis, and trachoma. Bulletin of the World Health Organization 69(5):609-621.

Evans GW, English K. 2002. The Environment of Poverty: Multiple Stressor Exposure, Psychophysiological Stress, and Socioemotional Adjustment. Child Development 73(4):1238–1248.

Evans J, Hyndman S, Stewart-Brown S, Smith D, Petersen S. 2000. An epidemiological study of the relative importance of damp housing in relation to adult health. Journal of Epidemiology and Community Health 54:677–686.

Evans RG, Stoddart GL. 1990. Producing Health, Consuming Health Care. Social Science and Medicine 31(12):1347-1363.

Favel-King A. 1993. The Treaty Right to Health. In: Royal Commission on Aboriginal Peoples, editor. The Path to Healing: Report of the National Round Table on Aboriginal Health and Social Issues. Ottawa: Canada Communication Group Publishing. p. 120-129.

Feinstein L. 2002. Quantitative Estimates of the Social Benefits of Learning 2: Health (Depression and Obesity). Wider Benefits of Learning Research Report 6. London: The Centre for Research on the Wider Benefits of Learning.

Flannigan B, McCabe EM, McGarry F. 1991. Allergenic and Toxigenic Micro-organisms in Houses. Journal of Applied Bacteriology Symposium Supplement 70:61-73.

Fleras, A. 2011. The Media Gaze: Representations of Diversities in Canada. Vancouver: UBC Press.
Ford JD, Berrang-Ford L, King M, Furgal C. 2010. Vulnerability of Aboriginal health systems in Canada to climate change. Global Environmental Change in press:1-13.

Frohlich, K.L., Ross, N., et al., 2006. Health disparities in Canada today: some evidence and a theoretical framework. Health Policy 79 (2–3), 132–143.

Fugler D. 2008. Usage of Ventilation Systems in Canadian Houses. In Veitch JD, editor. Proceedings of the 1st Canadian Building & Health Sciences Workshop. Montreal: National Research Council Canada Institute for Research in Construction. p. 87-91.

Fuller-Thomson E, Hulchanski JD, Hwang S. 2000. The housing/health relationship: what do we know? Review of Environmental Health 15(1-2):109-133.

Fumoleau R. 2004. As Long as this Land Shall Last: a history of Treaty 8 and Treaty 11, 1970-1939. Calgary: University of Calgary Press.

Fung IC, Cairncross S. 2006. Effectiveness of handwashing in preventing SARS: a review. Tropical Medicine and International Health 11(11):1749-1758.

Galabuzi GE. 2009. Social Exclusion. In Raphael D, editor. Social Determinants of Health: Canadian Perspectives. Toronto: Canadian Scholars‘ Press Inc. p. 252-268.

Gardner MJ, Altman DG. 1986. Confidence intervals rather than P values: estimation rather than hypothesis testing. British Medical Journal 292(6522): 746–750.

Gent JF, Ren P, Belanger K, Triche E, Bracken MB, Holford TR, Leaderer BP. 2002. Levels of Household Mold Associated with Respiratory Symptoms in the First Year of Life in a Cohort at Risk for Asthma. Environmental Health Perspectives 110(12):A781-A786.

Godsell, Phillip H. 1934. Arctic Trader: The Account of Twenty Years With the Hudson’s Bay Company. New York: G.P. Putnam’s Sons,.

Goering J, Feins JD, Richardson TM. 2003. What have we learned about housing mobility and poverty deconcentration? In Goering J, Feins JD, editors. Choosing a better life: evaluating the Moving to Opportunity social experiment. Washington DC: Urban Institute Press. p.3-36.

Goldberg, DS. 2012. The difficulties of enhancing public understanding of the social determinants of health in the United States: A commentary on Pesce, Kpaduwa, Danis (2011). Social Science and Medicine 74(8):1139–1142.

Government of Canada. 1984. Bill C-3, The Canada Health Act, Second Session, 32nd Parliament.

Gracey M, King M. 2009. Indigenous Health Part 1: Determinants and Disease Patterns. Lancet 374(9683):65-75.

Green L, Daniel M, Novick L. 2001 Partnerships and Coalitions for Community-Based Resaerch. Public Health Reports116(S1):20-31.

Griscom JD. 1845. The Sanitary Condition of the Laboring Population of New York with Suggestions for its Improvement: a discourse (with additions) delivered on the 30th December, 1844, at the repository of the American Institute. New York: Harper Brothers.

Hallett B. 2006. Aboriginal People in Manitoba. Ottawa: Service Canada.

Hallowell AI. 1992. The Ojibwa of Berens River, Manitoba: Ethnography into history. Fort Worth, TX: Harcourt Brace.

Harding R. 2005. The Media, Aboriginal People and Common Sense. Canadian Journal of Native Studies 25(1):311-335.

Hart M. 2010. Colonization, Social Exclusion, and Indigenous Health. In: Fernandez L, MacKinnon S, Silver J, editors. The Social Determinants of Health in Manitoba. Winnipeg: Hignell. p. 115-126.

Haverinen-Shaughnessy U, Pekkanen J, Hyvärinen A, Nevalainen A, Putus T, Korppi M, Moschandreas D. 2006. Children's homes – determinants of moisture damage and asthma in Finnish residences. Indoor Air 16:248-255.

Health Canada [Internet]. Taking action on population health: a position paper for health promotion and programs branch staff. Health and Welfare Canada; 1998 [cited 2010 June 20]. Available from: http://www.phac-aspc.gc.ca/ph-sp/pdf/tad-eng.pdf

Heaman M, Martens P, Hart L, Smylie J, Agnew E, Simonet F, Wassimi S, Fraser WD, Luo ZC. 2010. Does Living On-Reserve Versus Off-Reserve Make a Difference in First Nations Birth Outcomes in Manitoba, Canada? The Open Women's Health Journal 4:39-45.

