

Gender, Deprivation and Health in Winnipeg

by

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Abstract

This thesis is an examination of the sex and gender differences in measures of relative deprivation for Winnipeg, Manitoba, and the value of these measures to predict health outcomes. Within theoretical frameworks of relative deprivation and intersectionality, principal component analysis was used to test nineteen different versions of a national area-based deprivation index using Census variables, for the total population and for males and females separately. Only one version of the deprivation index provided consistent factor scores, in keeping with the theoretical constructs, for the total, female-only and male-only populations for Winnipeg. Administrative health data were used to calculate area-level rates of select health outcomes and binomial negative regressions were then used to analyze whether the “best” index was predictive of health outcomes for the three populations. In regression models, only the “material” component of the deprivation index was predictive of the health outcomes, but results varied across the three populations. The application of the “best” deprivation index to health planning may depend on the health issue and the population in question. This thesis confirmed that examining the intersections of sex, gender and deprivation in population health research unmask important differences that would otherwise be missed and could have implications in health planning.

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Chapter 1 – Introduction: Gender, Deprivation and Health in Winnipeg

1.1 Statement of the Problem

This thesis is an examination of the sex and gender differences in measures of relative deprivation and the value of these measures for predicting health outcomes.

The connection between health and gradients in socio-economic status has been well established in both Canadian (1,2) and international research (3-5). The evidence shows that health outcomes are incrementally better with every increase in socio-economic status in a society. There have been on-going policy and research discussions, however, regarding the best way to measure socio-economic status, in order to use the information from such measures to allocate financial and other resources. For example there are debates about whether absolute levels of income (creating a threshold of poverty) should be used, or whether it is more appropriate to examine relative differences between populations in terms of income as well as other factors that confer status such as home ownership, employment, job satisfaction, or higher education (6). The British Whitehall Studies of the 1970s and 1980s, for example, demonstrated that men had better health outcomes if their civil service positions had greater authority and status (7-9). Disadvantage in socio-economic status is thus considered to contribute to inequities that can lead to poor health status (10).

A seminal work by the late Peter Townsend (11) is frequently cited as a starting place to examine relative deprivation,¹ or disadvantage, because he developed an argument about the effects local gradients of disadvantage have on the health of populations and individuals. Critically, he argued for including “social” dimensions of deprivation – how well one is able to function and participate in society, to get beyond measures of strictly “material” resources – income, adequate food or shelter (11).

Based on Townsend’s arguments, composite deprivation indices with variables to represent material and social deprivation have been developed and tested using small area analysis in a number of countries (6,12-18). The indices are calculated by weighting selected variables to produce material and social deprivation scores. They can potentially quantify how material and social factors contribute to relative deprivation together, how in combination they relate to health status and health outcomes, and how these multi-indicator measures can be used in health planning (6,18-20). However, deprivation indices represent an aggregate measure of individual level data and there is a risk of ecological fallacy; that is, there is a risk of assuming that the deprivation measured *across* the group pertains to all the individuals or even sub-populations *within* the group (21). Two such broad sub-populations are males and females, not frequently separated in analyses using deprivation indices (22-25), even though primary data collected typically include a variable for sex (usually male or female).

Robert Pampalon and his colleagues developed a deprivation index for Quebec (20), later expanding the work to include other parts of Canada (26), to be applied in health

¹ I define “relative deprivation” fully in Chapter 2.

planning to address health disparities. The deprivation index uses Census data to assess relative deprivation based on six variables, chosen because they represent social and material dimensions of deprivation, have known links to health, have been previously used as geographic proxies, and are consistently available at the smallest Census level (20,26-28). The three variables intended to represent material deprivation are education level (persons without a high school certificate), employment² and personal pre-tax income. Social deprivation is represented by living alone, marital status³ (being separated, widowed or divorced), and being a single parent. The index composed of these six variables will be referred to in this thesis as the original deprivation index. Pampalon et al. (26) derived their index to use the smallest geographical areas possible for Census data, dissemination areas (DAs). This feature of the smaller geographical area is desirable since spatial scale has been found to influence the results of Canadian deprivation index scores (29); a conclusion Krieger reached in her work in the U.S. (30,31).⁴

The original index developed by Pampalon is interesting to examine for three reasons:

- 1) The index has been in development and use for a number of years and has some currency nationally (32,33);

² “Employed” is a Census measure of persons who answer a question saying that they have paid employment on Census day. See Table 4.1 for more detail.

³ “Marital status” is the variable name used by Census Canada. According to the Census definition this term is applied to any relationship between two adults who were or are co-habiting. In this deprivation index, the indicator of interest is a derived variable of divorced, separated or widowed, with no constraints put on whether these relationships were based on formal marriage, nor on the sexes of the people involved (241). See Table 4.1 for more detail.

⁴ In a review of Canadian deprivation indices, Schuurman et al. noted that Census and other administrative boundaries are not intended to represent any homogeneity of the populations within their bounds. However, the authors concluded that concerns about the validity of inferences about the population within an area can be “ameliorated by using the smallest unit of analysis possible” (29, p.600).

- 2) The index can be replicated and used across most of Canada because it uses Census data for each of the six variables in the index; and
- 3) The data are available by sex.

In a 2009 study Pampalon et al. noted that the association of deprivation with life expectancy and disability differed for males and females (27), and this was partially tested again by Auger et al. (34). However neither study looked at deprivation scores generated for each sex. A 2011 report from the Centres of Excellence for Women's Health (35) found that the original index did show sex differences in scores for three Canadian cities: Halifax; Winnipeg and Vancouver. The authors demonstrated how differences in gender, the influences of social roles and relationships in males' and females' experiences,⁵ may contribute to the observed sex differences in the deprivation scores, and noted these differences may have implications for associated health events, although the authors did not test the relationship of sex-specific index scores with health outcomes. The 2011 study found that the original index may not sufficiently represent social dimensions of deprivation in the three cities, as one of the "social" variables, lone parenting, was representative of both material and social deprivation for females in Winnipeg and Halifax, and did not represent either dimension of deprivation for males in Vancouver and Halifax (36). Chateau similarly found that lone parenthood was not an ideal variable for the social aspect of deprivation when testing an earlier version of the original index (using 2001 Census data) for Winnipeg (37). Chateau found that "moved within the last year" was a better representation of social disadvantage. He also tested "employment" instead of "unemployment" in the model as a better representation for

⁵ I define "sex" and "gender" more fully in Chapter 2.

people who want work but cannot find it (37). Chateau's changes to the original index were not tested by sex (37).

My experience in sex- and gender-based analysis and health statistics prompted me to consider whether the original index can be modified to better represent relative deprivation for women and men separately in Winnipeg. Integrating sex and gender analysis into programming and policy development can be used to improve many dimensions of health, including directed health services, health promotion and public education (38-40). As the goal of applying a deprivation index to health planning is to reduce health disparities in a population, it is useful to understand how well an index represents any disparity in the composite variables, or among the populations to which it is applied as a whole. If women and men do have different scores for different versions of the index, the result will have implications for health policy and planning. This thesis examines opportunities for using Townsend's theory of relative deprivation to estimate population health, and in particular examines the relationships between Census-based measures of relative deprivation and health outcomes for women and men in Winnipeg, Manitoba, Canada.

Accurate measures of gender-based disparity are recognized as critical to improving health because globally women are chronically disadvantaged in terms of income, education, opportunity to obtain health services, and decision-making power (4,41,42). Likewise, Canada continues to demonstrate gender gaps in achieving overall health and equity of opportunity (43). The World Health Organization notes that health indicators,

and thus potentially a composite index, may have varying abilities to be gender-sensitive – that is, to describe the gendered experiences of men and women (4). Analyses by Bierman using national-level data (44) and Haworth-Brockman et al. using provincial-level data (45), for example, found that sex and gender differences affect health in Canadian populations. Sex and gender differences have been documented in earlier studies in Manitoba (46,47), but not in relation to a deprivation index. The 2011 study by the Centres of Excellence for Women’s Health illustrated that there are sex differences in the original deprivation index scores for Winnipeg that are likely to be based on gendered influences (35). These observable gendered influences that demonstrate sex differences in analyses of population data represent gender-sensitivity in the underlying indicators. I define gender-sensitivity fully in Chapter 3, but for now it is important to note that gender-sensitivity of a composite index and its variables is essential for illuminating and understanding where disparities in population can arise.

1.2 Purpose

The purpose of this thesis research was to examine the gendered dimensions of a deprivation index and the utility of its application by sex to study health disparities in Winnipeg, Manitoba, Canada. The guiding research question was “Is there a Census-based index that best describes relative deprivation for men and for women in Winnipeg?” Supporting questions included: “Are there sex differences in deprivation scores for men and women and if there are sex differences in a deprivation index, how do these differences relate to health outcomes?” “What are the gender implications of the

variables used in the index?” and “Do any sex and gender differences have implications for the utility of a deprivation index to reduce health disparities?”

There were two hypotheses for this research:

- 1) Variations of the original deprivation index can be created using Census data that produce statistically significant differences in scores of material and social deprivation for males and females for the Winnipeg Census Metropolitan Area (CMA); and
- 2) The original deprivation index and the variations constructed in this research are associated with differences in health outcomes for males and females in the Winnipeg CMA.

The results of this project can be used to determine how well a deprivation index can predict health outcomes for each sex, and therefore whether a single deprivation index should be applied in health policy and planning to reduce disparities between and among men and women.

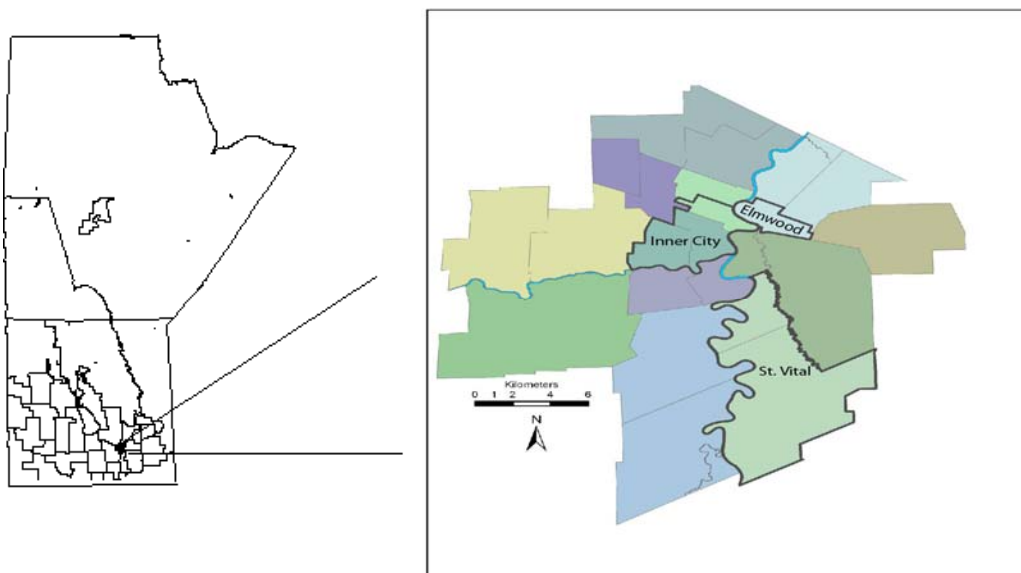
1.3 A Short Profile of the Residents of the City of Winnipeg

Winnipeg is the capital city of the province of Manitoba, in the east-west geographic centre of Canada. According to the 2006 Census Community Profile for Winnipeg, the population that year was 694,665, with 337,465 males and 357,205 females (48). Eighty-one percent of males and 83% of females in the city were aged 15 years or over (49).

Canada and Manitoba have two official languages and most Winnipeggers (88%) report that of the two, they speak English only; 0.2% Winnipeggers reported that they only speak French. More than 30 other languages, however, are spoken by city residents. Sixteen percent of the population identify as non-Aboriginal visible minorities and 10% identify as Aboriginal. Immigrants make up 19% of the Winnipeg population, with the greatest percentage of immigrants (3.8%) having arrived in Winnipeg between 2000 and 2006 (49).

Residents of inner city or core neighbourhoods have lower than average personal and household incomes and many are further disadvantaged by poor housing, limited employment opportunities and discrimination. The inner city neighbourhoods are not the only parts of Winnipeg with low-income residents, as there are portions of St. Vital and Elmwood in which residents have fewer material resources (Map 1).

Map1. Map of Manitoba, Canada, and Winnipeg neighbourhoods (City of Winnipeg map created by A. Werner for this thesis).



Winnipeg citizens, as with most residents of Canada, receive universal health care in the form of physician services and hospital care. Additional insured services are provided through the provincially-delegated Winnipeg Regional Health Authority.

1.4 Thesis Chapters

There are six chapters in this thesis. Following this introduction, Chapter 2 describes the theoretical frameworks I used in my thesis research, and the analytical approach to the literature review and statistical analyses. Chapter 3 is a review of the literature related to earlier deprivation indices and the index variables used in this thesis. Chapter 4 describes the statistical methods used, and the results are presented in Chapter 5. In Chapter 6, I return to the research hypotheses and questions and discuss the implications of my results within the theoretical frameworks, before making my concluding remarks.

1.4.1 A Note about Nomenclature for Variables in this Thesis

Specific Census variable names used in the deprivation indices in my thesis research are denoted by using italics. Other references to the concepts or similar terminology are not italicized.

Chapter 2 - Theoretical Frameworks and Analytical Approach

2.1 Introduction

My thesis is based upon two theoretical frameworks: 1) relative deprivation; and 2) intersectionality. In this chapter I describe each of the theories as well as the challenges that have been encountered in operationalizing them; that is, the challenges of moving from theory to practice as they relate to my research. In the case of relative deprivation, select examples of how the theory has been adapted in population health research are described more fully in Chapter 3.

2.2 Relative Deprivation

2.2.1 Defining Deprivation

The theory of relative deprivation was first described in detail in a 1987 paper by Peter Townsend (11). Townsend defined relative deprivation as, “*a state of observable and demonstrable disadvantage relative to the local community or the wider society or nation to which an individual, family or group belongs. The idea (is) applied to conditions (that is, physical, environmental and social states or circumstances) rather than resources and to specific and not only general circumstances...*” (11, p. 125). He differentiates relative deprivation from poverty in the following way:

“The concept has to be distinguished from poverty. People can be said to be deprived if they lack the material standards of diet, clothing, housing, household facilities, working, environmental and locational conditions, and facilities which are ordinarily available in their society, and do not participate in or have access to the forms of employment, occupation, education, recreation and family and social activities and relationships which are commonly experienced or accepted. If they lack or are denied resources to obtain these conditions of life and for this reason are unable to fulfill membership of society they can be said to be in

poverty. The first turns on the level of conditions or activities experienced, the second on the incomes and other resources directly available.” (11, p. 140)

That is, poverty can be understood as not having resources in absolute terms, but relative deprivation relates to the feelings and experience of “doing without”, compared to others in one’s community. However, this description does not fully relate the broader argument Townsend makes in his definition of relative deprivation. Townsend was careful to describe two distinct aspects of deprivation, material and social. Whereas he describes material deprivation as disadvantage in terms of tangible resources – inadequate food, shelter or sanitation for example, Townsend explains social deprivation in terms of the inability of an individual to fully participate in his or her community and local society (11). He noted, “People may not have the material goods of modern life or the immediately surrounding material facilities or amenities. On the other hand, they may not have access to ordinary social customs, activities and relationships” (11, p. 127). ,

Townsend’s argument is three-fold: that there are social elements to disadvantage, which are often left out of discussions and analyses; that there are social, political and economic structures that affect individual deprivation; and that deprivation is relative, meaning it is perceived and experienced in relation to the surrounding community, not as an absolute value. As he describes, “If inequality can be seen as a hill, deprivation is a ravine into which people should not be allowed to fall” (11, p. 126, citing *Berthoud, 1976, pp.175, 180*). Largely undeveloped, but requiring attention, he argued, is social deprivation, “the condition of those who do not or cannot enter ordinary forms of family and other social relationships” (11).

As Clow et al. (50) described, relative deprivation is one of several concepts that emerged since the 1960s to describe how disadvantage is experienced by individuals and populations, and how disadvantage hinders good health, if not causing illness. Among related concepts such as *social and economic inclusion and exclusion* and *social determinants of health*, there is a “common understanding that the interaction of health with living conditions and circumstances (is) context-specific. So, whereas unemployment may be highly important to feeling deprived in one setting, in another place employment that exposes workers to toxins or other hazards may be the cause of poor health” (50, p. 25).

Townsend acknowledged that the study of social deprivation may be more difficult to establish and measure. He also noted that the empirical patterns of deprivation may include paradoxes, as some people who are materially deprived may have strong social networks and relationships, while others with material prosperity may be deprived in other aspects of their lives. Critically, Townsend notes that concepts like inequality, poverty and deprivation can easily become gender blind, colour blind or age blind; that is they may not deal adequately with sexism, racism and ageism (11).

There are two other critical aspects to Townsend’s thesis. The first is that while some individuals and sub-populations experience one form of deprivation, others may be coping with multiple forms of disadvantage and marginalization. Compounded disadvantage, he acknowledged, may make it difficult to disentangle which disadvantages are most affecting health. The second aspect Townsend emphasized is that being a

member of a particular sub-group (such as males or females, or new immigrants) may affect the experience of deprivation because of discrimination, but that should not be confused with assuming the group classification causes deprivation. Clow et al. wrote that for these two reasons – the multiple or simple nature of deprivation and its social structuring – “any examination of deprivation requires a more general explanation of context.” (50, p. 23). Townsend encouraged new research to examine combinations of social and material aspects of deprivation, and especially to clarify the function of any particular indicators used to measure relative deprivation (11).

2.2.2 Operationalizing Deprivation

Finding appropriate ways to measure relative deprivation is a challenge Townsend anticipated (11). In research in London and Northern England, Townsend conducted surveys, asking participants about the factors that caused them to feel deprived compared with others in their society. The Caledon Institute in Ontario emulated this method, with a large survey of Ontario residents in 2008-2009. In both cases, survey respondents reported not only that they had inadequate income for fresh foods and regular savings among other things that represent material deprivation, but also that their circumstances prevented them from joining in family celebrations (because they could not buy small gifts), or enjoying a favourite hobby (aspects of social deprivation)(6,11, 51). Surveys, however, are costly and labour intensive and are thus not easily replicated (11, 52).

Population health researchers have to balance what individuals have said makes them feel deprived with indicator data that are available, that have been demonstrably linked to health, and that can be used for population level public health and planning. Townsend

acknowledged that numerical indicators typically used to measure social and material conditions of deprivation at a population level are dependent on existing data which are themselves dependent on prior decisions, made for political and other reasons.

Creating and testing indicators in a deprivation index is a method to represent Townsend's concept of relative deprivation and is a way to meet his challenge to find measurements that account for social and material aspects of relative deprivation (11). To be true to his concept, however, examining the meanings behind each of the indicators used in a deprivation index is also crucial. Winnipeg women, for example, have reported that coping with bad housing can pre-occupy their days, and the condition of their homes can lead to mental strain and physical illness (53-55). Mothers frequently report cutting deeply into their food budgets to avoid bad housing (56), or to pay for their utilities (57).⁶ The social stigma that bedbugs create is another example of how housing conditions deeply affect people's lives in Winnipeg, preventing them from participating in their lives socially as they would otherwise wish (58).

Furthermore, women's and men's lives change over the life course and individuals may move in and out and through different kinds of deprivation. A deprivation index, such as the one investigated in my thesis research, provides only a cross-sectional window at a particular point in time.

⁶ I note that there is little in the way of such qualitative evidence for men's specific experiences of bad housing from Winnipeg studies.

2.3 Intersectionality

2.3.1 Defining Intersectionality

Intersectionality is a theory about how marginalization operates. The theory has been developed by feminist scholars over the last two and a half decades to articulate and demonstrate the complexities of marginalization, including how it changes with time and place. The concept originated from among Black (African American) women who could not see themselves in feminist discourse, nor in Black civil rights movements (59). They perceived feminism as colour blind and civil rights movements as gender blind, and found both lacking. Kimberlé Crenshaw argued that a single axis of focus, racism or sexism, ignored how women can be marginalized by their vulnerabilities to both forms of discrimination (59).

