HEALTH DISPARITY IN SASKATOON

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Thesis Erasmus MC, University Medical Center Rotterdam,
With Summary in English

Financial support from the Canadian Institutes for Health Research for the printing of this thesis is gratefully acknowledged.

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Proefschrift

Ter verkrijging van de graad van doctor aan de
Eramus Universiteit Rotterdam
op gezag van de rector magnificus,
Prof.dr. S.W.J. Lamberts
en volgens het besluit van het College voor Promoties

De openbare verdediging zal plaatsvinden op
Woensdag 10 December 2008 om 15:45 uur
door

Mark Lemstra

Geboren December 13, 1969
Moose Jaw, Saskatchewan, Canada

Promotiecommissie

Promotor:	Prof.dr. J.P. Mackenbach
Copromotor:	Dr. A. Kunst

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1. Introduction

It is not that genetics and medical care are unimportant for health, but this limited focus misses out on the major determinants of health and health influencing behaviour.[1] The belief that health care treatment is the most important determinant of health has resulted in Saskatchewan residents increasing their annual expenditure for health care from 1.6 billion to 3.4 billion dollars in the past ten years with little change in overall population health. Even the focus on individual risk behaviours has lead back to the formal health care system in the form of specific disease prevention programs. The fact that socioeconomic disparity is preventable and modifiable presents a significant opportunity to not only improve population health but reduce overall health care spending as well.

The association between socioeconomic status (SES) and health disparity is now well documented by researchers. In England, the main SES determinant under review is social status based on occupational hierarchy. In comparison, research in Europe tends to focus on educational status whereas income is the main SES determinant under review in North America. Some suggest that income status, educational status and occupational status are strongly interrelated and there is little benefit to delineate the independent effect of one SES variable on health outcomes while controlling for the other SES variables. Others suggest that it is very important to ascertain which SES determinants have the strongest association with health outcomes in order to prioritize limited financial and human resources on a few key determinants of health that will have the largest impact on reducing health disparity.

Although the association between SES and health disparity has received enough attention by researchers that specific details are being debated, the general association is less well known among policy makers and the public at large. Perhaps this is due to the fact that a majority of analysis on this topic is at the national level. This is a problem for countries like Canada where a majority of social policies that influence the determinants of health are funded at the provincial level (i.e., education, social services, housing, health care) and provided at the regional level. In other words, local data will be required to influence policy at the local level.

The primary purpose of this thesis is to determine if SES is associated with poor health status in Saskatoon residents. At the onset, however, there is already a major complication to address. In Canada, it is not difficult to find a government agency reporting that Aboriginal cultural status is associated with poor health outcomes.[2,3] The complication is that Aboriginal cultural status is strongly correlated with socioeconomic status in Canada. As such, the second purpose is to determine if Aboriginal cultural status is independently associated with poor health status after controlling for other covariates, namely SES.

1.1. Socioeconomic Status and Health Status

The Whitehall study prospectively followed more than ten thousand British civil servants for twenty years with longitudinal data. This study design offered important advantages over previous studies of occupational status and health that included only cross-sectional data at a single point in time.[4]

There were three main findings. First, the age-standardized mortality among males aged forty to sixty-four was much higher for those in the manual occupational grades in comparison to professionals and senior administrators.[5] For example, manual workers were three and a half times more likely to die from lung cancer than professionals or executives (Table 1.1). Second, there was an obvious and clear gradient in mortality from the top to the bottom of the hierarchy in almost all of the causes of death.[6] Third, differences in mortality from heart disease persisted

even after adjustments for smoking, blood pressure and cholesterol.[6] These observations suggest some underlying general causal process, correlated with occupational status, which expresses itself through different diseases.[7] As such, the specific diseases that eventually result in death may simply be alternative pathways rather than causes of death; the essential causal factor is socioeconomic status.[7]

Table 1.1 Age Adjusted Relative Mortality by Occupational Status and Cause of Death

Cause of Death	*Senior Administrators*	*Professional & Executive*	*Clerk*	*Manual*
Lung cancer	0.5	1.0	2.2	3.6
Other cancer	0.8	1.0	1.4	1.4
Coronary heart disease	0.5	1.0	1.4	1.7
Cerebrovascular disease	0.3	1.0	1.4	1.2
Chronic bronchitis	0.0	1.0	6.0	7.3
Other respiratory	1.1	1.0	2.6	3.1
Gastronintestinal diseases	0.0	1.0	1.6	2.8
Genitourinary diseases	1.3	1.0	0.7	3.1
Accidents and homicide	0.0	1.0	1.4	1.5
Suicide	0.7	1.0	1.0	1.9
Non smoking related cancer	0.8	1.0	1.3	1.4

Source: Evans[7] Reprinted with permission.