Henderson JY (Sa'kei'j). 2008. Indigenous Diplomacy and the Rights of Peoples: Achieving UN Recognition. Saskatoon: Purich.

Hennessy TW, Ritter T, Holman RC, Bruden DL, Yorita KL, Bulkow L, Cheek JE, Singleton RJ, Smith J. 2008. The relationship between in-home water service and the risk of respiratory tract, skin, and gastrointestinal tract infections among rural Alaska natives. American Journal of Public Health 98(11):2072-2078.

Herring DA. 1993. There Were Young People and Old People and Babies Dying Every Week. Ethnohistory 41(1):73-105.

Herring DA, Sattenspiel L. 2007. Social Contexts, Syndemics, and Infectious Disease in Northern Aboriginal Populations. American Journal of Human Biology 19:190–202.

Hlady W. 1960. A Community Development Project Amongst the Churchill Band at Churchill, Manitoba, September 1959 to March 1960. Unpublished Report, Saskatoon 1960.

Hoffman SC, Stanley EM, Cox ED, DiMercurio BS, Koziol DE, Harlan DM, Kirk AD, Blair PJ. 2002. American Journal of Transplantation 2: 560–567.

Holme J, Hägerhed-Engman L, Mattsson J, Sundell J, Bornehag CG. 2010 Culturable mold in indoor air and its association with moisture-related problems and asthma and allergy among Swedish children. Indoor Air. 20: 329–340.

Hopton JL, Hunt SM. 1996. Housing conditions and mental health in a disadvantaged area in Scotland. Journal of Epidemiological Community Health 50(1): 56–61.

House JS, Landis KR, Umberson D. 1988. Social Relationships and Health. Science 241(4865):540-545.

Howard G, Bartram J. 2003. Domestic Water Quantity, Service Level and Health. Geneva, Switzerland: World Health Organization.

Hudson, Pete. 2010. Caring for the Sick. In: Fernandez L, MacKinnon S, Silver J, editors. The Social Determinants of Health in Manitoba. Winnipeg: Hignell. p. 223-231.

Hunter PR, MacDonald AM, Carter RC. 2010. Water Supply and Health 7(11):1-9.

Institute of Medicine of the National Academies. 2004. Damp Indoor Spaces and Health. Washington: The National Academies Press.

International Housing Coalition. 2006. Case study 3: Aboriginal Housing in Canada: Building on Promising Practices. Report of the World Urban Forum III held June 2006 in Vancouver. Ottawa: The Canadian Real Estate Association.

Irwin A, Millen J, Kim J, Gershman J, Schoepf BG, Farmer P. 2002. Suffering, Moral Claims, and Scholarly Responsibility: A Response to Leslie Butt. Medical Anthropology 21(1):25-30.

Jackson A. 2009. The unhealthy Canadian Workplace. In Raphael D, editor. Social Determinants of Health: Canadian Perspectives. Toronto: Canadian Scholars‘ Press Inc. p.99-113.

Jieru Z. 2012. Life Cycle Management of Prefabricated Housing. Applied Mechanics and Materials 209-211:1476-1479.

Jin A, Martin JD. 2003. Hepatitis A Among Residents of First Nations Reserves in British Columbia, 1991-1996. Canadian Journal Of Public Health 94(3):176-179.

Jin RL, Shah CP, Svoboda TJ. 1995. The impact of unemployment on health: a review of the evidence. Canadian Medical Association Journal 153(5): 529–540.

Kaplan GA, Pamuk ER, Lynch JW, Cohen RD, Balfour JL.1996. Inequality in Income and Mortality in the United States: Analysis of Mortality and Potential Pathways. British Medical Journal 312(7037):999-1003.

Katz L, Kling JR, Liebman JB. 2001. Moving to Opportunity in Boston: Results of a Randomized Mobility Experiment. The Quarterly Journal of Economics 116:607-654.

Katz LF, Kling JR, Liebman JB. 2003. Boston site findings. In Goering JM, Feins, editors. Choosing a better life?: evaluating the Moving to Opportunity social experiment. Washington: Urban Institute Press. p. 177-212.

Kawachi I, Kennedy BP, Lochner K, Prothrow-Stith D. 1997. Social capital, income inequality, and mortality. American Journal of Public Health. 87:1491-1499.

Kennedy BP, Kawachi I, Prothrow-Stith D. 1996. Income distribution and mortality: cross sectional ecological study of the Robin Hood index in the United States. British Medical Journal 312:1004-1007.

Kermode-Scott B. 2009. Canada has world's highest rate of confirmed cases of A/H1N1, with Aboriginal people hardest hit. British Medical Journal 339:b2746.

Kieffer CH. 1984. Citizen empowerment: a developmental perspective. Prevention in Human Services 3(2-3):9-36.

King M, Smith A, Gracey M. 2009. Indigenous health part 2: the underlying causes of the health gap. Lancet 374: 76–85.

Kingdon J. 2002. The Reality of Public Policy Making. In Danis M, Clancy C, Churchill LR. Editors. Ethical dimensons of health policy. New York: Oxford. p. 97-116.

Kirkpatrick SI, McIntyre L. 2009. The Chief Public Health Officer's Report on Health Inequalities: What Are the Implications for Public Health Practitioners and Researchers? Canadian Journal of Public Health 100(2):93-95.

Kling J, Liebman J, Katz L, Sanbonmatsu L. 2004. Moving to Opportunity and Tranquility: Neighborhood Effects on Adult Economic Self-Sufficiency and Health from a Randomized Housing Voucher Experiment. National Bureau of Economic Research Working Paper. Cambridge: NBER.