As Leslie McCall (60) has described, intersectionality theory recognizes that individuals have multiple identities which can create multiple, compounded points of marginalization. In her arguments, Crenshaw observed that Black women are both “black” and “women” which means they face oppression faced by others with those identities but that they also have additional vulnerabilities in the face of the dominant society because they embody both identities (59,61). One label, one identity, connotes a simplification of their “otherness” that is better understood when instead the combined identities are recognized. Browne et al. have argued that intersectional analysis requires attention to several concurrent levels of marginalization to reveal which structures of inequality are affecting individuals and limiting possibilities (62). Intersectionality rejects “primacy of a singular category but also transcends an additive approach because of its emphasis on simultaneity and mutuality of differences” (63, p.13). Instead,

intersectionality emphasizes the ways in which “differences work through one another to produce something unique and distance from any single form of difference standing alone” (63, p. 13).

Other scholars have since expanded upon Crenshaw’s work, encouraging the use of intersectionality as a paradigm for social and health research to deconstruct the points of marginalization – the intersections of identity such as sexual orientation, age, ethnicity, disability – any woman (or man)⁷ may have at any one time, to explain better where disadvantage and inequity reside (60,64-67). For the purposes of this thesis I adopt a definition used by Östlin and Sen, of inequity as unjust, remediable, socially governed differences that prevent individuals and groups from participating fully in the dominant society (42).

Intersectionality is not only concerned with categories of personal identity. More recent investigations have pushed the concept of intersectionality to consider how such categories are interdependent with political, social and economic structures *and processes* of marginalization and inequity (63,68-70). These structures and processes include familiar “isms” – racism, sexism and classism – as well as hidden privileges and discrimination, such as poor public transit in lower income neighbourhoods, prohibitive user fees for public facilities, or ice rinks that privilege boys’ hockey teams over girls’.

⁷ Intersectionality emerged from feminist discourse, as described. As such, many authors focus on intersections in women’s lives. A few authors have extended their work to investigate intersections that create disadvantage for men (see Bassel (68) and Dhamoon (69), for example).

Kathy Davis actually defines intersectionality *as* exclusion (71), resulting from primary points of disadvantage of gender, race and class. Other scholars define intersectionality as the analysis they apply, but they also regularly return to these three points (intersections) of oppression – gender, race and class – to refine their arguments about how inequity arises and where social justice can be applied (72,73).

Gender can be defined simply as imposed and adopted privileges, responsibilities and roles, based on what it means in a society to be masculine or feminine (40,42,74,75).

Gender is frequently conflated with sex, but the latter is more specifically understood to refer to biology and physiology (76,77). Both sex⁸ and gender should be regarded as continua from “male” to “female”. Most people identify as (or are identified by others as) male or female, but some identify as neither, and others as both (75). Beyond this simple definition of roles and responsibilities, gender is also understood to represent relational power that is manifested between and among women and men, in households, communities, work places, politics and economic systems (42,75).⁹

Race is also about biology (appearance) and society (culture) (78).¹⁰ Race is identification by skin colour, as well as identification as belonging to a group of people

⁸ At the chromosomal level, not all people are strictly female (XX) or male (XY) (77). However, health and census data are typically collected in these two categories.

⁹ Gender inequity between males and females is persistent throughout the world and is, as Östlin et al. write, “unjust, unfair, ineffective and inefficient” (42) (p viii). It is also true that there are gendered inequities among women and among men, such as discrimination against women and men of colour, or those who do not “fit” heterosexual norms (69), to give two examples.

¹⁰ Mullings and Schulz briefly describe the history of ascribing poor health to “bad” genetics (such as racial typographies), used to dismiss health inequities as biological phenomena, and the evolution of more sensitive science that acknowledges how social constructs of race are much more likely to create health disparities (78).

with similar histories of oppression (61,69). In the American legal and policy cases described by Crenshaw, Black women were excluded from the essentialisms of “women” when their rights as Blacks were debated, and they were excluded from the essentialisms of “Black” when fighting for their rights as women; they could not get attention for the discrimination they faced for the combination of the two identities (59,61). In Canada, Aboriginal identity may be a more familiar intersection of race and racism. “Aboriginal identity” can be de-constructed depending on whether an individual is Status or non-Status, lives on reserve or off, is Métis¹¹ or Inuit. Individually and as a group however, Aboriginal women are particularly marginalized through their sex, their gender and the history of racism and colonialism in this country (79,80), what Verna Kirkness calls “discrimination-within-discrimination” (81).

Finally, class is a third intersection of disadvantage described in papers on intersectionality (71,78,82). It is perhaps least well defined of the three in the North American literature, but can be understood to represent socioeconomic privilege, via income, education or employment status or in some combination. Canadian papers on intersectionality discuss the marginalization of women with low income who are constrained also by where they live, in inner-city Toronto, for example (83) or immigrant communities in Quebec (84). Canadians do not like to think about class systems in this country, but elitism and the inability to relinquish power can also create marginalization, as was described in a case study by Lee of the Canadian Research Institute for the Advancement of Women (85). In contrast, in the United Kingdom class operates in more

¹¹I note that “Métis” is not always spelled this way. The Manitoba Metis Federation, for example, prefers a spelling with no accent.

obvious ways, creating segregation based on family histories, schooling and employment as much as income *per se* (9,11).

As Leslie McCall described the analysis of intersectionality, researchers must be able recognize and include categories of identity and “otherness” in order to understand the factors that create marginalization for a particular individual or group of people, at a particular time and place (60). That is, at any point of inquiry, intersectionality requires analysis of which identities are represented and how they create inequity or disadvantage not only in sum, but as they combine. Each intersection is more complicated than just the ascribed label, because it is attached to social structures that also create inequity. Such analyses are not static, nor linear. They require an ability to assess where an individual faces opportunities and where there is oppression, or at least discrimination. For example, an immigrant woman may face discrimination in her work place because she is a woman of colour, with an education that is not accredited in her new country. However, in the context of her home and immediate neighbourhood, she may be respected for her activism and support for other women, which gives her credibility in working towards a stronger community.

According to Bedolla, intersectionality can render power visible and therefore possibly decrease its negative effects (66). Link and Phelan defined the powerful as those who “talk more frequently, have ideas more readily accepted and are more likely to voted group leaders”. Where there is stigma or discrimination, the powerful “control access to major life domains, educational institutions, jobs, housing and health care” (86, p. 371).

Power is, then, the exertion of control of one group over other groups, “to gain substantial material and non-material resources” (87, p. 182). In contrast, those who are discriminated against, who experience stigma and are oppressed, are faced with resistance and constraints. In the context of intersectionality theory, Hankivsky and Cormier wrote that power is a system of the “dynamic interactions between individual and institutional actors” (88). Furthermore, Manuel cited Crenshaw that, “the social power in delineating differences need not be the power of dominating, it can instead be the source of social empowerment and reconstruction” (87, p. 193). Thus intersectionality must deconstruct assumptions about social norms and prevailing political arrangements to understand inherent structural processes of marginalization, and subsequently act to rectify problematic structures and relationships (66). Researchers need to attend to the differential position of power in which identity groups can be located in specific historical contexts as well as the dynamics of power within these groups, without reifying or essentializing differences, but rather researchers need to be open to a changing story (66). As Yuval-Davis summarized, “what is important is to analyze how specific positioning, identities and political values are constructed, interrelate and affect each other” (73, p. 200).

Intersectionality can therefore be imagined as picking up a fold of cloth or tissue to examine its weave. Wherever you grasp the fabric between thumb and forefinger, you can examine the threads that intersect at that point. But all of those threads are supported by the woven threads of the remaining fabric. Picking up the fabric somewhere else or at

another time brings other threads to your attention, but they are also surrounded and supported by the rest of the fabric structure.

As Paula Braveman wrote, “The question is not: ‘Is race or class more important?’” (89, p. 1029). Pitting one category against another is precisely what intersectionality seeks to avoid. An exclusive focus on one category “ignores or downplays” the role of the other (89, p. 1029). The question is how to address the complex interactions of identity and social structure with “research and effective action” (89, p.1029).

2.3.2 Operationalizing Intersectionality

As with Townsend’s concept of relative deprivation, intersectionality is still a relatively new paradigm. Unlike deprivation, however, there have been few attempts to operationalize intersectionality with quantitative data. Sen et al. pointed out, for example, “because of the paucity of research, we still do not know with a lot of empirical backing how gender affects class inequalities, for instance, or how gender relations are modified by class, let alone how these intersections influence health inequalities” (90, p. 398).

Sen and her colleagues proceeded, in the same paper, to describe a method of creating dummy variables used to represent individuals in a heuristic matrix of their multiple identities: poor men (i.e. poor *and* male), non-poor men, poor women, and non-poor women, for example. The dummy variables can be used in regressions models that then allow for statistical testing of the differences within as well as between groups (90).

In an investigation of the processes of marginalization, Black and Veenstra studied the intersections of gender, race, class and neighbourhood and the associations of these intersections with self-reported health (83). They employed statistical methods similar to those used by Sen and her colleagues (90) and compared their results to simpler multiple regression models in a second series of statistical tests. The authors wrote,

“Our greatest insight is that the additive approach is inadequate to the task of describing health inequalities in Toronto and [New York City]. Knowing an individual’s simple social location (such as female or poor) can provide insight about health outcomes, but understanding individual’s complex social location (female and poor) often provides additional information that helps to untangle the complex determinants of health outcomes...It is clear from our analysis of the intersecting roles of place, race, gender and class that, had we not tested interaction terms and neighbourhood level effects, a number of important insights would have been missed” (83, p. 86).

Despite a growing and rich literature that is developing to understand what intersectionality is, how it manifests in the lives of women (and men), and the social and political drivers that create marginalization, quantitative descriptions of how intersectionality operates are still in the earliest stages. By replicating the methods used by Pampalon et al. (26), my thesis research did not adopt the methods described by Sen et al. and Black and Veenstra. The statistical methods I have used, however, do represent the way in which individuals may cope with multiple forms of disadvantage as Townsend described (11). Analysis of the results is enriched when the intersections of these multiple places of disadvantage are de-constructed.

2.4 Analytical Approach

My analytical approach is intersectional (91), with an emphasis on sex- and gender-based analysis (SGBA) to uncover and describe how and why any observed differences occur in

the deprivation scores I derive, the associated health outcomes, and the gendered influences and implications of those differences.

As the deprivation index is intended to represent Townsend's concept of relative deprivation, not only is it important to parse the components of the index and deconstruct what each represents individually, it is also necessary to understand the meanings of the indicators for males and for females separately, as the experiences of men and women can be very different, even in the same circumstances (92). Intersectionality provides a framework to analyze how individual people or groups of people experience disadvantage and marginalization (60,63). Intersectionality includes SGBA, but also examines the cumulative discriminations of race, class and other personal and group identities at a given time, in a given place (63,92).

Focussing on SGBA has been considered an incomplete approach to intersectional analysis (63), but health data are available by sex and analyzing the gender sensitivity of the deprivation index and its components (93,94) provides a mechanism to explore other intersections of exclusion such as age and aspects of socio-economic status including education level, unemployment or long hours spent on unpaid caregiving. Examination of the potential for intersections of class and race (60,72,73,95) is not possible with the variables in the quantitative data sets to be used in this thesis research, but the literature review in Chapter 3 provides the necessary context and analysis of the structural and historical power relations that can lead to deprivation for males and females (71,73).

The SGBA used in my analysis builds upon the concepts and processes described by Clow et al. (75). The authors explain SGBA in terms of four core concepts: sex, gender, diversity and equity. As noted, *sex* describes the physical and physiological make-up of a human body. Most, but not all, people are chromosomally either male or female. Sex characteristics from the cellular to the organic level can influence the mechanisms of health and disease response (77). *Gender* describes what it means to *be* male or *be* female in a society, the imposed and adopted patterns of social behaviour norms. Many people do not identify with either masculine or feminine characteristics, and others may identify somewhere along a continuum of both (96). SGBA acknowledges that not only are there differences and similarities between women and men, but also among women and men: that there is a *diversity* of lived experiences and circumstances. Lastly, the intent of SGBA is to identify and rectify where there is inequality in health created by inequity. Whereas “inequalities” in health are understood to mean measurable differences, “inequities” refers to unfair but modifiable distribution of resources that may lead to inequality in health outcome (42). The Pan-American Health Organization has stated that, “*Equity* of resources and opportunities provides the means to achieve the goal of equality” (97), but it may be the case that redressing inequalities requires an uneven distribution of resources and opportunities to reach people who are otherwise marginalized. Östlin and Sen noted that gender equity in health cannot be based only on the principles of sameness but must also be based upon an absence of bias (42).

In the case of health, SGBA helps to identify how biological factors, social norms and structured systems (e.g. legal, political, religious) that govern those norms are all

important influences on women's and men's health status, and to clarify the different and similar ways that women and men are vulnerable (96). There is growing recognition of the role sex and gender play in health and there are policies that not only enable but, as seen in the new Health Portfolio policy for example, *require* the use of SGBA in health research, programming and planning (39,75).

The intersectional approach in research and analysis advocated by Östlin and Sen (42), McCall (60), and others (63) broadens SGBA to examine the social locations where inequities and inequalities arise. As noted, the starting categories of males and females in the Census and administrative data allow for initial comparisons between men and women, while statistical analyses allow for examination of some other intersections among women and men (age, for example). While the quantitative intersectional analyses may be limited, I draw in other research and community knowledge to understand the greater structural contexts in which the measures of deprivation and the associated health events operate (63,71,88,98, 99).

2.5 Summary

In this chapter I have described two theoretical frameworks that underpin my thesis research: relative deprivation as conceptualized by Townsend; and intersectionality, a concept about the mechanisms that create marginalization depending on individual identities in a particular space and time. I use the framework of intersectionality to expand my analysis of relative deprivation beyond the measures of area-level experiences the deprivation index represents for women and men. To do so, the deconstruction of

gender influences and implications must be examined in the context of other marginalizing conditions and processes (100). As with the analogy of plucked fabric I used earlier, in Chapter 3 I examine the intersections of marginalization that operate in the social and economic systems as well as power relations that are part of living in Winnipeg to truly understand how deprivation is created and perpetuated.

Chapter 3 – Moving from Theory to Index: A Literature Review of Gender-Sensitive Indicators and Measures of Relative Deprivation

3.1 Introduction

As described in the preceding chapter, operationalizing theories of relative deprivation and intersectionality to address disparities in population health is challenging.

Researchers are “faced with a dilemma of how to apply the concept of ... deprivation, to population and individual health outcomes in a meaningful way” (101, p. 27). As Etches et al. (102) have noted, there is a lengthy history of measuring population health, but they advised that in all cases, health indicators and frameworks must be assessed to ensure they “effectively and efficiently serve their intended purposes” (102, p. 50).

Townsend (11) conducted surveys, asking participants about the factors that caused them to feel deprived, compared with others in their society. Similar research was conducted in Ontario in 2009 (6,51). Although the results of the two surveys, conducted in two different countries 20 years apart, showed some similarities (the inability to afford suitable work clothes, for example), the differences reflect the very different times and surrounding social circumstances in each location (6,11,101). However surveys are costly and labour intensive (103) and are thus not easily replicated. Population health researchers have to balance what individuals have said makes them feel deprived with the availability of indicator data that have been demonstrably linked to health, and that can be used for population level public health and planning.

Health indicators have been defined as direct measurements that reflect the state of an individual's health. They may be descriptive or evaluative and should meet the criteria proposed by the U.S. Institute of Medicine: reliable/reproducible; valid; sensitive; acceptable; feasible; and universal (quoted in Young (103)). Deprivation indices use non-health indicators because their intent is to measure factors that create or hinder health. Thus, I adopt a definition of indicator used by Tony Beck: "*An indicator is a pointer. It can be a measurement, a number, a fact, an opinion, or a perception that points at a specific condition or situation, and measures changes in that condition or situation over time*" (104, p. 3). If used for practice or policy change, "indicators provide a close look at the results of initiatives and action" (104). Beck describes indicators as different than statistics, because indicators are, by his own definition, used to measure change. Indicators may be created specifically for a research study or, as is more often the case, may be adopted from existing data sets, such as a census, infectious disease surveillance or administrative data (102,103). The Repository at the Manitoba Centre for Health Policy is an example of the opportunities for sophisticated analyses through linked data sets from health administration, Census, education and social welfare sectors (105). In other jurisdictions, researchers have made use of locally available data sets to characterize the nature of relative deprivation for the populations of interest.

In this chapter I briefly describe four deprivation indices developed in Canada, to explore how they can inform any variations of the index developed by Pampalon et al. (20).¹² I then describe the concept of gender-sensitive indicators, within the theoretical frameworks of relative deprivation and intersectionality. This is followed by an

¹² Refer to Chapter 1 for a description of the original index.

intersectional analysis of the literature concerning indicators used in the original index, and the ones I used to test variations of the index, assessing their gender-sensitivity as well as what they may represent for women and for men in a deprivation index. The final section of this chapter is a brief rationale for my selection of the health outcomes tested in the statistical analyses.

3.2 Taking up Townsend's Challenge: Deprivation Indices and Health

Having put forward his thesis on relative deprivation, Townsend encouraged new research to examine combinations of social and material aspects of deprivation; he anticipated that researchers might find it difficult to select and adapt appropriate indicators (11). Townsend acknowledged that numerical indicators typically used to measure social and material conditions of deprivation at a population level were dependent on existing data which were themselves dependent on prior decisions, made for political and other reasons. The challenge he put to his peers was to explicitly clarify the functions of any particular indicators used as they relate to the theory of relative deprivation (11).

Townsend's concept and challenge are the paradigm adopted for a number of deprivation indices (15,106-108). Composite indices are created from a number of indicators, in recognition of the multiple ways disadvantage compounds, and have been validated as providing a truer depiction of disadvantage (109) than a single indicator such as employment or income alone. Researchers in Canada and in a number of other countries

– including New Zealand (24), Sweden (14), the United States (110), and Scotland (111)

– have applied the concept of material and social deprivation to census data. A few studies found sex differences in the association between deprivation index scores and health outcomes. In Sweden (14), Scotland (111), and the US (112), higher levels of deprivation are associated with higher levels of cardiovascular disease (CVD) for both males and females, but the correlation was stronger for women than for men. Matheson et al. found a sex difference in the relationship between higher body mass index and higher levels of deprivation: for men, living in an affluent neighbourhood was associated with higher body mass index (BMI), whereas higher BMI in women was associated with disadvantaged neighbourhoods (113). This kind of information is critical for policy and program development and resource allocation; in the case of CVD for example, the sex differences have implications on health care utilization and costs (114). The gendered influences and implications were not explored or reported in these examples. Each of these deprivation indices is a compromise based on what deprivation likely means to individuals locally, available data, and what can be measured on a large enough scale to be effective in policy.

3.2.1 Four Canadian Deprivation Indices

In this section I summarize four Canadian examples of deprivation indices, which illustrate the choices and compromises made in previous research. In each case, the authors have investigated the suitability of different variables to represent relative deprivation.

Langlois and Kitchen used 1996 Census data to create a general deprivation index of 20 variables for the city of Montreal (22). While the authors noted Townsend's differentiation of material and social deprivation, they focused more upon Townsend's other point, that deprivation can be multi-faceted (11). Langlois and Kitchen argued that poor income and employment create deprivation, and concentrated on an index that examined several factors facing those with low incomes and poor employment opportunities. They were specifically interested in how the move of industries out of Montreal affected its inner-city residents. The authors did not segment their index into material and social deprivation *per se*, but they included an indicator for language, to "take into account the possible impact of linguistic barriers on urban deprivation, especially when accessibility to the mainstream labour market is considered as a major factor for economic mobility and socio-linguistic integration" (22, p. 127). Their statistical modelling identified types of urban deprivation characterizing the Montreal urban core. Factor analysis of 20 indicators created loadings on five components. Their results showed that young people living in low-quality housing were an important feature represented in the data, and the second strongest component was for older residents with a relationship to work participation. Ethnic density (described as no official language) was a separate factor identified in their model. All the deprived areas had "low income, high percentage of less educated people and low work participation" in common (22, p. 133). Although some of the indicators the authors used were sex-specific, the authors did not continue their analysis by sex. As their intent was to investigate different measures of deprivation, the authors did not test any associations with health outcomes.