The Black report provides mortality data for men aged 15-64 in England and Wales by occupational classification from 1911 to 1981.[7,8] At the beginning of the century, infectious diseases were the main causes of death and age-standardized mortality rates were higher in the lower occupational classes. At the end of the century, however, heart disease and cancer were the main causes of death but they too had higher incidence in the lower occupational classes.[7] The fact that the diseases responsible for death changed over time while mortality rates remained higher in the lower occupational classes suggests that disease specific prevention programs may be of limited benefit to prevent health disparity.[7] Even if one disease is cured, another will simply take its place (Table 1.2).[7,9]

Table 1.2 Mortality by Occupational Status in England and Wales 1911-1981

	Social Class				
Year	*Professional*	*Managerial*	*Skilled Manual and non-manual*	*Semi-Skilled*	*Unskilled*
1911	88	94	96	93	142
1921	82	94	95	101	125
1931	90	94	97	102	111
1951	86	92	101	104	118
1961	76	81	100	103	143
1971	77	81	104	114	137
1981	66	76	103	116	166

Source: Evans[7] Reprinted with permission.
Numbers are standardized mortality rates. (Data from 1941 was not collected due to world war)

Now let's move to Europe where comparative reviews have been made using educational status as a key SES indicator. Four reviews will be highlighted.

The first review looked at four indicators of self-report morbidity and mortality by level of education, occupational class, and/or level of income from western European countries for the years 1985 to 1992.[10] Socioeconomic status was associated with health disparity in every

country but educational status was the socioeconomic indicator that had the strongest association with health disparity. Odds ratios for morbidity ranged between 1.5 and 2.5 and the rate ratios for mortality were between 1.3 and1.7.[10]

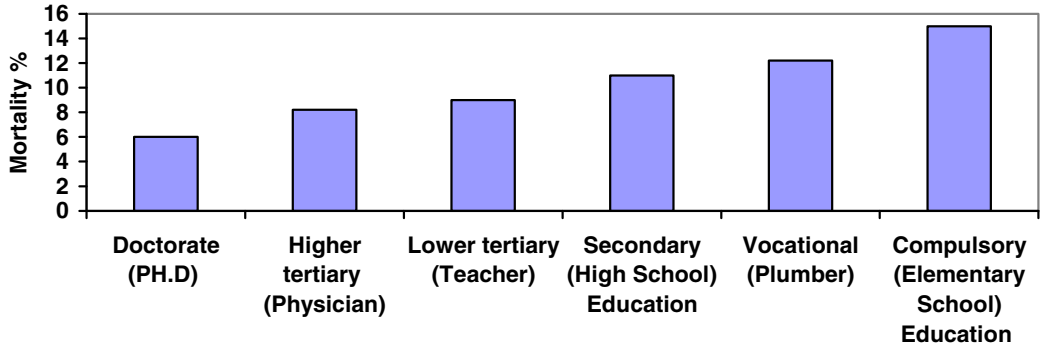
The second review analyzed disparities in mortality by education in eight western European populations. In this study, increased mortality was found in all specific causes of death by educational status; except prostate cancer in men and lung cancer in women.[11]

The third review looked at national health surveys conducted in eight European countries in the 1990s. The prevalence of 17 chronic disease groups were analysed in relation to education.[12] Most diseases showed a higher prevalence among the lower education group. Stroke, diseases of the nervous system, diabetes and arthritis had relatively large inequalities (OR > 1.50) but no socioeconomic differences were evident for cancer, kidney diseases and skin diseases.[12]

The fourth and most recent review looked at socioeconomic inequalities in health in the European Union including the new eastern member states.[13] Not only were rates of mortality consistently higher among those in a lower socioeconomic position but the inequalities in mortality increased in many European countries in the past few decades.[13] This study, however, found no clear trend as to which socioeconomic indicator (education, occupation or income) was more strongly associated with health disparity.[13] The study found that people with lower socioeconomic positions not only live shorter lives but also spend a large number of years in ill-health with increased incidence and prevalence of many chronic conditions, most mental health problems, functional limitations and disability.[13]

In Sweden, the entire population aged twenty-five to sixty-five was matched to the national census in 1990 with subsequent mortality.[1,14] Higher education resulted in substantially lower mortality in comparison to men with lower education at each step of the gradient (Figure 1.1).[1,14]