Kristenson M, Weinehall L. 2006. Towards a more health-promoting health service: summary of study material, government bills, parliamentary decisions, draft indicators and examples of application. Stockholm:Swedish National Institute for Public Health.

Koolage WW. 1971. Adaptation of Chipeywan Indians and Other Persons of Native Background in Churchill, Manitoba. PhD dissertation, University of North Carolina at Chapel Hill.

Koolage WW. 1976. Differential Adaptations of Athapaskans and Other Native Ethnic Groups to a Canadian Northern Town.. Arctic Anthropology 13(1):70-83.

Kovesi T, Gilbert NL, Stocco C, Fugler D, Dales RE, Guay M, Miller JD. 2007. Indoor Air Quality and the Risk of Lower Respiratory Tract Infections in Canadian Inuit Children. CMAJ 177(2):155-60.

Kovesi T, Zaloum C, Stocco C, Fugler D, Dales RE, Ni A, Barrowman N, Gilbert NL, Miller JD. 2009. Heat recovery ventilators prevent respiratory disorders in Inuit children. Indoor Air 19(6):489-99.

Kuh D, Ben-Schlomo Y. 2004. A life course approach to chronic disease epidemiology. Oxford: Oxford University Press.

Kuhn DM, Ghannoum MA. 2003. Indoor Mold, Toxigenic Fungi, andStachybotrys chartarum: Infectious Disease Perspective. Clinical Microbiology Reviews 16(1):144-172.

Kumanyika S. 2012. Health disparities research in global perspective: new insights and new directions. Annual Review of Public Health 33:1-5.

Kumar A, Zarychanski R, Pinto R, Cook DJ, Marshall J, Lacroix J, Stelfox T, Bagshaw S, Choong K, Lamontagne F, et al. 2009. Critically ill patients with 2009 influenza A(H1N1) infection in Canada. Journal of the American Medical Association 302(17):1872-1879.

Lal R. 1969a. From Duck Lake to Camp 10: Old Fashioned Relocation. The Musk-Ox 6:5-13.

Lal R. 1969b. Some Observations on the Social Life of the Chipewyans of Camp 10, Churchill, and their Implications for Community Development. The Musk-Ox 6:14-20.

Lalonde M. 1974. A new perspective on the health of Canadians: a working document. Ottawa: Health and Welfare Canada.

Larcombe L, Orr P. 2007. Housing Conditions that serve as Risk Factors for Tuberculosis Infection and Disease. Canada Communicable Disease Report 33(ACS9):1-13.

Larcombe L. 1994. Cultural Heritage Reource Predictive Modeling Project: Volume 2. Boreal Forest Aboriginal Land Use Patterns: An Evaluation of the Ethnographic Literature. Center for Archaeological Resource Prediction, Thunder Bay.

Larcombe LA, Nickerson P, Hoppa RD, Matheson C. 2005. Detection of a single nucleotide polymorphism in the IL-6 promoter region of ancient nuclear DNA. Infection, Genetics and Evolution 5(2):117-22.

Larcombe L, Waruk J, Schellenberg J, Ormond M. 2007. Rapid Emergence of Methicillin-resistant Staphylococcus Aureus (MRSA) among Children and Adolescents in Northern Manitoba, 2003-2006. Canada Communicable Disease Report 33(2):9-14

Larcombe LA, Orr PH, Lodge AM, Brown JS, Dembinski IJ, Milligan LC, Larcombe EA, Martin BD, Nickerson PW. 2008. Functional gene polymorphisms in Canadian Aboriginal populations with high rates of tuberculosis. Journal of Infectious Disease 198(8):1175-1179.

Larcombe L, Nickerson P, Singer M, Robson R, Dantouze J, McKay L, Orr P. 2011. Housing conditions in 2 Canadian First Nations communities. International Journal of Circumpolar Health 70(2):141-153.

Laverack G. 2007. Health Promotion Practice: Building Empowered Communities. Berkshire: Open University Press.

Lavis JN, Ross SE, Stoddart GL, Hohenadel JM, McLeod CB, Evans RG. 2003. Do Canadian civil servants care about the health of populations? American Journal of Public Health 93(4):658-63.

Lehmann I, Muller A, Diez U, Richtera M, Wallach S, Sierig G, Seiffart A, Wetzig H, Bortec M, Herbarth O. 2003 Indoor Mould Exposure Reduces Th1 Reactivity in Early Childhood. Indoor and Built Environment 12:231–233.

Lehmann S. 2013. Low carbon construction systems using prefabricated engineered solid wood panels for urban infill to significantly reduce greenhouse gas emissions. Sustainable Cities and Society 6:57-67.

Leichter HM. 2003. "Evil Habits" and "Personal Choices": Assigning Responsibility for Health in the 20th Century. The Milbank Quarterly 81(4):603-626.

Lerner M. 1986. Surplus Powerlessness. Oakland: Institute for Labour and Mental Health.

Leventhal T, Newman S. 2010. Housing and child development. Children and Youth Services Review 32(9):1165–1174.

Lewchuk W, de Wolff A, King A, Polanyi M. 2006. The Hidden Costs of Precarious Employment: Health and the Employment Relationship. In Vosko LF (editor.). Precarious Employment: Understanding Labour Market Insecurity in Canada. Montreal: McGill-Queen's University Press. p. 141-162

Link BG, Phelan J. 1995. Social Conditions As Fundamental Causes of Disease. Journal of Health and Social Behavior 35(Extra Issue):80-94.

Lix LM, Bruce S, Sarkar J, Young TK. 2009. Risk factors and chronic conditions among Aboriginal and non-Aboriginal populations. Statistics Canada Health Reports 20(4):21-29.