The Vancouver Area Neighbourhood Deprivation Index (VANDIX) was derived by geographers at Simon Fraser University who invited provincial Medical Health Officers¹³ to select from among 21 indicators, chosen because of their known association with material and social disadvantage as well as with health outcomes (115,116). Although some indicators in the list described the population by age (“Elderly 65+ living alone” and “Children under age 5”), sex differences were not considered. The authors found that the VANDIX was comparable with other Canadian indices, and that it also correlated well with self-reported health status reported in the Canadian Community Health Survey. However the VANDIX more strongly reflected material rather than social deprivation than the Quebec (provincial-level) version of the original index developed by Pampalon et al. (20) or the Manitoba Socio-Economic Factor Index described below (23). It is notable that when the authors looked across the original replies from the Medical Health Officers, there was not a very high level of agreement among their contributors about which indicators were valuable (115).

At the Manitoba Centre for Health Policy, Frohlich and Mustard (23) developed the SEFI, the Socio-Economic Factor Index. Frohlich and Mustard considered 23 indicators from Census data in the categories of dwelling characteristics, educational attainment, employment, income, mobility and social characteristics for municipalities. When normalized and then correlated individually to a previously derived health status index, six indicators were found to explain the maximum variance in the index measure of health status: age dependency ratio, rate of single parent households, rate of female single

¹³ Having providers select the indicators of interest follows methods used by researchers in Britain in the early 1980s (242).

parent households, female labour force participation rate, an unemployment rate composite, and a high school education rate composite (23). SEFI 2 was developed some years later (117) to take advantage of the smaller Census dissemination area size available, and to include average household income, which had not been available for SEFI 1 (118). The four indicators now used in SEFI 2 are average household income, percent of single parent households, unemployment rate and high school education rate. In a review of composite indices, Metge et al. found that the SEFI 2 correlated strongly with premature mortality rate, potential years of life lost, life expectancy (males only) and excellent/very good self-rated health for Manitoba residents (117,119)

Matheson et al. developed the Canadian Marginalization Index (CAN-Marg) to “understand inequalities in health and other social problems related to health either between population groups, or between geographical areas” (120, p. S12). The researchers wished to explore factors that create deprivation beyond concepts of material deprivation that concentrate on income inequality. Furthermore, the authors wanted to create an index independent of association with health outcomes to ensure that later predictive use of the index for health outcomes were not tautological. Four dimensions of marginalization are identified in the CAN-Marg: ethnic concentration, dependency (proportion of the population over the age of 65 years, under the age of 14 and the proportion aged 15 years and over not in the labour force), residential instability and material deprivation (120). CAN-Marg is notable for its inclusion of residential instability as an aspect of marginalization. This component of deprivation includes proportion of the population living alone, residence in the same home for 5 years or more as well as one of

the three criteria of core housing need, overcrowding (120).¹⁴. Ethnic concentration is defined by variables for recent immigration (within 5 years) and visible minority (which in the Census does not include Aboriginal identity).

Associations of the CAN-Marg with health varied, depending on the aspect of the index used. Greater ethnic concentration was associated with better health status and fewer unhealthy behaviours such as binge drinking and smoking. High self-perceived stress and poor self-rated mental health were, however, associated with living in areas of high ethnic concentration. Greater material deprivation was significantly associated with poor physical and mental health, as well as with less likelihood of having a flu shot and greater likelihood of reporting binge drinking and smoking. Residential instability and living in areas with high proportion of dependency showed similar associations with poor health outcomes, binge drinking and smoking; however, residential instability was not associated with being overweight but was associated with getting a flu shot (120).

3.2.2 Summary

The challenge set by Townsend has been taken up by population health researchers in Canada. Different combinations of variables have been investigated for their ability to represent relative deprivation, and tested for their ability to predict health outcomes. The range of variables used reflects the necessity of adapting datasets that are available in a given locale. Typically what is missing, however, is an analysis of the findings – either in the validation of an index structure or in its application for health planning – for women

¹⁴ Core housing need is defined more fully in section 3.4.2.1.

and for men separately. Analyses of the theoretical underpinnings of the intersections of disadvantage they represent are also not consistently described in detail.

3.3 Gender-Sensitive Indicators

In 2002, an Expert Reference Group brought together by the World Health Organization made recommendations for health statistics to be routinely disaggregated by sex as well as by other identifiers so that governments and researchers can optimize their opportunities for understanding where there are health disparities in populations and use this information for strategic interventions to improve health outcomes (121). As noted at a follow-up forum in 2010 on Gender and Health Statistics, although health and demographic data are regularly collected by sex, they are not routinely reported or used by sex, which can inhibit opportunities to address inequities (40,122).

It is not sufficient, however, to report indicator data by sex.¹⁵ To meaningfully represent differences between and among women and men, indicators must also be gender-sensitive. In documents commissioned by the Canadian federal Women's Health Bureau (104) and the Commonwealth Secretariat (93), Tony Beck defined a gender-sensitive indicator as an indicator,

“that captures gender-related changes in society over time ... Whereas a gender statistic provides factual information about the status of women, a gender-sensitive indicator provides “direct evidence of the status of women, relative to some agreed normative stand or explicit reference group” (quoting Johnson, 1985)” (93, p. 7).

¹⁵ I would argue, however, that reporting health information by sex is at least a starting place. It is possible to develop fairly complex analyses of sex and gender differences and influences using sex-disaggregated data and other available sources of evidence (96,243).

Jara refined this definition: “*Gender-sensitive indicators provide direct evidence about the situation of women compared to another specific population group, which may be men, but may also be women of another age group, ethnicity, socioeconomic level or place of residence*” (123).

The emphasis in both of these definitions is on women, because historically women have been consistently disadvantaged in comparison to men. As with intersectionality, the call for gender-sensitive indicators (for health and other sectors) arose because of the disproportionately poor outcomes for women in many societies, in comparison to men. As intersectional theorists have pointed out however (and as Jara’s definition takes into account), women may be multiply disadvantaged by other circumstances as well as by sex and gender (61,63). Similarly, not all men benefit from the advantages of the dominant society. Thus, for this thesis I further expand Jara’s definition to look for indicators that “provide direct evidence about the differences in situation of women *and of men* depending on ... socio-economic level or place of residence”. As the following sections of this literature review will show, sex-disaggregation and gender analyses of social, economic and health indicators have demonstrated situational differences between and among women and men.

3.3.1 A Note about Aboriginal Identity as it Relates to Gender-sensitivity, Intersectionality and Relative Deprivation

There is a strong body of evidence that Aboriginal people (those who identify as First Nations, Métis, Inuit, or Aboriginal in some other way) in Winnipeg are disproportionately disadvantaged in multiple ways (124), and that Aboriginal women and

men in Winnipeg have dis-proportionately poor health, compared with the city population as a whole (125,126).

I did not endeavour to describe the circumstances specific to Aboriginal Winnipeg residents in this thesis, although I acknowledge that an intersectional analysis of the compounded disadvantages for some individuals who identify as Aboriginal and male, or Aboriginal and female, or Aboriginal and any other gender identity, would more completely situate their lived experiences (80). There are three reasons I did not include these important intersections in this thesis¹⁶. First, I did not wish to further emphasize the experiences of disadvantage, deprivation and discrimination among Aboriginal women and men when it has been well documented elsewhere, and in light of the desire of many members of the community to focus now more on resiliency and ways forward (127,128). Secondly, many First Nations people do not take part in the Census (129) and questions regarding the specificity of the “Aboriginal identity” within Census data, even within Winnipeg which is off-reserve, mean that there may be some underestimating of the composition of the Aboriginal population (130). Thirdly, as Townsend pointed out, members of a population may be oppressed, but their identity is not the cause of deprivation (11). Oppression and discrimination are structural intersections of marginalization (59,61) that are not captured, *per se*, in either Census or health administration data. A similar case could be made for not focusing on sexism, and indeed my intent instead is to examine the intersections of sex and gender with other disadvantage. Gender-based and intersectional analyses are contributing to un-packing

¹⁶ Note that I do cite research related to Aboriginal people in this Chapter to illustrate examples of difference or similarity for Census variables. I do not, however, use “being an Aboriginal person” as a point of intersectional analysis.

the mechanisms that contribute to disadvantage, including for Aboriginal peoples; important new work that is beyond the scope of this thesis research.

3.4 Census Variables for the Winnipeg Deprivation Index

As noted, Townsend recommended that any variables chosen to represent relative deprivation should be meaningful to a local population, but he also acknowledged that population health researchers will be challenged in finding suitable population-level measures (11). The original index developed by Pampalon et al. uses six variables from the Census of Canada that are reliable and have been linked to health status (20). In a 2011 study, the six variables were analyzed by sex and gender in a literature review by Liwander et al. to understand whether and how they were gender-sensitive (131). In this section I summarize the findings from Liwander et al. regarding the six original index variables, and how they may have different meanings and implications for women and for men. I then provide similar analyses concerning the gender implications for four additional variables I tested in the statistical variations of the deprivation index, with one exception. The original index uses *employment rate* and the variations I tested used *unemployment rate*. Chapter 4 describes the technical differences between these two variables in Census data. Here I present them together because published research studies have addressed both unemployment and employment as they relate to health. Note that the following are descriptions of the gendered experiences of women and men for each variable from the literature. The technical, area-level measures used in the deprivation index tested are described fully in Chapter 4 (see Table 4.1).

3.4.1 Variables in the Original Index

Variables in the original index developed by Pampalon et al. (20) are presented here in alphabetical order. Wherever possible I have specified whether the literature reviewed refers to males or females; when it was not possible to discern, or if paper authors have not differentiated, I adopt gender-neutral language.

3.4.1.1 Education

Education level has been associated with health both indirectly and directly. Less education, and in particular not completing high school, creates a greater likelihood of remaining in low paying jobs with little authority, being chronically unemployed, or being forced out of the labour force altogether (47). According to Ross and Mirowsky, higher education has been associated with decreases in “age-specific rates of morbidity, disability and mortality” (132, p.1). The authors suggested that the benefits of higher education are greater for women than for men, because women, on average, do not have other important resources of authority, power.

In Manitoba, slightly more women than men had completed high school (81.5% and 75.6%, respectively) among adults aged 25 to 64 years, according to results from the 2006 Census (47). Among women in Winnipeg, Aboriginal women (133) and older women (47) often have lower educations than the general population. According to Silver and Mallett in a 2002 study, 12.9% of Aboriginal people in Manitoba aged 15-29 had less than a Grade 9 education, compared with 1.9% non-Aboriginal Manitobans (133).

Low levels of education have been associated directly with poor health as women and men with who have not completed high school or who have poor literacy levels are more likely to smoke cigarettes, eat unbalanced diets and not participate in physical activity (134,135). Pottie et al. found that immigrants in Canada with lower levels of education were more likely to self-report their health as poor than immigrants with higher education (136). Women who had not completed high school were found to be more likely to have coronary heart disease than men with the same limited education (137).

Finally, poor education is linked to (though not synonymous with) poor literacy, and poor health literacy has been found to contribute to poor understanding of illness and treatment, as well as to greater risk for chronic diseases, injuries and accidents (134).

3.4.1.2 Employment and unemployment

The original index included “employment” with the assumption that its opposite, “not-employed”, would represent deprivation in the index (36). As Chateau demonstrated, however, because of the way they are defined, employed and unemployed are not measuring opposites of the same information (37). Labour force participation refers to all persons who are employed or actively looking for employment. Women and men may opt out of the labour force when they retire, when they are raising children or caring for the infirm full-time, when they are concentrating on their education, or when they have to make use of social assistance. According to Census definitions, citizens are “employed” when they have paid jobs, “unemployed” when they are looking for paid work, but neither unemployed nor employed when they are not part of the labour force at all (138) (see Table 4.1). While not participating in the labour force may be disadvantageous and

thus be a form of deprivation, deprivation is better represented by “unemployed”, the status of unsuccessfully (at the time of the Census) seeking employment.

Donner et al. reported that 2001 Census figures for Manitoba showed a greater proportion of males than females were in the labour force and were employed in every age group. Unemployment was higher among males also, except among young adults, aged 15-19 years (47).

Men and women who are Aboriginal, physically and mentally disabled, or new immigrants are less likely to be employed than the general population. According to Statistics Canada, in the 2006 Census Aboriginal people aged 25 to 54 had a higher unemployment rate, compared with the non-Aboriginal people (9.1% and 3.4%, respectively). Métis women had higher unemployment than Métis men, but among First Nations people, men had a higher unemployment rate than women. The employment rates for Métis and First Nations women in Winnipeg were 71% and 53.4%, respectively. Métis men had an employment rate of 82.4%, whereas the employment rate for First Nations men was 64.8% (139). Similar profiles for other populations in Winnipeg are not publicly available, although data from Statistics Canada show that immigrants are less likely to be employed, depending on how recently they immigrated (140).

Women’s sex and gendered roles as mothers contribute to the differences in employment, as raising small children can mean that women remove themselves from the labour force for extended periods of time. State-supported maternity leave protects women’s jobs, but

personal income can be reduced by as much as 45% during maternity leave (141), and women have reported that job advancement may be hindered by time taken to raise children. Some women may choose to leave the labour force, or may feel that they are forced to do so either because their earnings do not exceed the cost of child care or because they cannot find a childcare space. In Winnipeg, there is insufficient child care to meet the demand and moreover there are more child care spaces available in outlying, wealthier, neighbourhoods than in the inner-city. As Prentice described, many day cares are started by well-resourced parents, who have time as well as familiarity with government bureaucracy to initiate new co-operatives (142).

Women's employment differs from men's in other ways. As Reskin and Padavic noted women are disproportionately represented in low-paying, precarious, routine and less-fulfilling work than men (cited in Ross and Mirowsky (132); see also Townson (43)). Such positions are less likely to provide additional employee benefits, such as disability insurance, and health insurance for services not covered by provincial health insurance, such as for eye and dental care (43).

The nature of employment can also contribute to relative deprivation. The Whitehall studies documented the decreasing health status of male civil servants, which was directly related to the men's declining levels of authority and control within their jobs (7,9), contributing to a body of evidence that the circumstances of employment and the status jobs confer can affect men's health substantially. Michael Marmot's work was part

of the impetus for developing the theory of deprivation – the concept of seeking that which others in one immediate circle have.

A British study found that men were more likely to have poor health associated with job insecurity than women (143), but McDonough found that women and men had similar patterns in the way that job insecurity affected their self-rated health, distress and prescription drug use (144). As in the Whitehall studies by Marmot et al., McDonough suggested that a lack of personal autonomy in the workplace reduces self-evaluation (that is, self-regard), leading to more serious health consequences (in this study these included heavy drinking and distress)(144).

3.4.1.3 Income

The association of health and income has been established in a number of jurisdictions (2,9,145), including in Manitoba and in Winnipeg (1). In many cases, disease prevalence and premature mortality increase with declining income. Low income may cause poor health because of the inability for women and men to secure the resources they need to maintain their health – good housing, adequate physical recreational facilities, nutritious foods, and so on. Numerous studies also report on the mental strain of living with low income, creating anxiety, social isolation and chronic stress (57,146,147). At the same time, illnesses can lead to work absenteeism, burdensome out-of-pocket expenses for non-insured medical supplies, and job loss, which can then lead to having less disposable income.

Despite the legal structures in Canada designed to diminish inequities between women and men (148), women still consistently earn less than their male counterparts across employment sectors, creating a gender wage gap and income disparities (148,149).

Women's lifetime earnings may be further reduced because of their gendered roles as caregivers, circumstances are that are particularly observed among older women who are less likely than younger women to have been consistently in the labour force (43).

Research conducted in the late 1990s suggested that women did not necessarily have equitable access to household income with their male partners (150). A more recent 2006 paper by Phipps and Woolley found that decisions about couples' long-term savings were also not necessarily made in a balanced manner, with women's incomes being perceived as the "extra income" for the household (151) (see also Ludwig-Mayerhofer, et al. (152)).

In a comparative review across several countries, Youdanis and Lauer found that how incomes are shared between couples depends on family gendered roles, but also on societal views of equality between spouses (153). Women's decision-making over their own income was considered a leading health indicator for women by an international group of experts in 2003 (121), but there is no equivalent measure in Manitoba data (45), leaving the question of equitable income use unanswered.

There are income differences among males also, with Aboriginal males, particularly First Nations males in Winnipeg, earning considerably less than their non-Aboriginal counterparts. Men and women who are new immigrants, on average, have lower incomes than most Winnipeggers who have lived in Canada all their lives (49). Statistics Canada

data show that elderly males have lower incomes than their younger counterparts, but that elderly women are more than twice as likely as elderly males to have low income. The highest rates of low income are found among unattached (living alone or living with others with whom there is no relationship) women under the age of 65 (154).

3.4.1.4 Living alone

Selected to represent relative social deprivation, living alone is used as a proxy for “not being engaged in social relationships, and therefore not having social support” (131, p. 50). For men, living alone does appear to be detrimental. Kandler et al, for example found that living alone is a risk factor for mortality, but it is not for women (155).

Schmaltz et al. found similar sex differences for patients of acute myocardial infarction, with men having higher risk of mortality than women (156). For men, living alone can mean that there is no one with whom to discuss intimate matters (157). Conversely, women who live alone are more likely to have unmet physical needs, that is, there is no one at all to help them with day-to-day activities and personal hygiene (158,159).

Women who live alone have been found to become fearful about their safety and their health as they age, but generally appear to be better at keeping up with their social circles among neighbours, friends and family than men (160).

A European study found that leaving home was a predictor of poverty for young people, but that the decision to do so differed by culture and nationality (161). Young people in Mediterranean countries tended to stay at home longer and moved out when they were getting married, whereas it was more common in Scandinavian countries for young

people to accept the risk of temporary poverty, because moving out and living alone signified greater independence (161). In Canada, living alone as a student in some inner cities would be a different experience than establishing oneself with a new career and living alone for its independence. It is reasonable to consider that the consequential experiences of social engagement would also be different and may not necessarily lead to feelings of disadvantage and deprivation.

3.4.1.5 Lone parenthood

Running a household with children without the financial and emotional support of a partner is challenging. The proportion of lone-parent (or single parent) households was chosen to represent social deprivation in the original index because having to juggle the time children require, as well as domestic chores, as well as earning a living, can leave little time for a social life.

According to Perez and Beaudet (162) and Cairney and Wade (163), single mothers report high levels of time stress and lower self-rated health than their married counterparts. Boyle and Lipman (164) reported that lone mothers were more likely than lone fathers to report feeling socially stressed and lone mothers were at greater risk of chronic diseases than other family groups.

While there is thus evidence of social isolation for lone parents, it is important to bear in mind that most lone parents in Canada (and indeed, in Winnipeg) are women and women who are raising children on their own were among the groups most likely to have income below the low income cut off. In 2008, lone fathers had average annual incomes (after

tax) of \$54,200, compared with lone mothers whose average annual income was \$41,300 (165).

As Kinniburgh et al. (36) and Chateau et al. (117) have demonstrated, for Winnipeg and Manitoba lone-parenting is more predictive of material deprivation, and while it may or may not be socially isolating as conceived in the original index, the Census variable does not work well in Winnipeg as a component of social deprivation.

3.4.1.6 Separated, divorced, or widowed

Separated, divorced or widowed is intended to represent a social aspect of deprivation, presumably because it represents loss of an intimate partner and thus loss of a key part of one's social network. According to the literature, losing a partner has been found to be both beneficial and detrimental for women and for men. Women who leave abusive relationships, for example, have expressed "a profound sense of freedom, relief and enhanced sense of control" (166, p. 1022). Even after leaving, however, many women still reported physical and mental effects from the violence they had escaped. Women have also reported that their social supports may fragment when their relationship ends, as some of their friends may side with their ex partner or interfere with women's decisions about the future (166). Widows have been found to have stronger social networks, or to rebuild them after their spouses' deaths, than men, whose mental health is more likely to suffer with widowhood (167).

Widowhood, separation and divorce have financial implications for women as well.

Following a divorce, women are more likely than men to find their standards of living

considerably lowered. Women are more likely to be granted custody of their children in a separation and divorce and, compounded with women's lower average earnings compared to men's, raising children alone creates gendered poverty for women. Ruspini found, however, that divorced or separated women in Europe were more likely to move in and out of poverty than men, whose poverty was more long term (168).