Luby SP, Agboatwalla M, Feikin DR, Painter J, Billhimer W, Altaf A, Hoekstra RM. 2005. Effect of handwashing on child health: a randomised controlled trial. Lancet 366:225-233.

Luo ZC, Senécal S, Simonet F, Guimond E, Penney C, Wilkins R. 2010. Birth outcomes in the Inuit-inhabited areas of Canada. Canadian Medical Association Journal 182(3):235-242.

Lynch JW, Kaplan GA, Pamuk ER, Cohen RD, Balfour JL, Yen IH. 1998. Income Inequality and Mortality in Metropolitan Areas of the United States. American Journal of Public Health 88:1074-1080.

Mackenbach JP, Bakker M. 2002. Reducing Inequalities in Health: A European Perspective. Routledge:London

MacMillan HL, MacMillan AB, Offord DR, Dingle JL. 1996. Aboriginal Health. Canadian Medical Association Journal 155(11):1569-1578.

Mahler H. 1981. The meaning of "health for all by the year 2000". World Health Forum 2(1):5-22.

Mallick H. [Internet]. 2013 January 13. Canadian anti-Idle No More racism grows online. Toronto: thestar.com; [cited 2013 May 25]. Available from: http://wayback.archive-it.org/3490/20130129210011/http://www.thestar.com/opinion/editorialopinion/article/1314100--mallick-canadian-anti-idle-no-more-racism-grows-online

Mann JM. 1998. AIDS and Human Rights: Where Do We Go from Here? Health and Human Rights 3(1):143-149.

Mann SL, Wadsworth ME, Colley JR. 1992. Accumulation of factors influencing respiratory illness in members of a national birth cohort and their offspring. Journal of Epidemiology and Community Health 46(3):286-92.

Marmot MG. 2005. Social determinants of health inequalities. Lancet 365:1099-1104.

Marmot MG, Wilkinson RG. 2006. Social Determinants of Health, 2 edition. Oxford: Oxford University Press.

Marmot MG, Shipley MJ, Rose G. 1984 Inequalities in death--specific explanations of a general pattern. Lancet 1(8384):1003-1006.

Marmot M, Friel S, Bell R, Houweling TA, Taylor S; Commission on Social Determinants of Health. 2008. Closing the gap in a generation: health equity through action on the social determinants of health. Lancet 372(9650):1661-1669.

Martens PJ, Bond R, Jebamani LS, Burchill CA, Roos NP, Derksen SA, Beaulieu M, Steinbach C, MacWilliam L, Walld R, et al. 2002. The Health and Health Care Use of Registered First Nations People Living in Manitoba: A Population-Based Study. Winnipeg: Manitoba Centre for Health Policy.

Martin D, Belanger D, Gosselin P, Brazeau J, Furgal C, Dery S. 2007. Drinking Water and Potential Threats to Human Health in Nunavik: Adaptation Strategies under Climate Change Conditions. Arctic 60(2):195-202.

Kennedy M. [Internet]. 2012 November 30. Colonial legacy haunts Canada, Paul Martin says. Postmedia Network Inc; [cited 2013 May 26]. Available at: http://o.canada.com/2012/11/30/colonial-legacy-haunts-canada-paul-martin-says/

McCallum MJ. 2005. This Last Frontier: Isolation and Aboriginal Health. Canadian Bulletin of Medical History 22(1)103-120

McDonald JT, Trenholm R. 2010. Cancer-related health behaviours and health service use among Inuit and other residents of Canada's north. Social Science and Medicine 70:1396-1403.

McKenna JAJ. 1909. Sessional Paper no. 27: Annual Report of the Department of Indian Affairs for the Year Ended March 31, 1908. Ottawa: Dominion of Canada.

McMillan AD. 1995. Native Peoples and Cultures of Canada. Vancouver: Douglas and McIntyre Ltd.

Meyer D, Thistle PC. 1995. Saskatchewan River Rendezvous Centers and Trading Posts: Continuity in a Cree Social Geography. Ethnohistory 42(3):403-444.

Mikkonen J, Raphael D. 2010. Social Determinants of Health: The Canadian Facts. Toronto: York University School of Health Policy and Management.

Milloy JS. 1999. A national crime: The Canadian government and the residential school system 1879 to 1986. Winnipeg: University of Manitoba Press.

Moffat T, Herring A. 1999. The historical roots of high rates of infant death in Aboriginal communities in Canada in the early twentieth century: the case of Fisher River, Manitoba. Social Science and Medicine 48:1821-1832.

Montgomery S, Bartley M, Wilkinson R. 1997. Family conflict and slow growth. Archives of Disease in Childhood 77(4):326-330.

Morin A, Edouard R, Duhaime G. 2010. Beyond the harsh. Objective and subjective living conditions in Nunavut. Polar Record 46(237): 97–112.

Morris JK, Cook DG, Shaper AG. 1994. Loss of employment and mortality. British Medical Journal 308(6937): 1135–1139.

Nettleton C, Napolitano DA, Stephens C. 2007 An overview of current knowledge of the social determinants of indigenous health. Working paper commissioned by the Commission of WHO Social Determinants of Health for the Symposium of the Social Determinants of Indigenous Health, Adelaide Australia, 29-30 April 2007

Newland D [Internet]. 2012. Parsing the online comments on #IdleNoMore: How Canadians are failing a tolerance test. Toronto: Macleans.ca; [cited 2013 May 25]. Available from: http://www2.macleans.ca/2012/12/20/parsing-the-comments-on-idlenomore/

Newman S, Harkness J, Yeung WJ. 2003. Neighbourhood poverty, housing assistance, and children's educational attainment. In: Goering J, Feins JD, editors. Choosing a better life: evaluating the Moving to Opportunity social experiment. Washington DC: Urban Institute Press. p. 339-364.

Nicas M, Nazaroff WW, Hubbard A. 2005. Toward Understanding the Risk of Secondary Airborne Infection: Emission of Respirable Pathogens. Journal of Occupational and Environmental Hygiene 2(3):143-154.

O'Byrne N. 2007. A 'Living Tree' has Roots: The Natural Resources Transfer Agreements and the Constitutionalization of Treaty Rights Prior to 1982. In: A Living Tree: The Legacy of 1982 in Canada's Political Evolution conference. 2007 May 23-25. Regina, SK: Saskatchewan Institute of Public Policy.

O'Neil JD. 1986. The Politics of Health in the Fourth World: A Northern Canadian Example. Human Organization 45(2): 119-128.

Oberlander HP. 1984. Aspects of Public Health in Toronto, in the 19th and Early 20th Centuries. Canadian Journal of Public Health 75(5):364-365.

Ofner-Agostini M, Simor AE, Mulvey M, Bryce E, Loeb M, McGeer A, Kiss A, Paton S. 2006. Methicillin-Resistant Staphylococcus aureus in Canadian Aboriginal People. Infection Control and Hospital Epidemiology 27(2):204-207.

Optis M, Shaw K, Stephenson P, Wild P. 2012. Mold growth in on-reserve homes in Canada: the need for research, education, policy, and funding. Journal of Environmental Health 74(6):14-21.

Palmater P. [Internet]. 2013 January 4. Idle No More: What do we want and where are we headed? rabble.ca; [cited 2013 May 26]. Available from: http://rabble.ca/blogs/bloggers/pamela-palmater/2013/01/what-idle-no-more-movement-really

Palmater P. 2011. Stretched Beyond Human Limits: Death By Poverty in First Nations. Canadian Review of Social Policy 65/66:112-127.

Patrick RJ. 2011. Uneven access to safe drinking water for First Nations in Canada: Connecting health and place through source water protection. Health and Place 17:386-389.

Pendakur K, Pendakur R. 2011. Aboriginal Income Disparity in Canada. Canadian Public Policy 37:61-83.

Petch VP. 1998. Relocation and loss of homeland. The story of the Sayisi Dene of norteern Manitoba. PhD Dissertation, University of Manitoba.

PHAC. 2008. The Chief Public Health Officer's Report on the State of Public Health in Canada 2008. Ottawa: Public Health Agency of Canada.

PHAC. 2012. Tuberculosis in Canada 2010 – Pre-release. Ottawa: Minister of Public Works and Government Services Canada.

Platt S, Martin C, Hunt S, Lewis C. 1989. Damp housing, mould growth, and symptomatic health state. British Medical Journal 298:1673-1678.

Power C, Manor O, Matthews S. 1999. The Duration and Timing of Exposure: Effects of Socioeconomic Environment on Adult Health. American Journal of Public Health 89(7):1059-65.

Raphael D. 2003 Addressing the social determinants of health in Canada- bridging the gap between research findings and public policy.pdf

Raphael D. 2007. The Future of the Canadian Welfare State. In D. Raphael Poverty and policy in Canada: Implications for health and quality of life. 365-398 Toronto: CanScholarsPressInc

Raphael D. 2009a Social Determinants of Health: and overview of key issues and themes. In Raphael 2009 SDH 2nd Ed, CSPI Toronto, pp2-19

Raphael D. 2009b. Social Determinants Of Health: Canadian Perspectives. Second edition. Toronto: Canadian Scholars' Press Inc.

Raphael D. 2010. The health of Canada's children. Part I: Canadian children's health in comparative perspective. Paediatrics and Child Health 15(1):23-29.

Raphael D. 2011a. Mainstream media and the social determinants of health in Canada: is it time to call it a day? Health Promotion International 26(2):220-229.

Raphael D. 2011b. A discourse analysis of the social determinants of health. Critical Public Health 21(2):221-236.

Raphael D. Raphael D. 2013. The political economy of health promotion: part 1, national commitments to provision of the prerequisites of health. Health Promotion International 28(1):95-111.

Raphael D, Macdonald J, Colman R, Labonte R, Hayward K, Torgerson R. 2005. Researching income and income distribution as determinants of health in Canada: gaps between theoretical knowledge, research practice, and policy implementation. Health Policy 72(2):217-232.

Raphael D, Labonte R; Colman R, Hayward K, Torgerson R, Macdonald J. 2006. Income and Health in Canada: Research Gaps and Future Opportunities. Canadian Journal of Public Health 97(S3):S16-S23.

Ray AJ. 1998. Indians in the Fur Trade: their role as trappers, hunters, and middlemen in the lands southwest of Hudson Bay, 1660-1870. Toronto: University of Toronto Press.

Ray AJ. 1996. I have Lived Here Since the World Began. Key Porter: Toronto.

Ray AJ. 1976. Diffusion of Diseases in the Western Interior of Canada, 1830-1850. Geographical Review 66(2): 139-157.

Regina v. Johnston. 1966. 56 DLR (2nd) 749: Saskatchewan Court of Appeal.

Regina v. Marshall. [Internet]. 1999. CanLII 665 (SCC), [1999] 3 SCR 456; [cited 2013 May 26]. Available from: http://www.canlii.org/en/ca/scc/doc/1999/1999canlii665/1999canlii665.pdf

Regina v. Van der Peet. [Internet]. 1996. CanLII 216 (SCC), [1996] 2 SCR 507; [cited 2013 May 26]. Available from: http://www.canlii.org/en/ca/scc/doc/1996/1996canlii216/1996canlii216.pdf

Richmond CAM, Ross NA, Egeland GM. 2007. Social Support and Thriving Health: A New Approach to Understanding the Health of Indigenous Canadians. American Journal of Public Health 97(9):1827-1833.