In a study of men whose marriages dissolved, Jamieson found that fathers demonstrated a range of behaviours, from becoming totally absent fathers to those who were as involved as possible (157). According to the authors, when a marriage comes to an end, men will struggle with gendered expectations for their roles as fathers and husbands, and their own distress about continuing relationships with their children and their ex-partners.

3.4.2 New Variables – Considering their Gender-Sensitivity and Ability to Represent Deprivation

3.4.2.1 Core housing need

Core housing need is defined by the Canadian Mortgage and Housing Corporation as housing that is unsuitable (too crowded), unaffordable (costing more than 30% of the household income) or inadequate (requiring substantial repairs) (169). Persons who live in shelter (rented or owned) that meets one or more of these criteria are said to be in core housing need.¹⁷ Townsend noted that although poor housing might be seen as only

¹⁷ Core housing need is not the same as homelessness. In a 2011 Winnipeg study, The Main Street Project found that homeless women's and men's health was severely compromised by living in squalor, without essential hygiene, and by the stresses of coping every day with their circumstances (244).

material deprivation, living in a bad housing also has social and relational effects:

“Housing as space to fulfil individual and family and other social potentialities is different from housing as a hygienic environment in which to serve food, get rid of waste and faeces and protect human bodies from exposure to extreme climatic conditions. Study of what it means to experience housing deprivation can therefore itself take quite complex forms – as for other types of deprivation” (11, p. 127).

In several qualitative studies done in Winnipeg, women reported that the poor state of their housing affected their health either directly because of mould, vermin or draughty conditions, or indirectly because the anxiety and stress resulting from living in substandard housing prevented them from improving their health in other ways (53,54,57).

There are fewer male-specific studies on core housing need. Research evidence has been more routinely focussed on the effects of homelessness on men (or more generally, people), particularly in relation to HIV/AIDS (e.g., Wolitski et al. (170)) or tuberculosis (e.g., Haddad et al. (171)). It is reasonable to infer, however, that men in core housing need are exposed to the same physical hazards of bad housing as women – mould, insects and inadequate heat for example – as well as the same social stresses of living in an unsafe home and having too little money to pay for it.

Langlois and Kitchen used variables for old housing and housing needing major repairs, “because of the high maintenance and replacement costs associated with these

dwellings”. (22, p. 127). They also used a variable for housing tenure as renters usually have lower incomes (they cannot afford to buy a house) and may have fewer choices about where to live. In inner Montreal, young people were more likely to live in older housing and housing in need of repairs, which is a distinct feature of Montreal, given the location of three universities in the central downtown area.

3.4.2.2 Knowledge of official languages

As described above, in an investigation of measures of relative deprivation in Montreal in the 1990s, Kitchen and Langlois included a variable for knowledge of language (22). They said, “This has been done to take into account the possible impact of linguistic barriers on urban deprivation, especially when accessibility to the mainstream labour market is considered as a major factor economic mobility and socio-linguistic integration”. (22, pg 127).

Fluency and literacy have been associated directly with health outcomes, when women or men cannot understand the health treatments and decisions described to them, arising when there are mistakes or misses in translation (172) and when low levels of reading and comprehension limit people’s ability to read prescriptions or treatment instructions, or reluctance to participate in health-promotion programs (173). Lack of familiarity with the dominant language can also create social isolation. Kwok and White for example, found that Chinese-Australian women felt more isolated and distressed when treatment and progress information was not available to them in their first language and was not presented in a culturally sensitive manner (174).

A lack of fluency can also prevent women and men from finding work related to their training. Nurses from non-English speaking backgrounds, for example, reported feeling disempowered, isolated and discriminated against in one Australian study (175). Young refugees (aged 11-19) to Australia (176) were found to require strategic social supports to improve their language fluency and proficiency, cope with schooling and ultimately be able to choose their own career paths. O'Sullivan found that Aboriginal peoples who used an Aboriginal language had attained lower levels of education, and had lower income, labour force participation and employment, but only when they were isolated already from community and family supports (177).

3.4.2.3 Moving

Feelings of belonging to a neighbourhood can help build social capacity and capital. According to Moore et al., perceived neighbourhood cohesion and the feelings of trust were associated with high self-rated health in Montreal. Study participants with higher socio-economic status had stronger personal networks, but people with lower socio-economic status often had stronger ties within their neighbourhoods (178). They found that women in their study had stronger neighbourhood connections than men.¹⁸ In another study in Montreal, researchers found that when individuals talked regularly with their neighbours (179) they were more likely to say that the diversity of their neighbours (in this case diversity refers to ethnic differences) was unimportant to them. In analysis of data from the National Longitudinal Survey of Children and Youth, Abada et al. found that neighbourhood cohesion was beneficial to the general health status of adolescents,

¹⁸ Moore and his colleagues found that women reported significantly stronger social networks than men in their study, but the authors did not persist with the gender analysis when looking at neighbourhood cohesion (178).

but was not protective for depressive symptoms, two health outcomes of interest to the researchers (180)

In the UK, Tunstall et al. found that among people who moved to more deprived neighbourhoods where they were the minority, health outcomes were worst, in comparison to families who moved to less deprived neighbourhoods, although infant birth weight, accidents and mothers' self-rated health remained poor (181).

In an analysis of cross-sectional national survey data from the U.K. Stafford et al. investigated sex and gender differences in women's and men's perceptions of neighbourhood cohesion and associated self-rated health (182). The authors found that while women and men had similar perceptions of neighbourhood cohesion, "*Women living in areas with greater political engagement, less left-wing political climate, greater affluence and less economic deprivation tended to participate in more local groups and associations. In areas of lower unemployment, women also reported seeing local friends more frequently*" (182, p. 1686).

Aspects of the socio-political environment, amenities and the physical environment, and economic characteristics were "*more consistently associated with women's self-rated health ... On the other hand, individual economic activity was more strongly related to self-rated health for men... In contrast with previous work which suggested that social and physical domains are associated with men and women's health differently... we found*

no clear gender division in the characteristics of neighbourhood which were most salient for health” (182, p.1689-90)

Census provides data on citizens who have moved in the last year and those who have moved in the last 5 years. Data are available regarding whether these were moves in or out of provinces, but they are not available by sex.

3.4.2.4 Unpaid work – child care and senior care

There is a strong body of literature about the effects of caregiving on the women and men who provide unpaid care for extended periods of time. While many women and men report that they derive personal satisfaction from caregiving, that it can be a labour of love, it has also been reported (and sometimes by the same respondents in studies) that without respite, caregivers’ physical and mental health becomes strained and compromised (183, 184).

In a 2009 study in the US, Robison et al. found that people providing care to seniors rated their own health well, unless the care had to be given under duress (185). According to the authors, living with the care recipient, having inadequate income and knowing that the care recipients’ needs were not being met, were all factors that contributed to poor health outcomes for the caregivers, such as stress, anxiety, insomnia and depression. The study participants related that it was not the caregiving *per se* that created stress and depression, but rather feeling socially isolated and having no respite were the factors that led to poorer health outcomes (185).

Similarly, women who provide many hours of unpaid child care, without respite or a partner with whom to share responsibilities, have been found to be socially isolated. This was particularly true if they do not at least have the support of family. In a 2010 study from Dublin, Quinn found that low-income women's lives were "shaped by their obligations as care-givers" for their children, and that frequently they reported they were more enduring than enjoying their lives (186).

3.4.3 Summary

The Census variables described above are each intended to capture some aspect of relative deprivation. Material deprivation in the original index (20) is represented by employment rate, personal pre-tax income, and education. New variations of the index I tested included core housing need and unemployment rate¹⁹ as possible alternatives for the representation of relative material deprivation.

Relative social deprivation, understood to be a lack of social networks and capacity that can lead to isolation (11), is represented in the original index by living alone, lone parenthood and being separated, divorced or widowed. Alternates I tested were unfamiliarity with the dominant language in Winnipeg, unpaid work for seniors or children, and moving in the last one or five years.

According to this review of the literature, all but two of the Census variables can be gender-sensitive if they are used to establish and then ameliorate differences between and among the male and female populations in Winnipeg. The exceptions are the variable

¹⁹ See Table 4.1 in the next chapter

related to moving, which cannot be retrieved by sex from the Census data for studies such as this thesis research. As such, they do not meet the criteria for gender-sensitive indicators. However including the variable in sex-specific tests of the deprivation index and setting a gender-specific context does provide more nuanced understanding of the gendered implications and influences this variable may have.

3.5 Measures of Health Outcomes

Variations of the deprivation index were tried, including testing their application to predict health events. In this section, I briefly describe the six health outcomes tested by sex in my statistical analyses: premature mortality rate (PMR), treatment for arthritis, treatment for hypertension, hospitalization for injuries, use of one or more prescription drugs and anti-depressant use. I chose these health measures because they exemplify a small range of markers that would be of interest to health programmers and policy makers in Winnipeg.

Premature mortality rate is a measure of deaths under the age of 75 years, that is, deaths that are premature compared to the life expectancy. PMR is correlated with morbidity and self-rated health as well as with socio-economic indicators (187). It is considered by Cohen to be the “best single indicator of overall health status” and health care need for a region’s population (188, p. DS37).

Chronic diseases are causing considerable concern for men and women, providers and policy makers alike (189,190). Current and projected costs for chronic disease management are frequently used to make the case that Canada can no longer afford publicly funded health care (191). At the same time, health prevention and promotion advocates make a case for greater upstream spending to offset the long-term expense of managing chronic disease (not to mention, to relieve the suffering of patients) (191). Arthritis does not currently receive the same attention as diabetes or overweight/obesity or heart disease. Nevertheless arthritis has an average prevalence of 20% in Manitoba and prevalence has been significantly related to geography (1), income, sex (46), and gender (47).

Similarly, hypertension is a common non-communicable chronic disease. As it frequently precedes other cardiac conditions, and is the primary risk factor for stroke (192), prevention and detection are considered priorities for practitioners and health programmers (189,190). Fransoo et al. found sex differences in hypertension prevalence (46), as well as significant neighbourhood differences in Winnipeg, that indicate income may be a factor (1).

Injuries and injury prevention have been flagged by governments as another area of concern where prevention and health promotion could potentially offset considerable expense. Manitoba Health has an injury prevention program that is rolling out across the province (193). Based on reviews of injury data for the province, we know that two particularly high-risk groups are young men (because of risky behaviours) and elderly

women (because of risk of falls) (194). Hospitalizations for injuries are known to be higher in some populations (125,126), and related to income gradients (1) in Winnipeg.

Although medications can be the most cost-effective means of prevention and treatment for illness (195), pharmaceuticals are one of the larger cost drivers for increasing health care budgets in Manitoba (196). According to the Canadian Institute for Health Information, although drug price inflation has relatively been kept in check, compared with other cost drivers such as medical services, “over the period from 1998 to 2007, prescription drug expenditures grew at an annual average rate of 10.1% per year” (197, p. v). This has been a result of volume increases in prescriptions filled as well as new drug types.

The proportion of Manitobans using antidepressants has been steadily rising (1) and may be indicative of rising levels of chronic mental illness, and possibly some reduction in stigma. In an analysis of 2002 CCHS data for Canada, women’s and men’s self-reports of major depressive episodes, women in every age group reported having had an episode at some time in their lives. Females were more likely to report having had an episode at a younger age than males, but reports declined for both sexes after the age of 55 years (47).

Martens et al. found that treatment for depression showed a significant income-related gradient for Winnipeggers, with treatment prevalence increasing with declining income (198). Women were significantly more likely to be prescribed anti-depressants than males, and in Winnipeg, adolescent girls were twice as likely as adolescent boys to be

prescribed Selective Serotonin Reuptake Inhibitors to treat depression. There may be important other differences within the Winnipeg community in anti-depressant use. In a 2009 study for example, Martens et al. found that Métis residents of Winnipeg had a “significantly higher prevalence of depression compared to all other Winnipeggers” (126, p. 160). Although considerably fewer Métis residents filled prescriptions for anti-depressants than were diagnosed, there was a higher percentage of Métis residents with anti-depressant prescriptions than non-Métis residents.

3.5.1 Summary

I chose six health outcomes to test the predictive value of the deprivation indices in Winnipeg. Each of the health outcomes has demonstrated sex differences in the Winnipeg population, and there is evidence that there are sub-populations of Winnipeg residents who are disproportionately affected by these diseases or events. If the new variations of the deprivation index can be found to be associated with the outcomes in sex-specific populations, there is a potential for an index to be used in directed health planning.

Chapter 4 – Research Design and Methods

4.1 Research Design

This thesis research was an ecological study based on small area analysis for Winnipeg, Manitoba, using data from the 2006 Census and Manitoba health administration data from 2004-2009. An ecological study provides comparisons of groups rather than of individuals, in some cases because individual level data are not available, but in other cases, such as this, when the purpose is to use aggregate individual-level measures to make inferences about a population (rates, proportions or means, for example) (199). Ecological studies are relatively inexpensive and can make use of extant data (21), in comparison to conducting new surveys.

Small-area analysis (also called small area-based study) is a method of ecological study that “uses large administrative databases to obtain population-based measures of utilization and resource allocation” (200). As Diehr et al. described, characteristics of a defined geographical area (such as average personal income) are ascribed to all residents of that area, allowing statistical analyses to test whether the variation between the small areas is greater than would be expected by chance alone (201). Small area analysis has been used in epidemiology to demonstrate how variations in social and economic status can affect health status and the need for health care in a population (201-205), or physicians’ variations in health practice (204,206). As Schuurman et al. (29) noted, the size of the area chosen is important, because residents within a smaller area (a street block, for example) are more likely to have similar characteristics than those who reside

in a wider geographic area. That is, the larger the scale, the greater the heterogeneity of the people in an area (29).

Ecologic studies and analyses are limited, however, by the possibility of making incorrect inferences regarding individuals within the group, based on evidence about the group as a whole. Piantadosi et al. (21) illustrated mathematically that ecological correlations depend on the relative dispersion of the individual level covariates and the response variables. Pampalon et al. (27,28), for example, compared area-based versions of their original index with individual-level versions, and found stronger associations of the individual-level versions with health outcomes such as life expectancy and disability-free life expectancy, than for the area-level versions. Among their findings, they noted that their area-based index underestimated disadvantage for women. Note, however, that their model in these papers used Census enumeration areas (which are larger than dissemination areas) because they were using data from the 1991 Census. The authors conclude that area-based measures still provide a good approximation of relative deprivation for planning purposes, particularly for urban areas (28).

Morgenstern (199) and others (98,207) have noted that: a) some measures can only be made at an area or neighbourhood level (such as proximity to resources, or exposure to industrial toxins); and b) ecologic studies can provide important context which can be used to better understand how health inequalities arise. While an ecological study is limited in its representation of homogeneity of the characteristics of all individuals within an area, it can provide good evidence for area level policy and planning (21,199).

The data used in my research were from the Winnipeg Census Metropolitan Area (CMA), a CMA being defined as having, “a total population of at least 100,000 of which 50,000 or more live in the urban core” (138). Dissemination Areas (DAs), which include between 400 and 700 residents, within the Winnipeg CMA were the geographical unit of analysis. All of Canada is divided into DAs, and they are the smallest geographic level for which Statistics Canada will release Census data (138).

4.1.1 Ethics

This thesis research was conducted in Winnipeg, Manitoba, using anonymous Census data at the Dissemination Area level, provided by Statistics Canada Data Liberation Initiative at the University of Manitoba and anonymized administrative data sets retrieved through the Data Repository at the Manitoba Centre for Health Policy (MCHP). Access and use of data in the Repository is governed by provincial law and policies and procedures of the University of Manitoba and MCHP, as are results derived through data research, to protect the confidentiality, privacy and security of sensitive personal health information. No consent was required from participants and no personal identification was available to me in the course of the research.

Ethics permission was received from the Human Health Research Board, University of Manitoba, Bannatyne Campus (HREB # H2011:384). Permission was also received from the Manitoba Health Information Privacy Committee (HIPC #2011/2012-36) for use of Manitoba Health administration data. The thesis research complied with the strict policies and procedures of the MCHP to protect the privacy and security of data used.

4.2 Data Sources

4.2.1 Census of Canada 2006

The Canada Census of Population collects data on every person (citizens, landed immigrants and refugees) in households in Canada (208). The 2006 Census was issued to 13,576,855 households.²⁰ There were eight questions on the short questionnaire issued to 80% of households, which an adult from every household was required to answer, and the long questionnaire included an additional 53 questions for the remaining 20% of households. Respondents could choose to assent to Statistics Canada linking to their personal income tax forms to reduce their personal burden on answering income-related questions. Federal laws protect the confidentiality of Census data.

Most Census data for this thesis were retrieved through the Data Liberation Initiative at the University of Manitoba. The original index variables were provided as counts per DA (*single, divorced, widowed, living alone, lone parent families, lack of high school diploma*) or as an average for a DA (*employment rate and personal pre-tax income*), for the total population and by sex for the Winnipeg CMA. A second data request was submitted for the new variables (*knowledge of official languages, moved within the last year, moved within the last 5 years, unemployment rate, unpaid child care, unpaid senior care*), which were provided as part of a greater data set for Manitoba. *Moved within last year* and *moved within the last 5 years* were not available by sex.

Table 4.1 provides the Census definitions for the variables used.

²⁰ Enumeration on Indian reserves and settlements was considered incomplete, an important fact regarding the comprehensiveness of the Census, but not relevant for the purposes of my thesis research.

Table 4.1 Census definitions of variables used in deprivation indices, and short forms used in this thesis. Source: Statistics Canada (205).

Census variable	Statistics Canada definition	Variable as used in the index variations (<i>short form</i>)
Core housing need ²¹	“A household is in core housing need if its housing does not meet one or more standards for housing adequacy (repair), suitability (crowding), or affordability and if it would have to spend 30 per cent or more of its before-tax income to pay the median rent (including utilities) of appropriately sized alternative local market housing.”	Proportion of residents in core housing need (<i>core housing need</i>)
Knowledge of official languages	Knowledge of neither official language, and Knowledge of English – “The ability to conduct a conversation in English only, in French only, in both English and French, or in neither English nor French.”	Proportion of residents with No English (<i>no English</i>) Proportion of residents with No official language (<i>no official language</i>)
Labour force participation	<p>Employed – “Persons who, during the week (Sunday to Saturday) prior to Census Day (May 16, 2006):</p> <ol style="list-style-type: none"> 1. did any work at all for pay or in self-employment or without pay in a family farm, business or professional practice 2. were absent from their job or business, with or without pay, for the entire week because of a vacation, an illness, a labour dispute at their place of work, or any other reasons.” <p>The employment rate is the number of persons employed in the week prior to Census Day, expressed as a percentage of the total population 15 years of age and over.</p> <p>Unemployed – “Persons who, during the week (Sunday to Saturday) prior to Census Day (May 16, 2006), were without paid work or without self-employment work and were available for work and either:</p> <ol style="list-style-type: none"> 1. had actively looked for paid work in the past four weeks; or 2. were on temporary lay-off and expected to return to their job; or 3. had definite arrangements to start a new job in four weeks or less.” <p>The unemployment rate for a particular group is the unemployed in that group, expressed as a percentage of the labour force</p>	<p>Proportion of residents employed (<i>employment rate</i>)</p> <p>Proportion of residents unemployed (<i>unemployment rate</i>)</p>

²¹ Core housing need is a derived variable, retrieved from the Canadian Mortgage and Housing Corporation (103).

	in that group, in the week prior to enumeration.	
Living alone	“Number of persons occupying a private dwelling.”	Proportion of persons living alone <i>(living alone)</i>
Lone parent family	<p>“Refers to the classification of census families into married couples (with or without children of either or both spouses), common-law couples (with or without children of either or both partners), and lone-parent families by sex of parent. A couple may be of opposite or same sex. 'Children' in a census family include grandchildren living with their grandparent(s) but with no parents present.”</p> <p>Census families are “A married couple (with or without children of either or both spouses), a couple living common-law (with or without children of either or both partners) or a lone parent of any marital status, with at least one child living in the same dwelling. A couple may be of opposite or same sex. 'Children' in a census family include grandchildren living with their grandparent(s) but with no parents present”</p>	Proportion of households with a lone parent <i>(lone- parent household)</i>
Marital status	<p>Separated – “Persons currently married, but who are no longer living with their spouse (for any reason other than illness or work) and have not obtained a divorce. Persons who are separated but who live with a common-law partner are not included in this category.”</p> <p>Divorced – “Persons who have obtained a legal divorce and who have not remarried. Persons who are divorced but who live with a common-law partner are not included in this category.”</p> <p>Widowed – “Persons who have lost their spouse through death and who have not remarried. Persons who are widowed but who live with a common-law partner are not included in this category.”</p>	Proportion of residents who are separated, divorced or widowed <i>(separated/divorced/widowed)</i>
Moved	<p>Within last year and Within last 5 years - “Refers to the relationship between a person's usual place of residence on Census Day and his or her usual place of residence one year or five years earlier.”</p>	<p>Proportion of residents who moved in the last year <i>(moved in the last year)</i></p> <p>Proportion of residents who moved in the last 5 years <i>(moved in the last 5 years)</i></p>
Personal pre-tax income	“Average income of individuals refers to the dollar amount obtained by adding up the total income of all individuals 15 years of age and over who reported income for 2005 and dividing this sum by the number of individuals with income.”	Average personal pre-tax income <i>(income)</i>

Unpaid work	<p>Child care – “Number of hours that the person spent looking after children without getting paid for doing so. For example, this includes time spent taking care of one's own children or looking after the children of relatives, friends or neighbours. The time spent on this activity is divided into blocks of hours (none, less than 5 hours, 5 to 14 hours, 15 to 29 hours, 30 to 59 hours, and 60 hours or more). Only hours spent on the activity during the week before Census Day are counted.”</p> <p>Senior care – “Number of hours that the person spent providing care or assistance to elderly people without getting paid for doing so. This includes time spent giving personal care to an elderly relative, helping elderly neighbours with their shopping, and so on. The time spent on this activity is divided into blocks of hours (None, Less than 5 hours, 5 to 9 hours, 10 to 19 hours, and 20 hours or more). Only hours spent on the activity during the week before Census Day are counted.”</p>	<p>Proportion of residents who did 60 or more hours of unpaid child care <i>(child care)</i></p> <p>Proportion of residents who did 20 or more hours of unpaid care for seniors <i>(senior care)</i></p>

Core housing need is a derived variable from the Census. A request was submitted to the Canadian Mortgage and Housing Corporation, which provided DA-level *core housing need* for the city of Winnipeg, not the entire CMA, by sex.