Richmond CAM, Ross NA. 2009. The determinants of First Nation and Inuit health: a critical population health approach. Health and Place 15:403-411.

Rissel C. 1994. Empowerment: the holy grail of health promotion? Health Promotion International 9(1):39-47.

Robson R. 1995. Housing in the Northwest Territories: The Post-War Vision. Urban History Review 24(1):3-20.

Rodgers GB. 1979. Income and Inequality as Determinants of Mortality: An International Cross-Section Analysis. Population Studies 33(2):343-351.

Romanow R. 2002. Building on Values: the future of Health Care in Canada. Saskatoon: Commission on the Future of Health Care in Canada.

Rose G. 1985. Sick individuals and sick populations. International Journal of Epidemiology 14(1):32-38.

Rosenberg T, Kendall O, Blanchard J, Martel S, Wakelin C, Fast M. 1997. Shigellosis on Indian reserves in Manitoba, Canada: its relationship to crowded housing, lack of running water, and inadequate sewage disposal. American Journal of Public Health 87(9):1547-1551.

Royal Commission for Aboriginal Peoples. 1996. Report of the Royal Commission on Aboriginal Peoples, 1996. Department of Indian and Northern Affairs, Ottawa.

Ryan MAK, Christian RS, Wohlrabe J. 2001. Handwashing and respiratory illness among young adults in military training. American Journal of Preventive Medicine 21(2):79-83.

Sandlos J. 2007. Hunters at the Margin: Native People and Wildlife Conservation in the Northwest Territories. UBC Press: Vancouver.

Sanmartin C, Berthelot JM, Ng E, Murphy K, Blackwell DL, Gentleman JF, Martinez ME, Simile CM. 2006. Comparing Health And Health Care Use in Canada and the United States. Health Affairs 25(4):1133-1142.

Sanmartin C, Ng E. 2004. Joint Canada/United States survey of health, 2002–03. Ottawa: Statistics Canada.

Schall PL, Landsbergis PA, Baker D. 1994. Job strain and cardiovascular disease. Annual Review of Public Health 15:381-411.

Scheper-Hughes N. 1995. The Primacy of the Ethical: Propositions for a Militant Anthropology. Current Anthropology 36(3):409-440.

Sen A. 1993. The Economics of Life and Death. Scientific American 268(5):40-47.

Shapcott M. 2009. Housing. In Raphael D, editor. Social Determinants of Health: Canadian Perspectives. Toronto: Canadian Scholars' Press Inc. p. 221-234.

Shenassa ED, Daskalakis C, Liebhaber A, Braubach M, Brown M. 2007. Dampness and Mold in the Home and Depression: An Examination of Mold-Related Illness and Perceived Control of One's Home as Possible Depression Pathways. American Journal of Public Health 97(10):1893-1899.

Simon vs. The Queen. 1985. 2 SCR 387-416; [cited 2013 May 26]. Available from: http://csc.lexum.org/decisia-scc-csc/scc-csc/scc-csc/en/93/1/document.do

Sinha SK, Martin B, Gold BD, Song Q, Sargent M, Bernstein CN2002 The Incidence of Helicobacter pylori Acquisition in Children of a Canadian First Nations Community and the Potential for Parent-to-Child Transmission. Helicobacter 9(1):59-68.

Smylie J. 2009. The Health of Aboriginal Peoples. In: Raphael D, editor. Social Determinants of Health: Canadian Perspectives. Toronto: Canadian Scholar's Press. p. 280-304.

Smylie J, Fell D, Ohlsson A; Joint Working Group on First Nations Indian Inuit; Métis Infant Mortality of the Canadian Perinatal Surveillance System. 2010. A Review of Aboriginal Infant Mortality Rates in Canada: Striking and Persistent Aboriginal/Non-Aboriginal Inequities. Canadian Journal of Public Health 101(2):143-148.

Sparer G, Okada LM. 1974. Chronic Conditions and Physician Use Patterns in Ten Urban Poverty Areas. Medical Care 12(7):549-560.

Speed S. 2006. At the Crossroads of Human Rights and Anthropology: Towards a Critically Engaged Activist Research. American Anthropologist 108(1):66-76.

Spence N, Walters N. 2012. "Is it Safe?" Risk Perception and Drinking Water in a Vulnerable Population. The International Indigenous Policy Journal 3(3):1-23.

Statistics Canada. 2005. Projections of the Aboriginal populations, Canada, provinces and territories 2001 to 2017. Catalogue no. 91-547-XIE. Ottawa: Demography Division, Minister of Industry.

Statistics Canada 2008. Aboriginal Peoples in Canada in 2006: Inuit, Métis and First Nations, 2006 Census. Catalogue no. 97-558-XIE. Ottawa: Minister of Industry.

Statistics Canada. [Internet]. 2010. Aboriginal Statistics at a Glance: Despite labour market improvement, Aboriginal people still less likely to be employed. Ottawa: statcan.gc.ca; [cited 2013 26 May]. Available from: http://www.statcan.gc.ca/pub/89-645-x/2010001/employment-emploi-eng.htm.

Statistics Canada. 2012. Churchill 1, Manitoba (Code 4623058) and Manitoba (Code 46) (table). Census Profile. 2011 Census. Statistics Canada Catalogue no. 98-316-XWE. Ottawa; [cited 2013 May 26]. Available at: http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/index.cfm?Lang=E

Statistics Canada. 2013a. Aboriginal Peoples in Canada: First Nations People, Métis and Inuit National Household Survey, 2011. Catalogue no. 99-011-X2011001. Ottawa: Minister of Industry .

Statistics Canada 2013b High-income trends among Canadian taxfilers, 1982 to 2010. The Daily. Catalogue no. 11-001-X. Monday, January 28, 2013. Ottawa: Statistics Canada.

Stephens C, Porter J, Nettleton C, Willis R. 2006. Indigenous health. 4. Disappearing, displaced, and undervalued: a call to action for Indigenous health worldwide. Lancet 367 (9527), 2019–2028.

Strachan D. 1988. Damp housing and childhood asthma: validation of reporting of symptoms. British Medical Journal 297:1223-1226.

Tait CL. 2003. Fetal alcohol syndrome among Aboriginal people in Canada: review and analysis of the intergenerational links to residential schools. Ottawa: Aboriginal Healing Foundation.

Tarlov A. 1996. Social Determinants of Health: the sociobiological translation. In Blane D, Brunner E, Wilkinson RG, editors. Health and Social Organization: Towards a Health Policy for the 21st Century. London UK: Routledge. p. 71-93.

Thomas C, Power C. 2010. Do early life exposures explain associations in mid-adulthood between workplace factors and risk factors for cardiovascular disease? International Journal of Epidemiology 39: 812-824.

Tjepkema M, Wilkins R, Senécal S, Guimond É, Penney C. 2011. Potential years of life lost at ages 25 to 74 among Métis and non-Status Indians, 1991 to 2001. Health Reports no. 82-003-XPE 22(1):1-11.

Tough F. 2000. As their Natural Resources Fail: Native Peoples and the Economic History of Northern Manitoba, 1870-1930. UBC Press, Vancouver.

Townsend P, Phillimore P, Beattie A. 1988. Health and deprivation: inequality and the North. New York: Croom Helm.

Townsend P, Davidson N, Whithead M. 1992. The Black Report and the Health Divide: Inequalities in Health. London: Penguin.

Ungerleider C, Burns T, Cartwright F. 2009. The State and Quality of Canadian Public Elementary and Secondary Education. In Rapahel D, editor. Social Determinants of Health: Canadian Perspectives. Toronto: Canadian Scholars‘ Press Inc. p156-169.

United Nations General Assembly. 2007 September 7. United Nations Declaration on the Rights of Indigenous Peoples, 61st Session, Agenda item 68, Report of the Human Rights Council, A/61/L.67.

United Nations General Assembly. 2010 August 3. The human right to water and sanitation: resolution adopted by the General Assembly, A/RES/64/292.

Verhoeff AP, van Strien RT, van Wijnen JH, Brunekreef B. 1995. Damp housing and childhood respiratory symptoms: the role of sensitization to dust mites and molds. American Journal of Epidemiology 141(2):103-110.

Vowel C. [Internet]. 2012. Aboriginal issue primers. âpihtawikosisân.ca; [Cited 2013 May 26]. Available from: http://apihtawikosisan.com/aboriginal-issue-primers/

Wadsworth M, Butterworth S. 2006. Early life. In: Marmot M, Wilkinson R, editors. Social Determinants of Health. Oxford: Oxford University Press. p. 267-298.

Waldram JB. 1987. Relocation, Consolidation, and Settlement Pattern in the Canadian Subarctic. Human Ecology 15(2):117-131.

Waldram JB, Herring DA, Young TK. 2006. Aboriginal Health in Canada: Historical, Cultural, and Epidemiological Perspectives. 2nd edition. Toronto: University of Toronto Press.

Ward R. 2009 August. Going to New Heights: Building the World's Tallest Mixed-use Wood Structure. STRUCTURE:21-23.

Weiss BD, Blanchard JS, McGee DL, Hart G, Warren B, Burgoon M, Smith KJ. 1994. Illiteracy among Medicaid recipients and its relationship to healthcare costs. Journal of Health Care for the Poor and Undersefrved 5(2):99-111.

Wikler D. 2002. Personal and Social Responsibility for Health. Ethics and International Affairs 16(2):47-55.

Widdowson EM. 1951. Mental contentment and physical growth. Lancet 6668:1316-1318.

Wilkins R, Uppal S, Fines P, Senecal S, Guimond E, Dion R. 2008. Life expectancy in the Inuit-inhabited areas of Canada, 1989 to 2003. Statistics Canada Health Reports Catalogue no. 82-003-X: Ottawa: Statistics Canada.

Wilkinson RG. 1986. Class and Health: Research and Longitudinal Data. London:Tavistock.

Wilkinson R, Marmot M. 2003. The Social determinants of Health: The Solid Facts. 2nd ed. Denmark: WHO.

Wise M, Nutbeam D. 2007. Enabling health systems transformation: what progress has been made in re-orienting health services? Promotion and Education 14:23-27.

Wood JW, Milner GR, Harpending HC, Weiss KM. 1992. The Osteological Paradox: Problems of Inferring Prehistoric Health from Skeletal Samples. Current Anthropology 33(4):343-370.

World Health Organization. 1941. Constitution of the World Health Organization. Geneva: WHO.

World Health Organization. 1978. Declaration of Alma-Ata. International Conference on Primary Health Care, Alma-Ata, USSR, 6–12 September 1978. Alma-Ata: WHO.

World Health Organization. 1981. Global Strategy for Health for all by the Year 2000. Geneva: WHO.

World Health Organization. 1986 Ottawa Charter for Health Promotion. Geneva: WHO.

World Health Organization. 2008. UN-water global annual assessment of sanitation and drinking-water : 2008 pilot report - testing a new reporting approach. Geneva: WHO.