Senior care and *child care* are recorded in the Census data in incremental hours of unpaid work. In each case, the category with the most hours per week was used in this research: for *senior care* this is 20 or more hours of unpaid care; and for *child care* it is 60 hours or more of unpaid care.

4.2.2 MCHP Repository Data

Data from six databases held by MCHP (209) were used to investigate health outcomes.

The **Registry** data represent all Manitoba residents, registered through unique personal health identification numbers. The Registry database at MCHP contains scrambled, anonymized personal health identification numbers (PHIN). Date of birth, sex, most recent postal code of residence, entry and exit to register, date of death and reason for leaving register are also included.

The **Long Term Care** database can be used to identify residents in personal care homes (i.e. nursing homes) in Winnipeg and other Regional Health Authorities.

The **Prescription** data base was established in 1994 and provides on-line electronic information about every prescription filled in every community pharmacy in Manitoba, regardless of payer or insurers, including dosage, drug code (DIN), prescription date and

information about the patient for whom the prescription was written. The database does not however, provide information about why a physician wrote the prescription for a patient. The database also does not include prescription drugs dispensed in hospitals.

The **ATC** data set holds the Anatomic, Therapeutic, Chemical codes for classifying drugs. Drugs are divided into different groups according to the organ or system upon which they act and their therapeutic, pharmacological and chemical properties. While a DIN specifies a dosage and formulation, an ATC code captures all related formulations. This means that a prescription for the same drug but slightly modified in form is captured as being part of the same drug family.

The **Medical Services** dataset is a record of all Manitobans receiving care from Manitoba physicians. Fee-for service providers must submit claims to Manitoba for reimbursement. Salaried physicians submit evaluation claims, called shadow billing.

Lastly, the **Hospital Discharge Abstract** database is “A set of data that includes inpatient hospital separations and major surgical outpatient cases that are performed on an inpatient or outpatient basis, for all regions during a given year” (209). The abstract contains information from patients’ hospital-stay medical records including sex, postal code of residence, diagnoses, procedures and length of stay. As many as 25 diagnosis codes based on the International Classification of Diseases and Related Health Problems, 10th Revision, Canada (ICD-10-CA) and 20 intervention (procedure) codes based on the

Canadian Classification of Health Interventions (CCI) are included per patient, per hospital admission.

MCHP provided 5 datasets for this thesis research, drawn from the Repository. These datasets were:

1. A subset of the Registry which included only those Manitoba residents who were 19 years of age or older in 2004-2009. DAs had been assigned to all residents' postal codes and were included in the data subset. Residents of long-term care facilities had been excluded from the subset, as the deprivation index includes only persons in private households;
2. A subset of the Medical Services dataset, for years 2004-2009;
3. Two subsets of the Pharmacy dataset:
 - a. Number of prescriptions filled per resident for the years 2007, 2008 and 2009;
 - b. Registrants who had one or more prescription filled for any drugs prescribed for hypertension, arthritis or depression;
4. A subset of the Hospital Discharge Summary dataset for 2004-2009.

4.3 Methods

The thesis research was done in two parts. In Part One, the original deprivation index was replicated for the total population and by sex. New versions of the index were then derived using different combinations of Census variables (six at a time) to represent material and social aspects of deprivation. New versions were tested for the total adult

population and for adult females and adult males separately. Part Two explored the relationship between the deprivation indices and health outcomes represented in administrative data held at MCHP, by sex and for the total adult population.

4.3.1 Part One – Deprivation Index

4.3.1.1 Data manipulation

Census data files sorted using Beyond 20/20 software (Statistics Canada) were exported to SAS for further manipulation and statistical analysis. All further data manipulations and statistical analyses were done using SAS[®] version 9.2 computer software (210).

All DAs with fewer than 250 adults (aged 15 years or older) living in private households were omitted from the analyses, to ensure each DA sample was sufficiently robust (20). *Single, divorced and widowed* were combined for each of males, females and the total population to create a new variable, *single/divorced/ widowed. No English* was calculated by subtracting the number of residents who did not know English from the total number of residents who knew one official language. The proportion of the population in every DA aged 65 years or more was calculated for the total population and by sex. Rates for all Census variables were calculated for the total population, and for males and females separately, per DA. In the case of *lone parent family*, the variable used in the index was a proportion of the families with a lone parent (by sex and for the total) over the total number of census families for each DA. As described by Kinniburgh et al., “*Because the proportion of lone parents is expressed as a proportion of the number of census family reference persons, it [is not possible] to use a sex-specific denominator for this indicator. For all models (total, male, and female) the proportion is therefore the sex-specific*

number of family heads who are lone parents divided by the total number of census families in each DA” (36, p. 62) .

DA-level rates for pre-tax personal income were log transformed, and the rates for persons living alone were arcsine transformed to normalize the distribution of the data (26). Univariate analyses of all other variables demonstrated that transformation was not required or that transformation did not improve the distribution.

4.3.1.2 Statistical analysis

Analyses of the different versions of the deprivation index (including the original) replicated the principal component analysis methods used by Pampalon et al. (SAS VARIMAX rotation) (20,26-28). Principal component analysis is a statistical technique that reduces variables into a smaller number of artificial variables that account for most of the variance represented in the original variables (211). According to Hatcher, “It is useful when you have obtained data on a number of variables ... and believe that there is some redundancy in those variables,” – redundancy referring to the possibility that the variables are correlated with each other, because “they are measuring the same construct” (211, p. 2). The close association of unemployment and education level (in this case, not completing high school) to average personal income exemplifies this kind of redundancy.

For the variations of the deprivation index, principal component analysis was used to reduce six Census variables to summary variables used to represent material and social deprivation. Factor scores derived in the principal component analyses for each version

of the index were assigned to “material” or “social” deprivation in accordance with the intended representation of the variables.

New versions of the deprivation index were initially run for the total population. Indices considered satisfactory were then re-run by sex. *Core housing need* was tested both as a potential “material” variable and as a “social” variable. Based on initial results, an additional set of indices were run using the variables *moved in the last year* and *moved in the last 5 years*. As noted, these variables could not be sex-disaggregated, therefore rates for the total population for each of these variables for each DA were included in the otherwise sex-specific indices. Two indices which included *child care* and *core housing need* were run by sex only.

Generally, results from principal component analysis are satisfactory when the factors explain at least 70% of total variance. Simple structure is identified when a variable has a strong association (factor score ≥ 0.40) on one component and weak or no association (factor score approaches 0) on the other(s) (211). A factor score between 0.30 and 0.39 is considered a moderate association (36), but for this thesis research, I used 0.40 as a cut-off.

Indices that showed distinct factor loading to two components were chosen for the negative binomial regressions. Absolute values and upper and lower confidence limits for the factor scores were assigned to every DA for the population of interest – total, females and males – and these absolute values were used in the regression models.

4.3.2 Part Two – Sex Differences in Deprivation and Health

4.3.2.1 Data manipulation

Using standard MCHP codes, new data sets were created for Manitoba residents who fit case descriptions for arthritis, hypertension, hospitalizations for all injuries, use of any prescription drug, anti-depressant use, and premature mortality. Case descriptions were based on previously validated definitions, as described in Table 4.2. Each new data set was merged with the Registry subset by scrambled personal health information number. Proportions for health events were then created for every Winnipeg DA for males, females, and the total population. These rates were the dependent variables in the regression models.

4.3.2.2 Statistical analysis

Following methods used by Pampalon et al. (26) and Chateau (37), negative binomial regressions models were created to test the suitability of the original index and the “best” other indices to predict health events.²² Negative binomial regressions are used for “analyses for count data that follow a negative binomial distribution, which occurs when an event is relatively rare, but is highly variable over the entire population” (212, 213).

²² Note however, that in published papers Pampalon et al. created quintiles of DAs ranging from “least deprived” to “most deprived” and used these rankings in their negative binomial regressions models (20,26,27)

Table 4.2 Definitions and values for select health outcomes. Source: Fransoo et al. (1)²³

Health Outcome Indicators	Definition	Values ²⁴
Premature Mortality Rate (PMR)	The number of deaths among area residents under 75 years old, per 1000 residents under 75, per year.	Rates calculated for 5-yr periods 2004-2009 Age-adjusted to the 2006 Manitoba population in the first time period, for males and for females.
Arthritis	The proportion of residents age 19 or older diagnosed with arthritis (rheumatoid or osteoarthritis) in a 2-year period, by either: At least two physician visits or home hospitalization with an ICD-9-CM code of 274, 446, 710-721, 725-729, 739 (ICD-10 codes M00-M03, M05-M07, M10-M25, M30-M36, M65-M79) OR One physician visit with an ICD listed above and two or more prescriptions for arthritis medications. ²⁵	Percent of residents treated for arthritis. Values calculated for 2-year period, 2007 – 2009, age-adjusted to the 2006 Manitoba population (19+) for males and for females.
Hypertension	The proportion of residents age 19 or older diagnosed with hypertension in a one- year period by either: At least one physician visit or one hospitalization (ICD-9-CM codes 401-405 (ICD -10_CA codes I10-I13, I15) Or Two or more prescriptions for hypertension drugs.	Percent of residents treated for high blood pressure, by sex. Values calculated for 2009.
Injury hospitalization rates	The number of hospital separations of Winnipeg residents for which any injury code was included as one of the diagnoses, per 1000 residents per year. It is a measure of the total number of injury-related separations from acute care facilities by all residents of the area. Encompasses injuries by all causes (including self-inflicted) Any inpatient hospitalization with an external cause of injury diagnosis coded (E-codes), ICD-9-CM codes E-800-E999; ICD -10-CA codes V01-Y89. Excludes hospitalization due to injury related to medical error or drug complications:	Rates calculated for 4-year period 2005-2009, age-adjusted to the 2006 Manitoba population in 2006 for males and females.

²³ Year values requested were updated from those used in the *RHA Atlas*.

²⁴ Note that values were calculated for the total population and for the sex-specific populations.

²⁵ Lists of relevant drugs are in Fransoo et al. (1).

	<p>Misadventures during surgical or medical care ICD-9-CM codes E870-E876; ICD-10-CA codes Y60-Y69, Y88.1;</p> <p>Reactions or complications due to medical care, ICD-O-CM codes E878-E879; ICD-10-CA codes Y70-Y84, Y88.2, Y88.3</p> <p>Adverse effects due to drugs, ICD-O-CM codes E930-E949; ICD-10-CA codes Y40-Y-59, Y 88.0</p>	
Total Prescription Use	<p>The proportion of residents who had at least one prescription dispensed in a given year. Includes all prescriptions dispensed from community-based pharmacies in Winnipeg (does not include prescription drugs given to hospitalized patients).</p>	<p>Percent use. Values calculated for 2007/2008 and 2008/09,</p>
Antidepressant use	<p>The proportion of residents who have had at least two prescriptions for antidepressants (ATC cod N06A) in a given year. Includes all sub-types of antidepressants, some of which may be prescribed for reasons other than depression.</p>	<p>Percent of residents with two or more prescriptions dispensed for antidepressants.</p>

The log of the population in each DA was included in the model as an offset to account for the differing populations of every DA (117). The negative binomial regression models were tested for social and material deprivation, for interaction of social and material deprivation and for the proportion of the populations aged 65 years and over.

The general model was thus:

$$\text{health event} = \text{social deprivation} + \text{material deprivation} + \text{social*material deprivation} + \text{proportion of the population age } 65^+$$

Both the dependent (rates of health outcomes per DA) and independent variables (proportions per DA) in this model are continuous variables. The results were exponentiated to derive the Relative Rates (RR), to determine how the rate of the health outcome, the dependent variable, in each model changed with an increase in an independent variable.

The inclusion of a variable for age (aged 65⁺) was decided upon to take into consideration the likelihood that in any given DA the proportion of residents aged 65 years or more would be predictive of the health event in question.

Results were considered significant if $p < .05$.

Chapter 5 – Results

5.1 Description of Winnipeg Dissemination Areas and Variables

The Winnipeg Census Metropolitan Area (CMA) contains 1,164 Dissemination Areas (DAs) in which there is a minimum of 250 residents aged 15 and over living in private households. As noted, the data for *core housing need* were limited to the Winnipeg geographical boundary and so there were only 1,150 DAs for that variable with the same criteria for number of adults living in private households.

The total population in the Winnipeg CMA DAs used (> 250 residents 15 years or older) was 562, 640, with a female population of 292,000 (51.9%) and a male population of 270,635 (48.1%).

Table 5.1 summarizes the numbers and mean rates for the Census variables, for the total population and for each sex in the DAs used in the datasets.

Females over the age of 15 in Winnipeg were more likely to be separated, divorced or widowed, living alone, and unemployed than males, and than the total population in 2006. Women were nearly twice as likely to be separated, divorced or widowed as males (18.16%, compared with 9.25%), and the proportion of females leading a household as a lone parent was almost five times greater than the proportion of males leading lone-parent households (15.82% and 3.42%, respectively). Males were more likely to be employed than females and the mean for the total population. Average pre-tax personal

Table 5.1. Mean, median and inter-quartile proportions for variables used in deprivation index variations, by population, per dissemination area, Winnipeg, 2006 Census.

Variable name (number of DAs)	Percent of Total Population	Percent of Female Population	Percent of Male Population
	Mean per DA, Median (Q1-Q3)	Mean per DA, Median (Q1-Q3)	Mean per DA, Median (Q1-Q3)
Single, divorced, or widowed (n=1139)	14.03, 13.06 (8.5%-18.3%)	18.16, 16.7 (10.9-24.1)	9.25, 8.33 (4.5-13.5)
Living alone (n=1161)	14.42, 11.69 (5.80-19.10)	14.90, 11.50 (5.88-20.51)	13.60, 10.47 (5.26-19.57)
Lone parent family	19.22, 16.13 (9.52-26.92)	15.82, 13.27 (7.69-22.22)	3.42, 0 (0-6.90)
Employment rate (n=1161)	65.65, 67.42 (59.21-73.56)	61.59, 63.04 (53.45-70.83)	70.26, 71.43 (63.46-78.57)
No high school (n=1160)	23.52, 22.1 (16.1-29.7)	23.17, 21.42 (14.89-29.55)	23.81, 22.50 (15.80-30.43)
Average personal pre-tax income (n=1162)	\$33 509, \$31 139 (\$26 150-\$37 675)	\$27 355, \$26 090 (\$22 262-\$30 744)	\$40 078, \$36 072, (\$29 512-45 298)
Unemployment rate (n=1164)	5.20, 4.30 (2.70-7.10)	5.37, 5.00 (0-8.70)	5.11, 4.9 (0-8.10)
No English (n=1161)	12.01, 9.42 (6.06-15.06)	13.20, 10.57 (6.25-17.14)	10.80, 8.5 (4.69-13.64)
No official language (n=1161)	0.84, 0, (0-1.55)	1.05, 0 (0-0)	0.61, 0 (0-0)
Senior care (20+ hours / week) (n=1160)	1.20, 0 (0-2.04)	1.83, 0 (0-4.0)	0.96, 0 (0-0)
Child care (60+ hours/week) (n=1160)	5.85, 5.50 (3.33-7.95)	10.58, 10.0, (6.00-14.55)	3.70, 3.85 (0-6.06)
Core housing need (n=1055)	9.93, 6.65 (2.22-13.95)	14.84, 7.23 (2.60-15.85)	9.02, 5.56 (0-12.86)
Moved in the last year (n=1161)	13.98, 11.58 (6.18-19.25)	n/a	n/a
Moved in the last 5 years (n=1161)	38.02, 35.57 (24.71-48.43)	n/a	n/a

income in Winnipeg for males was \$40,078 (median \$36,072) whereas for females, the average pre-tax income was \$27,355 (median \$26,090). Males had a slightly lower unemployment rate (5.11%) compared to females (5.37%) and the population as a whole. The rate for non-completion of high school was similar for all three populations. Male-female differences were not tested for significance.

Eleven percent of males in Winnipeg had no English, compared with 13% of females, and males were less likely to report having no familiarity with either official Canadian language (0.61%), compared with females (1.05%). Twice as many females as males provided 20 hours or more unpaid care to seniors, and females were three times as likely to provide 60 hours or more of unpaid child care. More females (14.8%) than males (9.0%) reported being in core housing need.

5.2 Part One - Principal Component Analyses

5.2.1 Original Deprivation Index

Principal component analysis was conducted for the variables in the original index for Winnipeg DAs for the total population and for the female and male populations separately. Factor scores have '+' or '-' values depending on how the statistical software has rotated the variances of the orthogonal measures. The directions assigned (+ or -) do not have to match for the loadings to be considered similar between studies. According to Burstyn, "Negative correlations among variables and negative loadings do not cause any specific concerns in PCA. In the interpretation of PCA, a negative loading simply means that a certain characteristic is lacking in a latent variable associated with the given

principal component” (214). In comparing my results with earlier research, it is the similarity of absolute values of the factor scores that is of interest.

Table 5.2 compares the results of the principal component analysis with the results from the Centres of Excellence 2011 study (36) and the national version of the original index from Pampalon et al. (26). Factor values >0.40 (representing strong association with the component) are bolded. Note that results for Pampalon et al. are for “Other CMAs”, and were not provided for Winnipeg specifically (26). It is important to note that Kinniburgh et al. followed the methods of Pampalon et al. and assigned a reverse value to all variables, to account for the fact that employment rate is really desired in the negative, “not employed”, for the purposes of representing disadvantage in the original index. I did not replicate this particular step in my analyses. Therefore my results appear to be mirror images of the results from the 2009 and 2011 studies (26,36)

Eigenvalues greater than 1 are considered desirable for rotated factors in principal component analyses (215,216). All eigenvalues for the components were >1 .

Consistent with the results of Pampalon et al. (26) (for “Other CMAs”), and Kinniburgh et al. (36), PCA of the original index did not separate cleanly for the two factors, material and social. In my analysis for the total population, *lone-parent families* loaded on the material component, rather than on the desired social component, and *employed* loaded with the social rather than the material variables. Results from Kinniburgh et al. showed

Table 5.2. Comparison of factor scores for original index, Winnipeg CMA, by population.

Original Index Total Population	Thesis Results ^a		Results from Centres of Excellence (Kinniburgh, 2011) ^b		Results from Pampalon et al. (2009) for “Other CMAs” ^c	
	Material	Social	Material	Social	Material	Social
Separated, widowed, or divorced	0.28	0.87	-0.24	0.86	-0.30	0.84
Living alone	0.13	0.89	-0.12	0.88	-0.04	0.89
Lone parent household	0.75	0.27	-0.63	0.51	-0.52	0.56
No high school certificate	0.84	0.16	-0.83	0.06	-0.85	-0.01
Employed	-0.31	-0.71	0.73	-0.15	0.67	-0.23
Pretax personal income	-0.84	-0.24	0.79	-0.30	0.78	-0.35

Original Index	Female Population				Male Population			
	Thesis Results		Results from Centres of Excellence		Thesis Results		Results from Centres of Excellence	
	Material	Social	Material	Social	Material	Social	Material	Social
Separated, widowed, or divorced	0.26	0.87	-0.16	0.88	0.30	0.81	-0.06	0.87
Living alone	0.03	0.91	0.00	0.83	0.36	0.71	-0.23	0.74
Lone parent household	0.72	0.24	-0.65	0.47	-0.02	0.64	-0.08	0.52
No high school certificate	0.83	0.19	-0.70	0.15	0.87	-0.02	-0.74	0.05
Employed	-0.41	-0.66	0.70	0.00	-0.62	-0.29	0.69	-0.08
Pretax personal income	-0.85	-0.10	0.81	-0.02	-0.76	-0.27	0.76	-0.31

^a Bolded factor scores denote strong association with component (≥ 0.40)

^b Kinniburgh et al. (36)

^c Pampalon et al., 2009 Table 3. (27)

that *lone parent families* loaded on both the material and the social components (36), findings which were similar to those of Pampalon et al. for the “Other CMAs” (26).

For the Winnipeg male population, factor loadings for the original index were more consistent with the intended representations of the variables for social and material deprivation. These results are similar to those found by Kinniburgh et al. in 2011 (36), when the original index was tested by sex.

Results for the Winnipeg female-only population demonstrated factor loadings that help to explain the results seen for the total population. In my analysis, *lone parent families* loaded on the material component and *employed* loaded on the social components, as was seen for the total population. Kinniburgh et al. (36) also found stronger loading of *lone parent families* on the material component, but the variable also loaded as a social factor in their research. Kinniburgh’s results did not demonstrate the differences for *employment* in the female population found in my analysis (36).

5.2.2 Variations of the Index for the Total Winnipeg Population

Seventeen variations of the index were tested for the total Winnipeg population. In all variations *unemployment rate* was used to replace *employment rate*.²⁶ *No official language, no English, senior care* and *child care* were tested for their suitability as indicators of the social aspects of the deprivation index. *Core housing need* was tested as a possible replacement on the material component of the index, except in three cases in which it was tested for possible use as a variable for social deprivation.

²⁶ I remind the reader to refer to Table 4.1 for the variable definitions.

Results of the principal component analyses for the first eight variations of the index are presented in Table 5.3. Indices A to H tested the utility of the variables *no English*, *no official language*, *child care*, *senior care*, or *core housing need* as replacements for *lone-parent families*. *Senior care* (indices C and G), *child care* (indices D and H), *no English* (indices B and F) and *no official language* (indices A and E) were tested as replacements for *lone-parent families* on the social component of the index. *Core housing need* was tested as a possible replacement for *no high school certificate* (indices E to H).

The language variables consistently loaded with the material component in the principal component analysis, as illustrated in indices A, B, E and F. Although in index F *no English* also loaded on the social component, there was no clear separation of social and material components at all in that index variation. Thus the language variables were not good representations of social deprivation in these variations of the original index.

Loading on the material side of the indices likely illustrates the confounding of lack of language fluency with inability to find employment and with personal income, and quite likely also with living in housing that is unaffordable, inadequate or unsuitable (*core housing need*) (indices E and F).

Child care loaded on the material factor side in index D and index H. In both indices income loaded with the material and the social components, so the index no longer clearly separated social from material deprivation in these models.

Table 5.3. Comparison of factor scores for original index and new indices (A-H) for total population, Winnipeg CMA.

Original Index	Material ^a	Social	Index A	Material	Social	Index B	Material	Social
Separated, widowed, or divorced	0.28	0.87	Separated, widowed, or divorced	0.19	0.89	Separated, widowed, or divorced	0.27	0.84
Living alone	0.13	0.89	Living alone	0.09	0.91	Living alone	0.13	0.90
Lone parent household	0.75	0.27	No official language^b	0.67	-0.17	No English	-0.59	0.38
No high school	0.84	0.16	Unemployed	0.60	0.19	Unemployed	0.60	0.19
Employed	-0.31	-0.71	No high school	0.78	0.27	No high school	0.79	0.24
Pretax personal income	-0.84	-0.24	Pretax personal income	-0.72	-0.41	Pretax personal income	-0.73	-0.40
Index C	Material	Social	Index D	Material	Social	Index E	Material	Social
Separated, widowed, or divorced	0.23	0.90	Separated, widowed, or divorced	0.23	0.86	Separated, widowed, or divorced	0.10	0.88
Living alone	0.13	0.92	Living alone	0.11	0.90	Living alone	0.11	0.90
Senior care	0.03	0.14	Child care	0.68	-0.39	No official language	0.68	-0.18
Unemployed	0.72	0.05	Unemployed	0.62	0.17	Unemployed	0.67	0.16
No high school	0.83	0.19	No high school	0.77	0.27	Core housing need	0.68	0.49
Pretax personal income	-0.78	-0.33	Pretax personal income	-0.73	-0.40	Pretax personal income	-0.71	-0.44
Index F	Material	Social	Index G	Material	Social	Index H	Material	Social
Separated, widowed, or divorced	0.18	0.83	Separated, widowed, or divorced	0.31	0.84	Separated, widowed, or divorced	0.13	0.86
Living alone	0.16	0.89	Living alone	0.39	0.79	Living alone	0.12	0.90
No English	-0.60	0.40	Senior care	-0.23	0.43	Child care	0.71	-0.36
Unemployed	0.66	0.15	Unemployed	0.75	-0.09	Unemployed	0.67	0.16
Core housing need	0.70	0.47	Core housing need	0.82	0.25	Core housing need	0.71	0.47
Pretax personal income	-0.73	-0.40	Pretax personal income	-0.79	-0.24	Pretax personal income	-0.70	-0.44

^a Bolded factor scores denote strong association ($\geq .40$)

^b Bolded variables denote changes from the original index.

Senior care did not load clearly on either the material or the social components of index C. Index G, however did show clear separation and loading between material and social deprivation, with *senior care* as a social component of deprivation.

Core housing need, tested for its utility to represent material deprivation, loaded on both the material and social components of Indices E, F and H. Among the first eight index variations tested, only Index G showed a clear loading of *core housing need* on the material component.

Of the first eight index variations tested, only Index G showed clear loadings of the variables on material and social components in the principal component analysis, in the manner in which they were assigned to the index for their theoretical representation of relative deprivation: *separated/divorced/widowed, living alone* and *senior care* to represent social deprivation; and *unemployed, core housing need* and *pre-tax personal income* to represent material deprivation. Given the satisfactory results for Index G, it was then tested for each of the sex-specific populations (see section 5.2.3 below).

Tests of the subsequent nine variations of the index (Indices 1 to 9) investigated the validity of using *moved in the last year* and *moved in the last 5 years* to represent social deprivation (Table 5.4.). Two indices produced clear separation of material and social components, Index 1 and Index 2, with Index 2 (*moved in last 5 years*) giving stronger loading values to each of the components. In both these indices the *moved* variables replaced the original variable of *lone-parent families*. These results are consistent with

Table 5.4. Factor scores for deprivation indices using *moved in last year* and *moved in last 5 years* (1-9), Winnipeg CMA, total population.

Index 1	Material ^a	Social	Index 2	Material	Social	Index 3	Material	Social
Separated, widowed, or divorced	0.19	0.85	Separated, widowed, or divorced	0.23	0.82	Separated, widowed, or divorced	0.15	0.90
Living alone	0.10	0.94	Living alone	0.11	0.93	Living alone	0.25	0.89
Moved in 1 year^b	0.37	0.57	Moved in last 5 years	0.23	0.70	Moved in last year	0.64	0.37
No high school	0.82	0.16	No high school	0.85	0.14	Unemployed	0.77	-0.06
Unemployed	0.71	0.09	Unemployed	0.69	0.12	Pretax personal income	-0.75	-0.31
Pretax personal income	-0.77	-0.36	Pretax personal income	-0.78	-0.36	Core housing need	0.80	0.34
Index 4	Material	Social	Index 5	Only 1 Factor Created		Index 6	Only 1 Factor Created	
Separated, widowed, or divorced	0.12	0.88	Separated, widowed, or divorced			Living alone		
Living alone	0.20	0.90	Core housing need			Core housing need		
Moved in last 5 years	0.51	0.54	Moved in last 5 years			Moved in last year		
Unemployed	0.80	-0.04	No high school			No high school		
Pretax personal income	-0.75	-0.33	Unemployed			Unemployed		
Core housing need	0.78	0.38	Pretax personal income			Pretax personal income		
Index 7	Material	Social	Index 8	Material	Social	Index 9	Material	Social
Child care	0.12	0.97	Separated, widowed, or divorced	0.22	0.84	Separated, widowed, or divorced	0.23	0.80
Core housing need	0.86	0.10	Living alone	0.17	0.93	Living alone	0.13	0.93
Moved in last year	0.71	-0.06	Moved in last year	0.47	0.50	Moved in last 5 years	0.31	0.67
No high school	0.71	0.27	No high school	0.84	0.10	No high school	0.87	0.10
Unemployed	0.60	0.19	Core housing need	0.78	0.36	Core housing need	0.73	0.42
Pretax personal income	-0.84	-0.15	Pretax personal income	-0.86	-0.24	Pretax personal income	-0.86	-0.27

^a Bolded factor scores denote strong association ($\geq .40$).

^b Bolded variables denote changes from the original index.

those of Chateau (37) and Chateau et al. (117). Indices 1 and 2 were therefore also subsequently tested by sex (see section 5.2.3 below).

Principal component analysis of indices 5 and 6, in which *core housing need* was included for its potential as a social component of deprivation, resulted in one factor only each. Index 9, which included *core housing need* to represent one of the aspects of material deprivation, showed loadings of the variables to the two factors that were close to the desired results. Because of its potential for describing relative deprivation for females in Winnipeg, Index 9 was subsequently tested by sex.

5.2.3 Deprivation by Sex – Principal Component Analyses of Select Indices

Principal component analyses for the female-only and male-only populations were conducted for variations of the deprivation index that had resulted in satisfactory factorial loading for the total population. Results of the analyses are presented in Table 5.5.

Index 1, with *moved in last year* as a social variable and which had demonstrated good separation of material and social components for the total Winnipeg population, did not produce consistent results for the sex-specific populations, and did not result in satisfactory loading to the two components for either sex. *Personal pre-tax income* did not load well to either component for the female population in index 1, whereas for the male population, *unemployment rate* did not load well to either component.

Table 5.5 Comparison of factor scores for total, female and male populations, indices 1, 2, 8, 9 & G, Winnipeg CMA.

Index 1	Total Population ^a		Females		Males		Index 2	Total Population		Females		Males	
	Material	Social	Material	Social	Material	Social		Material	Social	Material	Social	Material	Social
Separated, widowed, or divorced	0.19	0.85	0.15	0.88	0.14	0.79	Separated, widowed, or divorced	0.23	0.82	0.14	0.86	0.20	0.74
Living alone	0.10	0.94	0.05	0.93	0.14	0.89	Living alone	0.11	0.93	0.01	0.92	0.17	0.88
Moved in 1 year ^b	0.37	0.57	0.45	0.44	0.25	0.70	Moved in last 5 years	0.23	0.70	0.33	0.60	0.15	0.77
No high school	0.82	0.16	0.77	0.21	0.84	0.07	No high school	0.85	0.14	0.79	0.22	0.86	0.04
Unemployed	0.71	0.09	0.67	-0.05	0.60	0.14	Unemployed	0.69	0.12	0.67	-0.01	0.58	0.15
Pretax personal income	-0.77	-0.36	-0.80	-0.20	-0.72	-0.42	Pretax personal income	-0.78	-0.36	-0.80	-0.22	-0.72	-0.41
Index 8	Total Population		Females		Males		Index 9	Total Population		Females		Males	
	Material	Social	Material	Social	One Factor Only			Material	Social	Material	Social	Material	Social
Separated, widowed, or divorced	0.22	0.84	-0.15	0.87			Separated, widowed, or divorced	0.23	0.80	-0.14	0.85	0.16	0.73
Living alone	0.17	0.93	-0.02	0.93			Living alone	0.13	0.93	0.03	0.93	0.18	0.88
Moved in last year	0.47	0.50	-0.45	0.42			Moved in last 5 years	0.31	0.67	-0.31	0.58	0.20	0.75
No high school	0.84	0.10	-0.82	0.21			No high school	0.87	0.10	-0.83	0.23	0.89	0.03
Core housing need	0.78	0.36	-0.26	-0.02			Core housing need	0.73	0.42	-0.26	-0.01	0.64	0.54
Pretax personal income	-0.86	-0.24	0.87	-0.17			Pretax personal income	-0.86	-0.27	0.86	-0.21	-0.79	-0.37
Index G	Total Population		Females		Males								
	Material	Social	Material	Social	Material	Social							
Separated, widowed, or divorced	0.31	0.84	0.19	0.89	0.72	-0.10							
Living alone	0.39	0.79	0.17	0.90	0.83	-0.10							
Senior care	-0.23	0.43	-0.07	0.10	-0.06	0.90							
Unemployed	0.75	-0.09	0.69	-0.15	0.44	0.38							
Core housing need	0.82	0.25	0.80	0.26	0.81	0.18							
Pretax personal income	-0.79	-0.24	-0.81	-0.14	-0.75	-0.23							

^a Bolded factor scores denote strong association (≥ 0.40)

^b Bolded variables denote change from original index.

Index 2, with *moved in last 5 years*, showed good separation of the social and material components for both sexes, with factor loading values that were all consistently strong for their respective sex-disaggregated variables.

Indices 8 and 9, which each included *core housing need* as a variable for material deprivation, did not demonstrate satisfactory results for either sex-specific population. Index 8 could not be separated to two factors for the male population and *core housing need* in Index 9 loaded differently for males than for females, with strong loadings on both factors for males and weak loadings on both factors for the female population.

Index G, with *senior care* as a variable for social deprivation and *core housing need* included as a material variable, had shown clear loadings to the two components for the total population. When tested for the sex-specific populations, the clear differentiation did not hold. In the case of the female population, *senior care* did not load to either component, but it was the only variable to load to the social component for the male population.

Two final sex-specific indices were tested. Indices AA and BB, with *core housing need* replacing *unemployment rate*, *child care* replacing *living alone*, and either *moved in last year* (Index AA) or *moved in last 5 years* (Index BB), did not result in good separation of social and material factor loadings for either sex (Table 5.6).

Table 5.6 Factor scores for additional index variations, male and female populations only, Winnipeg CMA.

Index AA	Female Population		Male Population		Index BB	Female Population		Male Population	
	Material ^a	Social	Factor 1	Factor 2		Material	Social	Material	Social
Separated, widowed, or divorced	0.51	-0.67	0.64	-0.13	Separated, widowed, or divorced	0.57	-0.62	0.65	-0.11
Childcare	0.38	0.76	-0.02	0.92	Childcare	0.33	0.82	-0.05	0.90
Moved in last year ^b	0.66	0.15	0.73	-0.10	Moved in last 5 years	0.66	0.02	0.72	-0.10
No high school	0.76	-0.15	0.62	0.40	No high school	0.76	-0.03	0.59	0.46
Pretax personal income	-0.81	-0.01	-0.80	-0.28	Pretax personal income	-0.80	-0.10	-0.78	-0.32
Core housing need	0.84	0.11	0.83	0.12	Core housing need	0.83	0.15	0.83	0.15

^a Bolded factor scores denote strong association ($\geq .40$)

^b Bolded variables denote changes from the original index.

Index 2 was the only variation of the original index, of 19 tested, which demonstrated strong factor separation and loadings for material and social deprivation for the total population and for both sexes. Chateau et al. found similar results (117) although their version of the deprivation index used household income, not personal pre-tax income, and was tested only for the total population. My results demonstrate that Index 2 could also be used to represent relative deprivation for the male population and for the female population in Winnipeg.

5.3 Part Two – Sex Differences in Deprivation and Health

5.3.1 Health Outcomes

Premature mortality rate (PMR) among males in Winnipeg DAs was higher than for females, with an annualized PMR of 3.36 per 1,000 for males (3.21-3.52 95% CL)²⁷, and an annualized PMR of 2.38 per 1,000 for females (2.24-2.54 95% CL)(Table 5.7).

Arthritis and hypertension, two non-communicable chronic conditions, both demonstrate higher rates among females (326.9 and 278.6, per 1,000 females, respectively) than among males (267.3 and 248.9, per 1,000 males, respectively) and than the total population (297.8 per 1,000 population for arthritis and 263.9 per 1,000 population for hypertension). These rates are comparable to rates reported in the MCHP 2009 RHA Atlas (1), and the 2005 Sex Differences Report (46).

²⁷ A note to remind the reader: PMR was calculated for Winnipeg DAs based on five years of health data, 2004-2009.

Table 5.7 Crude mean rates, per thousand, and 95% confidence limits, for health outcomes in Winnipeg populations, per Census dissemination area (n=1162).

	Total Population Mean (95% CL)	Female Population Mean (95% CL)	Male Population Mean (95% CL)
Premature mortality (annualized for 2004-2009)	2.88 (2.74-3.02)	2.38 (2.24-2.54)	3.36 (3.22-3.52)
Arthritis (2008-2009)	297.8 (294.9-300.7)	328.6 (325.1-332.2)	267.3 (264.3-270.2)
Hypertension (2008-2009)	263.9 (259.8-267.9)	278.6 (273.4-283.7)	248.9 (245.3-252.5)
Total injuries requiring hospitalization (2008-2009)	13.6 (13.1-14.2)	14.8 (14.1-15.6)	14.1 (13.6-14.6)
One or more prescription drug (2008-2009)	605.0 (601.3-608.6)	686.2 (682.3-690.1)	523.6 (519.3 – 527.9)
Anti-depressant use (2008-2009)	147.3 (145.2-149.3)	193.9 (191.0-196.7)	100.8 (99.0-102.7)

Total injuries requiring hospitalization shows similar rates for males and for females and for the total population.

Females have much higher rates of filling one or more prescription than males, and the rate of anti-depressant use in the female population (193.9 per 1,000 females) is nearly twice that for the male population (100.8 per 1,000 males).

5.3.2 Negative Binomial Regressions

Results of the regression models are presented for the original index in Table 5.8a and for Index 2 in Table 5.8b. Adjusted Relative Rates (RR) show the relationships of the material and social components of the deprivation indices with health outcomes in the three populations. For every one unit of increase in the independent variables of the negative binomial regression model tested, the RR demonstrates the relative increase of the dependant variable (the health outcome). In the case of PMR for the female population, for example, the original index showed a RR of 1.26 (Table 5.8a) and Index 2 showed a RR of 1.22 (Table 5.8b) for the material components of the indices. In the first case, female PMR increased by 1.26 for every unit increase in the material component; in the case of Index 2, female PMR increased by 1.22 for every unit increase in the material component in the index. In both cases, the RR was significant ($p < .0001$).

Age (65 years or older) was significantly associated with all the selected health outcomes, regardless of the model used ($p < .01$).

Table 5.8a. Adjusted Relative Rates (RR) and p values for negative binomial regressions, original index.