Worthington C, Jackson R, Mill J, Prentice T, Myers T, Sommerfeldt S. 2010. HIV testing experiences of Aboriginal youth in Canada: service implications. AIDS Care 22(10):1269-1276.

Yen IH, Kaplan GA. 1997. Neighborhood social environment and risk of death: multilevel evidence from the Alameda County Study. American Journal of Epidemiology 149:898–907.

Young TK. 1979. Changing patterns of health and sickness among the Cree-Ojibwa of northwestern Ontario. Medical Anthropology 3(2):191-223.

Young TK, Reading J, Elias B, O'Neil JD. 2000. Type 2 diabetes mellitus in Canada's First Nations: status of an epidemic in progress. Canadian Medical Association Journal 163(5):561-566.

Zimmerman MR, Yeatman GW, Sprinz H, Titterington WP. 1971. Examination of an Aleutian mummy. Bulletin of the New York Academy of Medicine 47(1):80-103.

Zimmerman MR, Smith GS. 1975. A probable case of accidental inhumation of 1,600 years ago. Bulletin of the New York Academy of Medicine 51(7):828-37.

Zimmerman MR, Aufderheide AC. 1984. The Frozen Family of Utqiagvik: The Autopsy Findings. Arctic Anthropology 21(1):53-64.

Zimmerman MR. 1998. Alaskan and Aleutian mummies. In Cockburn A, Cockburn E, Reyman TA (eds) Mummies, Disease, and Ancient Cultures. Cambridge University Press: Cambridge. p.138 - 153.

Appendix 1. Request for housing and health survey

JUL 6. 2010 11:19AM SAYISI DENE FN NO. 962 P. 2

ᓴᕈᐢᕋᑌᓓᐢᓴᐅᑫᐁᒍᑲᐤ

SAYISI DENE FIRST NATION
TADOULE LAKE, MAN.

July 6, 2010

University of Manitoba
Dr. Linda Lamcombe
503-Basic Medical Sciences Building
745 Bannytne Ave.
Winnipeg, MB
R3E 0J9

Re: Letter received July 6, 2010

Sayisi Dene First Nation Chief Jimmy Thorassie and Councillors Steven Thorassie, Stewart Yassie, Tony Powderhorn would like to open an dialoge with the following;

1. Housing assessement
2. Collection of blood samples for genetic and vitamin D analyis
3. Collection of stories from people who have illness due to mold and mildew

The 80 houses in this community of Tadoule Lake, Mb, and the state of the people's in those houses to be investigated for health hazards. The survey would involved people's health in those houses, housing conditions, physical structure of the house - the condition of the housing material, ventilation, insulation, heating plumbing, water and the presence of mold), to interview for specific health
Information.

We the Council of Sayisi Dene First Nation request this approval from your department DEAN to move forward with this request as soon as possible.

We will await your response, We request to start immediately, the information will enable the leadership to make improvements for housing on local community of Tadoule Lake, Manitoba settlement.

Thank you for your kind consideration.

SDFN Chief and Councillors

[redacted]
SDFN Chief

[redacted]
Councillor

[redacted]
Councillor

[redacted]
Councillor

Cc:
SDFN administration
SDFN finance

Appendix 2: Ethics approval

UNIVERSITY of MANITOBA

BANNATYNE CAMPUS
Research Ethics Boards

P126-770 Bannatyne Avenue
Winnipeg, Manitoba
Canada R3E 0W3
Tel: (204) 789-3255
Fax: (204) 789-3414

APPROVAL FORM

Principal Investigator: Dr. P. Orr

Ethics Reference Number: H2007:075
Date of Approval: July 27, 2010
Date of Expiry: March 26, 2011

Protocol Title: How the Immunogenetic Program and Socio-economic Conditions of Manitoba's First Nations affect their response to Mycobacterium tuberculosis isolates. Survey of Housing Conditions and Health" similar to H2005:106 and H2007:026

The following is/are approved for use:

- **Annual Approval**
- **Amendment to include Sayisi Dené First Nation as per report dated July 14, 2010**
- **Research Participant Information and Consent Form (Narratives on Experiences with Tuberculosis), Version 3 dated July 14, 2010**
- **Research Participant Information and Consent Form [Inhabitant and Structural Survey Consent (Tadoule Lake)], Version 3.0 dated July 14, 2010**
- **Consent for the Release of Structural Information (Tadoule Lake), Version 3.0 dated July 14, 2010**
- **Housing Structure Survey, Version 3.0 dated July 14, 2010**
- **Inhabitant Questionnaire, Version 2 dated 27/06/2010**

The above was approved by Dr. John Arnett, Ph.D., C. Psych., Chair, Health Research Ethics Board, Bannatyne Campus, University of Manitoba on behalf of the committee per your submission dated July 14 and 27, 2010. The Research Ethics Board is organized and operates according to Health Canada/ICH Good Clinical Practices, Tri-Council Policy Statement, and the applicable laws and regulations of Manitoba. The membership of this Research Ethics Board complies with the membership requirements for Research Ethics Boards defined in Division 5 of the *Food and Drug Regulations of Canada*.

This approval is valid until the expiry date only. A study status report must be submitted annually and must accompany your request for re-approval. Any significant changes of the protocol and informed consent form should be reported to the Chair for consideration in advance of implementation of such changes. The REB must be notified regarding discontinuation or study closure.

This approval is for the ethics of human use only. For the logistics of performing the study, approval must be sought from the relevant institution, if required.

Sincerely yours,

[redacted]

John Arnett, PhD., C. Psych.
Chair, Health Research Ethics Board
Bannatyne Campus

Please quote the above Ethics Reference Number on all correspondence.
Inquiries should be directed to the REB Secretary **Telephone**: (204) 789-3255 / Fax: (204) 789-3414