Health Outcome	Model	Total population				Females				Males			
		RR	LCL	UCL	p value	RR	LCL	UCL	p value	RR	LCL	UCL	p value
Premature mortality	material	1.32	1.21	1.44	<.0001	1.26	1.13	1.40	<.0001	1.21	1.05	1.38	0.01
	social	1.28	0.98	1.66	0.07	1.01	0.89	1.15	0.87	1.33	1.03	1.72	0.03
	material * social	0.94	0.99	1.02	0.13	1.02	0.93	1.12	0.71	1.04	0.93	1.16	0.49
	65 years+	5.35	1.94	14.77	0.00	8.30	5.03	13.71	<.0001	9.49	5.35	16.84	<.0001
Arthritis	material	1.08	1.02	1.14	0.01	1.06	1.00	1.13	0.06	1.10	1.03	1.16	0.00
	social	1.02	0.95	1.10	0.55	1.00	0.92	1.08	0.90	1.07	0.98	1.18	0.14
	material * social	1.00	0.96	1.05	0.85	1.02	0.97	1.07	0.50	0.99	0.93	1.06	0.86
Hypertension	65 years+	3.67	2.54	5.30	<.0001	3.75	2.56	5.48	<.0001	3.38	2.50	4.56	<.0001
	material	0.99	0.95	1.04	0.81	0.97	0.92	1.03	0.37	1.00	0.94	1.05	0.91
	social	1.03	0.95	1.12	0.43	0.97	0.90	1.05	0.52	1.05	0.94	1.17	0.41
	material * social	1.01	0.97	1.04	0.79	1.03	0.99	1.08	0.16	1.03	0.97	1.09	0.40
	65 years+	10.58	7.25	15.29	<.0001	10.63	7.43	15.21	<.0001	11.57	8.49	15.77	<.0001
Total injuries	material	1.35	1.21	1.49	<.0001	1.27	1.14	1.42	<.0001	1.29	1.13	1.47	0.00
	social	1.23	0.98	1.53	0.07	0.91	0.85	1.14	0.81	1.31	1.03	1.66	0.03
	material * social	0.92	0.85	1.00	0.04	0.98	0.90	1.06	0.58	0.99	0.88	1.10	0.80
	65 years+	25.75	9.39	70.61	<.0001	64.77	29.37	125.95	<.0001	6.29	3.19	12.42	<.0001
One or more prescriptions	material	1.01	0.97	1.06	0.61	1.00	0.94	1.06	0.97	1.05	1.01	1.10	0.02
	social	1.01	0.95	1.07	0.76	0.99	0.92	1.07	0.86	1.06	0.98	1.16	0.14
	material * social	1.01	0.98	1.05	0.45	1.02	0.98	1.07	0.34	0.98	0.94	1.03	0.51
	65 years+	1.45	1.10	1.92	0.01	1.37	1.02	1.83	0.04	1.68	1.30	2.17	<.0001
Antidepressant use	material	1.11	1.04	1.18	0.00	1.08	1.00	1.16	0.05	1.18	1.08	1.28	0.00
	social	1.07	0.97	1.18	0.19	0.98	0.90	1.08	0.75	1.21	1.07	1.38	0.00
	material * social	1.00	0.95	1.06	0.87	1.03	0.97	1.10	0.33	0.99	0.92	1.06	0.73
	65 years+	3.27	2.00	5.35	<.0001	3.14	2.00	4.91	<.0001	3.58	2.37	5.42	<.0001

^a p values <.05 are bolded.

Table 5.8b. Adjusted Relative Rates (RR) and p values for negative binomial regressions, Index 2.

Health Outcome	Model	Total population				Females				Males			
		RR	LCL	UCL	p value ^a	RR	LCL	UCL	p value	RR	LCL	UCL	p value
Premature mortality	material	1.26	1.14	1.41	<.0001	1.22	1.10	1.34	0.0001	1.21	1.01	1.46	0.04
	social	1.40	0.94	2.10	0.10	1.17	0.88	1.55	0.29	1.48	0.94	2.33	0.09
	material * social	0.92	0.82	1.05	0.21	0.97	0.84	1.11	0.62	0.94	0.74	1.20	0.63
	65 years+	5.26	2.34	11.80	<.0001	6.22	3.61	10.73	<.0001	9.57	5.36	17.07	<.0001
Arthritis	material	1.04	0.98	1.10	0.23	1.07	1.03	1.12	0.0020	1.06	0.98	1.14	0.12
	social	1.04	0.94	1.16	0.42	1.01	0.93	1.09	0.80	1.04	0.90	1.21	0.57
	material * social	1.01	0.96	1.06	0.74	1.00	0.95	1.04	0.87	1.00	0.92	1.09	0.99
	65 years+	3.56	2.80	4.52	<.0001	3.81	2.69	5.40	<.0001	3.46	2.50	4.80	<.0001
Hypertension	material	0.97	0.92	1.01	0.15	0.99	0.95	1.04	0.81	1.01	0.94	1.09	0.83
	social	1.05	0.92	1.20	0.47	1.00	0.91	1.09	0.95	1.06	0.88	1.29	0.52
	material * social	1.01	0.97	1.05	0.69	1.00	0.95	1.05	0.96	0.97	0.88	1.07	0.54
	65 years+	10.79	8.12	14.34	<.0001	10.88	7.90	14.99	<.0001	11.95	8.71	16.38	<.0001
Total injuries	material	1.29	1.16	1.43	<.0001	1.24	1.13	1.35	<.0001	1.31	1.05	1.46	0.01
	social	1.36	0.98	1.90	0.07	1.13	0.91	1.41	0.25	1.40	0.94	2.06	0.09
	material * social	0.89	0.80	0.98	0.03	0.90	0.82	0.99	0.03	0.93	0.76	1.14	0.49
	65 years+	19.95	9.14	43.56	<.0001	47.37	22.86	98.16	<.0001	6.58	3.05	14.20	<.0001
One or more prescriptions	material	1.01	0.97	1.06	0.61	1.01	0.98	1.05	0.51	1.02	0.96	1.08	0.62
	social	1.01	0.95	1.07	0.76	1.00	0.94	1.07	0.98	1.02	0.90	1.15	0.74
	material * social	1.01	0.98	1.05	0.45	1.00	0.97	1.04	0.83	1.00	0.93	1.08	0.92
	65 years+	1.45	1.10	1.92	0.01	1.42	1.10	1.83	0.0079	1.68	1.30	2.17	<.0001
Antidepressant use	material	1.07	1.00	1.14	0.05	1.07	1.02	1.13	0.005	1.12	1.02	1.24	0.003
	social	1.14	0.99	1.32	0.07	1.03	0.99	1.14	0.52	1.21	0.96	1.52	0.10
	material * social	1.00	0.94	1.05	0.87	1.00	0.94	1.06	0.98	1.00	0.88	1.12	0.95
	65 years+	4.96	2.08	4.02	<.0001	3.02	1.98	4.62	<.0001	3.51	2.30	5.37	<.0001

^a p values <.05 are bolded.

The material component (consisting of *no high school certificate, unemployed, personal pre-tax income*) of Index 2 was significantly associated with premature mortality for the total population (RR 1.26, 95% CL 1.14-1.41, $p < .0001$), the female population (RR 1.22, 95% CL 1.10-1.34, $p < .001$), and for the male-only population (RR 1.21, 95% CL 1.01-1.46, $p < .05$). This result is similar to the results of the regressions for the original index, where the material component was predictive of premature mortality for all populations ($p < .01$) (Table 5.8a). Index 2's social component (consisting of *separated/divorced/widowed, living alone, moved in the last 5 years*) was not predictive of premature mortality in any of the three populations. The social component of the original index was a predictor for premature mortality ($p < .05$) for the male population, but it was not for the total population, nor for the female-only population.

The material component of Index 2 was significantly associated with arthritis among women (RR 1.07, 95% CL 1.03-1.12, $p < .01$), a result not seen when the original index was used in the regression model (n.s.). Conversely the material component of the original index was significantly associated with arthritis rates for the total, and for the male populations ($p < .01$).

Neither the original index nor the new variation, Index 2, was significantly associated with hypertension rates in the three populations, with the exception of adults aged 65 years and more in all three populations, a result that is likely a reflection of the high rates of hypertension in Winnipeg residents (see Table 5.7).

Index 2 showed an interactive effect of the social and material components for the total and female populations (RR 0.89, 95%CL 0.80-0.98 $p < .05$ for the total population; RR 0.90, 95% CL 0.82-0.99, $p < .05$ for the female-only population) for hospitalization rates for injuries. In the male population, an independent effect of the material component was seen (RR 1.31 95% CL 1.05-1.46 $p < .05$). These results differ from the associations seen with the original index, where the material component was significantly associated with injuries in the total and female populations, but not in the male-only population, and there was no interactive effect of the material and social components in any population (Table 5.8a).

Index 2 was not significantly associated with the rates of filling one or more prescription in any of the populations. This was also the case when using a model with the original deprivation index for the female and total populations, although a significant association was found for the male population. The material component of Index 2, however, was significantly associated with the use of anti-depressants for the total population (RR 1.07, CL 1.00-1.14, $p = .05$), the female-only population (RR 1.07, CL 1.02-1.13, $p < .01$), and in the male-only population (RR 1.12, CL 1.02-1.24, $p < .01$). In the case of the original index, both the material and the social components were associated with the use of anti-depressants in the male population and the material component was associated with anti-depressant use in the total and female populations.

5.4 Summary

Nineteen variations of the deprivation index were tested, using variables from the 2006 Census. Of these, 17 were tested for the total population, with three indices showing strong factorial loading to material and social components using the principal component analysis. When disaggregated by sex, only one index, Index 2, showed consistently strong loading to the two factors for the male-only and female-only populations. Two additional indices were tested by sex only, and the results from the principal component analysis found they were not satisfactory.

Negative binomial regression for health outcomes against the material and social components of Index 2 gave mixed results. The material component of Index 2 showed strong association with premature mortality rates and total injuries hospitalization rates for all three populations ($p < .05$). The material component was also predictive of arthritis and use of anti-depressants among females. The social component of Index 2 was not found to be predictive of any of the health outcomes tested.

Chapter 6 – Discussion: Intersections of Gender, Deprivation and Health in Winnipeg

6.1 Introduction – Restatement of the Research Hypotheses and Questions

In this chapter I return to the hypotheses and research questions set for my thesis research and discuss what my statistical analyses and literature review have demonstrated about a Census-based composite index of relative deprivation for Winnipeg populations.

My hypotheses were:

- 1) Variations of the original deprivation index can be created using Census data that produce statistically significant differences in scores of material and social deprivation for males and females for the Winnipeg Census Metropolitan Area (CMA); and
- 2) The original deprivation index and the variations constructed in this research are associated with differences in health outcomes for males and females in the Winnipeg CMA.

My guiding research question was, “Is there a Census-based index that best describes relative deprivation for men and for women in Winnipeg?” Additional questions I posed were:

“Are there sex differences in deprivation scores for men and women, and if there are sex differences in a deprivation index, how do these differences relate to health outcomes?”

“What are the gender implications of the variables used in the index?” and
“Do any sex and gender differences have implications for the utility of a
deprivation index to reduce health disparities?”

I begin with an assessment of the value of the index variations tested, and their ability to describe relative deprivation for men and for women in Winnipeg according to Townsend’s theory (11). The section following returns to the question of gender-sensitivity, to assess whether my original criteria for an index of relative deprivation have been met. I then consider how well the new index, Index 2, can be used to predict health outcomes, and thus be used in health planning. And finally, because *moved in the last 5 years* is a measure of the potential for stable relationships with neighbours in an area, I discuss whether an area is the same thing as a neighbourhood, and what this may mean for intersectional analyses. The chapter concludes with my final remarks.

6.2 A Deprivation Index for Winnipeg Populations

6.2.1 Finding a Better Mousetrap

The results described in Chapter 5 indicate that Index 2 is a better representation of relative deprivation for Winnipeg populations than the original index developed by Pampalon et al. (26). My analyses demonstrated that Index 2 also worked well to represent relative deprivation for the male-only and the female-only populations.

The original index, developed in Quebec, has already been demonstrated to be an unsuitable representation of relative deprivation for the Winnipeg populations – for the total populations, and for the sex-specific populations. As Kinniburgh et al. (36) and

Chateau (37) found previously, using the proportion of *lone parent families* as one of three Census variables to represent relative social deprivation in the original index did not achieve the desired results for the total Winnipeg population: a clear loading on the social component in principal component analysis. Sex-disaggregation of the data in my analysis demonstrated that in particular the original index does not work well to describe relative deprivation for the female population in Winnipeg, a result also found in the 2011 work by Kinniburgh et al. for the Centres of Excellence for Women's Health (36).

Index 2 is substantively different from the original index, in that *employment rate* and *lone parent family* in the original index have been replaced with *unemployment rate* and *moved in the last 5 years*. Unemployment as measured by Census is a better representation of the disadvantage of wanting to work but being unable to than “not employed”, and thus is a better representation of the relative disadvantage one would feel in society. Lone parenthood, while demonstrably bad for many women's (and some men's) socio-economic status, does not work well in the deprivation index as a measure of social deprivation. Both *moved in the last year* and *moved in the last 5 years*, however, showed clear loadings to social factor components for the total Winnipeg population in Index 1 and Index 2, respectively.

For adult women, lone parenting is a stronger representation of material deprivation than it is of social deprivation, although the variable was originally intended to describe a gap in social capacity or networks. That is, for females, raising children alone in Winnipeg is more strongly associated with low education, unemployment and low personal income

than it is with social isolation. This finding equates with the results of qualitative studies in which Winnipeg women have described the many challenges of parenting alone, including the difficulties they face in augmenting their education, in finding childcare and thus in finding sustainable employment and income. Women have related these challenges to their own poor health in terms of the stress and anxiety with which they contended (54,57).

Index 2, using *moved in the last 5 years* to replace *lone parent family*, was a more stable representation of social deprivation, as *moved in the last 5 years* was found to contribute to a clearer factor separation of social deprivation from material deprivation. My results replicate those Chateau found using 2001 Census data (37) and later with data from the 2006 Census (117).²⁸ As described in chapter 3, moving and having neighbours who have moved can create social instability for individuals and the surrounding community. An important limitation, however, is that the data for *moved in the last 5 years* were not sex-disaggregated, and given the ways other index variations changed between total population and sex-specific models, it is reasonable to be cautious about the ability of Index 2 to consistently represent relative social and material deprivation for the female and male populations.

Alternative variations of the original index did not show distinct factor separation for the total population, or for the sex-specific populations. As noted in Chapter 3, each of the variables chosen for my analyses has been found to be associated with disadvantage,

²⁸ Note, as before, that Chateau (37) and Chateau et al. (117) used household income (2001 and 2006 Census data, respectively) in their analyses, not personal pre-tax income.

isolation, or marginalization in other research, and can also serve as a gender-sensitive indicator. As recorded in the Census data however, the additional variables – *no official language, no English, senior care, child care, core housing need* – did not contribute meaningfully to the composite index in this model.

Unpaid work caring for seniors or for children, although demonstrated to create both joy and isolation for carers in other research (185), did not hold up well in these analyses of Census data. Neither was a suitable alternative in the index as a representation of social deprivation.

Townsend commented on the value good housing has for its inhabitants, both in material terms – having a home in good repair, or not having to choose between paying for a roof over one’s head and paying for other essentials – and in terms of its ability to confer social status and stability as well as to provide a base from which one can proceed to participate in society (11). *Core housing need*, the only variable that could capture the disadvantages of poor housing from Census data, did not satisfy the criteria set in this thesis. The variable did not load with other aspects of social deprivation in any index, and in the case of the only index in which *core housing need* satisfactorily loaded with material components of deprivation (Index G), the results did not hold for the sex-specific populations. Two attempts to create indices that included both unpaid work and core housing need (Indices AA and BB) did not work for the female or male populations either.

While each of the variables was selected for its potential to represent relative social or material deprivation in a complex index, and indeed had been found to be associated with disadvantage in other research, according to my results only *moved in the last 5 years* contributed to an index that potentially represents Townsend's theory of relative deprivation (11) and could be of value for health planning for the total as well as for the sex-specific populations.

6.2.2 Are the Goals of Gender-Sensitivity Achieved?

Testing every variation of the index by sex, however, illuminated simple differences between males and females and hinted at differences among men and women in the Winnipeg CMA. All of the variables used in this thesis research were technically gender-sensitive, in that they could be used to illustrate differences between the sexes and among the members of the sub-populations, including to set benchmarks and targets where improvement can be made (93), with the exception of *moving*. This one variable, that contributed to a reliable new version of the original index (in terms of its ability to represent relative deprivation), is not available by sex from the 2006 Census data in the usual files made available through the Data Liberation Initiative. This is a limitation to assessing the true ability of Index 2 to represent relative deprivation for all three populations in question.

Another criterion for gender-sensitivity in indicators is that improvements can be made, or that inequities can be ameliorated (93,94,94). In the case of personal income, unemployment (looking for work) and low education, it would seem that if society so

desired, political will and social policy could be brought to bear to improve the rates of these indicators to reduce the inequities that create disparity and deprivation.

Society may not desire to rectify the rates of separation, divorce, widowhood or living alone (as this may be seen as political interference in personal matters), but may instead wish to ameliorate the isolation that such life circumstances create. A 2003 guide to gender-based analysis (217) illustrated, for example, that elderly men in Manitoba were disproportionately likely to commit suicide, which led to speculations about the isolation some men might feel, particularly after the loss of a spouse. The presentation of the sex-disaggregated data led to changes in mental health programs for older men in some Manitoba regional health authorities (K. Love, Manitoba Health, personal comm., 2006). The Healthy Baby and Baby First (now called Families First) programs in Manitoba are similarly intended to offset the challenges faced by single mothers and other low-income parents (218). Such policy efforts represent structural changes to reduce individual experiences of deprivation.

6.2.3 Summary

As my analyses illustrated, there were sex differences in factor scores for all the index versions tested, information that would otherwise have been masked by exploring the results for the total population only. Statistical manipulations of Census data demonstrated that it was possible to create a version of the original deprivation index that is more suitable to describe material and social aspects of relative deprivation for the total population in the Winnipeg CMA, and for the female and male populations. My tests of Index 2 expand on the work of Chateau et al. (117), confirming that the index not only is

a better model for the population of Winnipeg as a whole, but also by sex, and thus has potential for use in addressing health disparities within one or all of the three populations. Furthermore, the variables that compose Index 2 have been demonstrated to be gender-sensitive, an important criterion to using population health measures for meaningful policy and practice improvement.

6.3 Predicting Health Outcomes with the Original Index and Index 2

The relationship of the new deprivation index, Index 2, to health outcomes gave mixed results. Index 2 showed associations of the material component with premature mortality rates for all three populations, but premature mortality rates were not associated with the social component of Index 2 for any of the populations.

My results for Index 2 illustrate and confirm the associations found between low income, low education and unemployment and premature mortality found in other data explorations for Winnipeg (and Manitoba) residents. Fransoo et al. (1), for example, found that premature mortality rates consistently increased with declining income both in the city of Winnipeg and in the rest of the province. As I noted in Chapter 3, premature mortality is considered to be the single health outcome that represents disadvantage and marginalization in a population, a “flagship” indicator, when compared with other measures of poor health (188, p. DS37)

As described in Chapter 3, recognizing that income alone may not be an adequate measure of disadvantage, SEFI2 (and its predecessor SEFI) was developed at MCHP to capture the more complex structure of disadvantage in the province (117). SEFI 2 uses two of the three variables in my Index 2 (unemployment rate, lack of high school education), as well as average household income (rather than personal income) *and* percent of single parent households (119). SEFI 2 is thus another index that can be understood to represent material deprivation as theorized by Townsend (11).

The association of Index 2 with area-level premature mortality rate in the total, female-only and male-only populations in my research demonstrates that Index 2 is indeed measuring deprivation among Winnipeg adults, based on the Census data from 2006.

Although the social components of Index 2 separated cleanly in the principal component analysis for all three populations, the social factor scores were not significantly associated with premature mortality rate. That is, although Index 2 could be thought to describe relative social deprivation in Winnipeg distinctly from material deprivation in the Census data, it is not statistically associated, at the DA level, with the one health outcome in the health administration data considered to be the best health indicator for marginalization.

The results of the tests for associations of Index 2 with other health outcomes illustrate that the application of a deprivation index in health planning may depend on the research and planning question being posed, the health issue of interest. Explorations of

deprivation indices have demonstrated associations with various health outcomes. Auger et al., for example, found that the material component of the original deprivation index was predictive of life expectancy rates for women and men, but the authors did not report on any tests of the social component with the same health outcome (34). Pampalon et al. found associations between their original index and health expectancy (a global measure of population health status based on the Health Utilities Index (44)) in Quebec, by sex. In a 2012 review, Pampalon et al. reported other associations found in research between their original index and “life expectancy and health expectancy at birth and different ages” (219, p. S21).

According to the 2010 report from the Chief Provincial Public Health Officer (Manitoba), injuries are among the four most common reasons for hospitalization, and the third leading cause of death for adults (189,190). Area-levels rates of hospitalizations for all injuries were associated with the material components of Index 2 in the male population, and there was an interactive effect of the material and social components seen in the female and total populations. Earlier studies from Manitoba have found associations between low income and injuries in children (220), and within Aboriginal (221) or First Nations (222) adult populations. These studies, however, did not directly consider the potential influence of material or social factors as conceptualized in this thesis.

The results of my analysis indicate that the social variables used in Index 2 are not associated with area-level rates of injuries requiring hospitalization in Winnipeg populations. The intersections of injuries – intentional and unintentional – with social

factors are not well explored for Manitobans. Living alone and lack of social support networks have been found to be risk factors for falls among young adults in Scotland (223), and violence against women as well as violence between spouses has been found to escalate when there is a separation or divorce (224). In the case of family or domestic violence (which includes spousal abuse), Manitoba has more male victims reporting than any other province (189,190), but the injuries sustained by women are more severe. Without a provincial surveillance program for domestic violence, it is difficult to quantify the intersections of gender, race, oppression, culture as they relate to rates of injury from assault.

Prevalence of hypertension increases with age and has been found in Manitoba to have increased in the 30 years since the early 1980s (1). As seen in the results from my analyses, hypertension rates were significantly associated with the proportion of DA residents 65 years or older, and a 2010 report notes that hypertension rates are “considerably higher” among women over 65 years, than among their male counterparts (189). My results did not demonstrate a significant association between Index 2 and hypertension rates in the total, male-only or female-only Winnipeg populations overall. This may relate to the high prevalence rate for hypertension seen among Winnipeg residents, diffuse across the population, regardless of experiences of relative deprivation.

Arthritis, another chronic non-communicable disease, was significantly associated with age (65 years and older) in my results. The material component of Index 2 was predictive of area-level arthritis rates for women in Winnipeg, although there was no significant

association found for the population as a whole, nor for the male-only population. This association for women between arthritis and material disadvantage was also found by Bierman in her explorations of national self-reported health data for women (44), and in a 2008 analysis of CCHS data, *A Profile of Women's Health in Manitoba* (47). As the 2008 report noted, “compared to women living with other chronic conditions, women living with arthritis have been found to be ... more vulnerable in social and economic respects” (47, p. 5.75). Women with low income were found to be more likely to report their health as poor overall, and to report living with disabling pain, than their counterparts with more income (44).

According to my results, being older (aged 65 years or more) was associated with filling one or more prescriptions. Grymonpre et al. commented that older members of the population are more likely to require (and to benefit from) prescription drugs to treat or control conditions that would otherwise prevent them from fully participating in daily activities (225). Neither the material nor the social component of Index 2, however, was predictive of area-level rates for using one or more prescription drugs for any of the three populations, and this may reflect the high rates for filling at least one prescription among Winnipeg residents. As Table 5.7 showed, at least 50% of adult males and 60% of adult females filled one or more prescription in 2008/009. Further investigation of whether Index 2 is related to greater prescription drug use may be warranted.

In contrast, the material component of Index 2 was predictive of area-level anti-depressant use in all populations. Other research has found that women with low income

are more likely than men to seek medical attention for psychological and social issues, although there is also an on-going critique that women may be prescribed anti-depressants when other non-medical supports could be equally effective (226). Nevertheless, depression is considered a critical measure of women's health, and has been included as a core indicator of women's status and equity worldwide (121). Men's mental health is only more recently receiving attention in research, policy and the public eye. Index 2 was predictive of area rates of anti-depressant use in the male population, and so the index could be used to address men's mental health issues in deprived areas of Winnipeg.

6.3.1 Summary and Policy Implications

The second part of this thesis research tested the utility of the "better" deprivation index, Index 2 in predicting selected health outcomes with mixed results. The results illustrate that the application of a deprivation index in health planning may depend on the research and planning question being posed, the health issue of interest.

It is clear, however, that it is worthwhile to examine sex differences in statistical tests such as these, because there are differences in results for the sex-specific populations that would otherwise be masked. The material component of Index 2 was predictive of area-level rates for health outcomes more often for the female-only population, than for the male-only population, which suggests that women's experiences of living in deprived areas has greater influence on these aspects of their health (premature mortality rate, arthritis rates, rates of hospitalizations for injuries and rates of anti-depressant use).

Examination of one particular age-group, the proportion of the population in each DA 65 years or more, suggests that it would also be valuable to look at life stages within populations, to get a better understanding of the value of Index 2 for health planning.

Consideration of the theoretical underpinnings of a Census-based index is also essential to be clear about what one is measuring and thus what should be addressed in policy change. Health planners and policy-makers are not typically able to address sweeping areas for policy change. Having precision in knowing what aspects of a population are being described in a population health measure enables decision-makers to be specific about the population targeted (teenage boys, or working-aged women, for example) and the responses to be employed. Jordan-Zachery (82) and Yuval-Davis (73) argued that the challenges of moving evidence to policy must include the complexities of the people described, not strictly as individuals but situated in the structures of their lives and intersections of marginality. As McCall wrote, intersectionality requires that the many intersections be brought into analysis in all their complexity – for effective policy change (60). Intersectionality theorists have not cornered the market on addressing inequity, but instead are endeavouring to explain the very complex ways it comes about and proceeds, a complexity that may be lacking in other interpretations of statistical interactions.

The results I have described in this thesis have, therefore, some mixed value in direct application to health planning, and there is room for further exploration about such application. Index 2 is a “better” index than the original with respect to describing relative deprivation among Winnipeg residents. Whether it is the best index for policy

change in this city requires further investigation, as described in more detail in section 6.5. First, however, I turn to the question of how area-level studies of this nature relate to neighbourhood characteristics.

6.4 Intersections of Deprivation: Is an Area a Neighbourhood?

In Chapter 3, I gave a brief description of the effects of residential instability (moving) on women and men, as described in the literature. Researchers have documented that not knowing one's neighbours well may be detrimental to one's social networks and supports. Neighbourhoods which have a lot of transience may lack social cohesion overall, which has been related to self-rated health for residents (178)

The idea that neighbourhood context matters to the health of the people who live there is not new to researchers (227,228). Neighbourhoods constitute and contain the social relations and the physical resources obtained and integrated in people's everyday lives (229) and thus need to be understood for their influences on health. Giovanna Di Chiro, for example, described the need to investigate the intersections of economic, social and environmental conditions that might "enable or dis-able (sic) an individual's or community's ability to grow up in a clean and healthy environment, to earn a decent livelihood or to develop social capital to actively participate in civic life" (100, p. 99).

The influence on residents' health has been explained to be based on two aspects of a neighbourhood, the composition and the context. According to Bernard et al., "The compositional explanation attributes the geographical clustering of health outcomes to the

shared characteristics of residents. Similar people (e.g., similar in terms of socioeconomic status, or educational level) tend to aggregate within geographical proximity, whether purposefully to share a common culture, or because they are driven to certain areas because of lack of personal resources, money and others” (230, p. 1840). O’ Campo et al. (231) and Krieger et al. (31) for example, found that low-income Hispanic or Black families tend to be concentrated in certain neighbourhoods in the U.S., and that these racially segregated neighbourhoods were associated with higher rates of cardio-vascular disease, low birth weights and other poor health outcomes (31,231). According to Merlo et al. (228) the more the health of the people within a neighbourhood is alike (as compared with the health of people from different neighbourhoods), “the more probable it is that the determinants of individual health are directly related to the contextual environment of the neighbourhood and /or that social processes of geographic segregation are taking place – that is, similar types of individuals choose or are forced to reside in a given neighbourhood” (228, p. 1026). It is important to remember, however, that being from a neighbourhood with certain characteristics does not necessarily mean that all residents share those characteristics (11,232).

The contextual explanation describes the physical (buildings, parks) and resource (banks, grocery stores, health clinics, schools, grass-roots organizations) attributes within a particular geographical space that contribute to or hinder good health “over and above the contribution of aggregate individual characteristics” (230, p. 1840). The context for a neighbourhood could include factories which provide employment but also emit toxins, potentially providing both a benefit to the health of local residents and a disadvantage. Bernard et al. argued that neighbourhood association with health is created not just by the

“sheer number of resources” (p. 1840) but by the particular configuration of physical and social assets and the opportunities neighbourhood residents have to use those assets (230). The configurations are in turn shaped by social interactions and the ability people have to move in and out of the neighbourhood. That is, their ability to choose to use the most local resources or not (230).

In a review of studies, Pickett and Pearl found a small proportion of health variation among individuals attributable to neighbourhood context, compared to individual risk factors (227). However Cummins et al. argued that Pickett and Pearl’s notion of neighbourhood was too restrictive, as it focused on physical attributes. Cummins et al. suggested that a neighbourhood should be envisaged as relational space, that is, the space in which relationships operate (229). Carpiano (233) describes two theories of such social relationships: one is focused on informal relationships and trust that engender feelings of personal security (Putnam, 1993, 1995, 2000 cited in (233) and the other is more focused on the collective social resources among a neighbourhood’s residents, and the ability of individuals to draw upon those resources (Bourdieu 1986 cited in Carpiano (233)). Not being able to draw upon those resources creates isolation and marginalization for some individuals (233). Carpiano distinguished these resources – the social capital – from the personal relationships needed, trust, familiarity and shared values, which he defines as social cohesion (233).

It is possible to see that these ideas of neighbourhood social capital and social cohesion better articulate the assets needed to prevent an individual from feeling socially deprived

(11) than whether or not a man or woman lives alone, or is isolated by family responsibilities. That is, the original deprivation index (with living alone, lone parent households and marital loss) cannot account for all of the relationships that can prevent social deprivation, such as feeling included in a neighbourhood, participating in local events, or daily encounters through neighbourhood facilities. *Moved in the last year or 5 years*, however, might represent social isolation if it means the residents in a DA have not been able to build relationships in a new neighbourhood, or if they have not moved, but their neighbours frequently change.

Stephanie Huie (232), however, pointed out that the environment of a small residential area also shapes the quality and extent of how an individual can act. She used the example of availability of public transportation. Those who rely on buses must walk where bus service is insufficient (232), and are forced to interact with other people in their immediate surrounds.

Cummins et al. proposed three principles for considering neighbourhood effects on health. Firstly to reject a “false dualism” (229, p. 1835) of context versus composition and recognize that the two, the neighbourhood environment and the social interactions within that environment, are entwined. This forces, they argued, a more critical analysis of the processes and interaction that occur between neighbourhood residents and the social and physical resources in their environment (229). Secondly, to recognize that context and place vary in time and space. Longitudinal studies can provide more information about how neighbourhoods influence health over a life time. Thirdly, the scale of analysis is an important consideration. As Ana Diez-Roux wrote,

“Although many studies have documented important differences in neighborhood physical and social environments by race/ethnicity or socioeconomic position, the extent to which these neighborhood differences contribute to disparities in health has remained elusive. This elusiveness may in part be a result of the virtually exclusive analytical focus on isolating the effects of context and composition. A crucial need is a more nuanced understanding of how the linked processes of residential segregation, differential location of health-related resources, and the behaviors of residents dynamically affect health differentials” (234, p 1630).

The area-level aggregation of individual Census data in the deprivation index, essentially a city block at a time, is not the same as an investigation of neighbourhoods. Aggregate variables and contextual variables should not be conflated. Subramanian et al wrote that we must “disentangle the idea of aggregate variables from contextual variables which cannot be reduced to a lower level” (235, p 349). They went on to say that this, “underscores the need for multilevel thinking; i.e. we need to simultaneously examine the circumstances of individuals at one level, *in the context of* the different levels shaping their circumstances.” (235, p 349) (my emphasis, see also Huie (232)).

6.5 Limitations and Future Research

6.5.1 Limitations

There are several limitations to the methods, results and implications of my thesis research, some of which have been already noted. The first of these is that area-based analyses such as this one may misrepresent the characteristics of residents within the area of study, creating a fallacy that all area residents are homogenous in one respect or another. Using Census data at the DA level reduces such ecological fallacy, however, because as Schuurman and others have noted, population data from a small spatial area (in this case one or two city blocks) are more likely to be representative than data from a

spatially larger area. In rural areas, where DAs are geographically larger, the risk of fallacy would necessarily increase (28).

Secondly, not all the Census data could be retrieved by sex – specifically, not the data related to moving – and therefore not all variations of the deprivation index tested were truly sex-specific as I had originally intended. There are two possible results. One is that I have not adequately represented the experience of moving for males or females in a DA that could contribute to their relative social deprivation. On the other hand, as I have described, the effects of moving may be more strongly experienced by the residents who do not move, but who must endeavour to maintain a social network when many of their neighbours are moving in and out of the DA. In either case, it would have been ideal to have had all the variables sex-disaggregated when testing Index 2.

A third limitation I have raised is that Index 2 was not universally predictive of the area-level health outcomes I selected to investigate. Critically, the social component of Index 2 was not associated with any of the health outcomes tested (except the population aged 65 years and over). The intent of including variables related to social conditions in a comprehensive index is to represent relative deprivation in keeping with Townsend's theory (11). Townsend himself predicted that this would be a particular challenge to creating population measures for relative deprivation. While Index 2 demonstrated distinct social and material components for all three populations, it remains to be seen (by perhaps testing other health outcomes) if the social component is valuable in health planning.

Lastly, I used a p value of 0.5 to assess significance of the results of the negative binomial regressions, as this was a first exploration of the predictive value of Index 2. The six health outcomes tested were largely distinct, with the exception of anti-depressant use and one or more prescription filled, and were not already correlated. Some of the marginal results could be questioned for that reason.

6.5.2 Future Research

There are a number of new research questions that arise from this thesis. The first of these was mentioned in the paragraph above: it would be valuable to investigate whether Index 2 is predictive of other health outcomes for Winnipeg residents, for the male and female sub-populations as well as for the total population. In addition, it will be valuable to know whether Index 2 has any particular benefits in predicting population health over the SEFI 2, which has been in use in Manitoba for some years.

Pampalon and his colleagues found that the original index produced different results when tested for rural parts of Canada or smaller cities (28), and this raises questions about how Index 2 would function as a model of relative deprivation for the rest of Manitoba, particularly in rural areas where DAs are geographically larger, as my thesis research was confined to the Winnipeg CMA.

As I described in Chapter 2, scholars of intersectionality have emphasized that disadvantage is experienced in ways that are compounded (60,63). Gita Sen et al. have described methods they have used to represent such compounding aspects of marginalization in population data by creating dummy variables for logistic regression

models (90). Their statistical methods are fundamentally different than the ones employed here, but such methods may more truly provide a means to operationalize the intersections of relative deprivation than the methods I used.

The value of the deprivation index is that it can identify where women and men who are most deprived reside. A critical next step will be to look at those residential areas and investigate other aspects of the surrounding neighbourhoods, in terms of the resources available, local hazards, and so on. Thus the dissemination area would be understood better as a place within a place. Examining the attributes of the neighbourhood would provide more context to understand the deprivation ascribed to the residents.

Numerous authors have suggested that multi-level analyses are more likely to provide answers about the causes of poor health and underlying health inequities (60,98,236). Quantitative studies are valuable to design policies that improve public health by being able “to estimate the magnitude of such relationships and understand how far relationship between health and places are generalizable ... and ... for identifying potential avenues for intervention” (229). If only individual level data are used, however, it will not be possible to tell where to target interventions (31). Qualitative studies can provide insights about the pathways to good health and healthy behaviours in particular neighbourhoods (229).

In a comprehensive review of deprivation and deprivation measures for the Scottish Executive, Bailey et al. concluded that both individual and area-based measures are

required, as each kind of measure gives different information. They recommended that their government adopt a multi-method approach, incorporating administrative data, quantitative surveys, as well as qualitative interviews (237). This recommendation complements calls for mixed methods approaches to understanding the intersections of privilege, power and marginalization made by scholars of intersectional theory and analysis (60,95,98).

The nature of research is that each new piece of evidence creates a litany of other questions and possibilities for new research. In some respects, explorations of deprivation indices are fairly new in Canada, and research by Nathaniel Bell et al. (116), Flora Matheson (120), and Robert Pampalon and his colleagues (219), illustrate interesting research variations. Following through with intersectional and sex-and gender-based analyses in such research can enrich our evidence and contribute to stronger health policy, programming and practice that improve health and reduce disparities.

6.6 Conclusions

The intent of creating a complex deprivation index is to devise a measure of population disadvantage that is multi-faceted, and not just dependent on a single measure such as income or employment. Composite indices have been found to be more robust in estimating the socio-economic status of a population than a single variable (119,238).

The deprivation index explored in this research, the original index developed and refined by Pampalon and his colleagues, has been used extensively in Quebec for health planning

(219) as well as in other parts of Canada (32), but had already been found to be unable to describe relative deprivation in Winnipeg (36,37,117).

My thesis research has demonstrated that Index 2 is a more appropriate version of the index and can more satisfactorily use Census data to represent relative deprivation. My results replicate earlier findings by Chateau and his colleagues (37,117). Additionally, I have demonstrated that Index 2 can be used to describe relative deprivation for the female-only and male-only populations in the Winnipeg CMA. This can increase the value of using Index 2 for targeted population-based interventions, depending on the health outcome in question. That is, a sex-specific version of Index 2 can be used to more accurately target areas of greater deprivation for males or females, depending on the health issue of interest. Sex- and gender-specific interventions have been found to be stronger in producing desired results, and in making the best use of resources (239).

Intersectionality is predicated on an understanding that the conditions, experiences and processes of marginalization in women's and men's lives are not solely a result of individual choices. This means, for example, that healthy living – eating well, getting enough exercise and not smoking are current policy favourites – is not merely a matter of individual preference. Townsend's concept of deprivation articulates the need to consider the tangible resources and the social interactions people must have to be healthy. In particular, Townsend's deprivation concept points to how people perceive their own disadvantage in relation to others (11). The results of my research on the deprivation index are intended to be relevant to the experience of women and men who live in

Winnipeg, and not necessarily to be compared to the deprivation of women and men living in Halifax, Vancouver, Montreal, or any other city in Canada.²⁹

Finding a “better” deprivation index may be as elusive as the proverbial mousetrap. However, an intersectional analysis is a framework for examining the identities and processes of marginalization at many levels that can have profound influence on health outcomes. To be true to Townsend’s definition of deprivation, my thesis work may be more meaningful when combined with other knowledge about the attributes of Winnipeg neighbourhoods, social norms and prejudices in this city, municipal, provincial and federal policies, and economic and political systems. Intersectionality can uncover the junctions of all these elements with sex, gender and other identities to help better understand the power dynamics that privilege and marginalize the women and men of Winnipeg.

The three principles suggested by Cummins et al. (229) regarding neighbourhoods (to avoid conflating physical environment with the social networks of the residents who live there, to recognize that context vary in time and space, and to pay attention to the scale of (place) analysis) reflect the same kind of critical thinking scholars of intersectionality encourage. To use my earlier analogy, fabric threads under scrutiny have their own attributes at the point of inspection, but the threads are also affected by the structure of the threads in the fabric that drapes away from the area pinched between finger and thumb, and they in turn are also affected by the rest of the structure of the weave. We can

²⁹ Although as I have argued elsewhere, the “horizontal” analysis of comparing one case study to another similar case can provide insights about pathways and processes to health (245).

learn about the threads as they intersect at a particular point, but our insights may relate only to that point. If we want to draw conclusions about anything more, then we are bound to look at all of the attributes and intersections in the rest of the weave of the cloth. As Edwards and Di Ruggerio wrote, “contextual influences are pervasive yet specific, and diffuse yet structurally embedded. Historical contexts that produced inequities have contemporary influences” (240, p. 43). Multiple levels of data and multi-methods for analyzing the evidence may well provide a better way to truly understand the intersections of gender, deprivation and health in Winnipeg.

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