Figure 1.1 Mortality by Level of Education in Sweden 1990-1996



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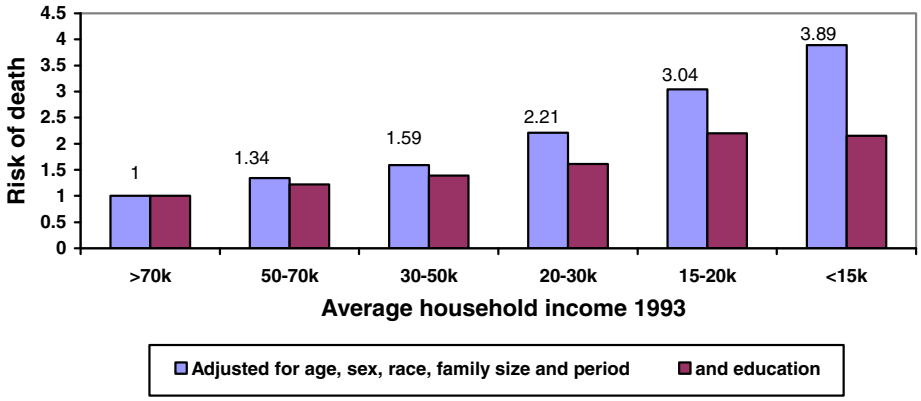
A meta-analysis from Belgium reviewed socioeconomic inequalities in major depression in adults in all studies published from 1979 to 2001. Results indicated that low-SES individuals had 81% higher odds of being depressed.[15] A dose-response relationship was observed for both education and income.[15] The authors concluded that they found compelling evidence for socioeconomic inequality as a risk indicator for depression.[15]

In North America, income status appears to have a stronger association with health disparity than either educational status or occupational status. In the United States, a sample of 8,500 men and

women were followed for twenty years from 1972-1991.[1,16] Men and women that made less than $15,000 per year were 3.89 times more likely to die than those making more than $70,000 per year after adjusting for age, sex, race, family size and time period (Figure 1.2).[1,16] The second group of bars show what happens to the relationship between income and mortality when education is taken into account. The association between income and mortality remains but is reduced after adjusting for education status.[1,16]

Figure 1.2 Relative Risk of Death in United States Study of Income Dynamics



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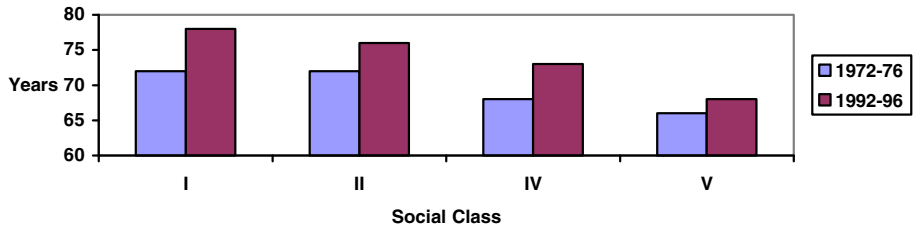
A recent cross-sectional analysis of the Canadian Community Health Survey, a comprehensive survey with more than 130,000 Canadians, demonstrated that those with the highest household incomes are two and a half times more likely to report excellent or very good health than those with the lowest incomes.[17]

The collection of information provided above suggests that variables like occupational status, educational status and income status are strongly associated with health status. Given that these variables are all modifiable, there is little reason to believe that health disparities could not be substantially reduced in a society. This leads to another complication. Despite the improvement in life expectancy of the lower social classes over the past few years, the health status of the higher social classes has improved more.[1,18] In other words, the relative gap in health disparity in the past twenty years by socioeconomic status has been increasing instead of decreasing.[1,18] In England, the gap in life expectancy between the top and bottom social classes increased from 5.5 years in 1976 to 9.5 years in 1996 (Figure 1.3).[1,18] This presents a challenge as it suggests that policy makers have been either unaware or ineffective in reducing health disparity over time.

Figure 1.3 Life Expectancy for Men by Social Class in England and Wales



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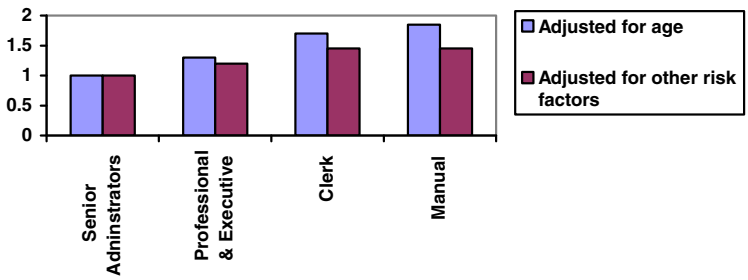
There is still one other complication to discuss. Some people argue that differences in health status between socioeconomic groups are the result of individual choices to engage in risk behaviours like smoking, physical inactivity and poor diet.[1] As such, some argue there is little we can do when individuals from lower socioeconomic status choose to engage in risk behaviour.[1] The problem with this argument is that the evidence does not support it. Differences in behaviour provide only a modest explanation of the socioeconomic gradient in health.[1] If lower socioeconomic status men died earlier from heart disease because they had higher levels of risk factors, then statistically adjusting for these risk factors and the consequences of these risk factors (i.e. smoking, blood pressure, plasma cholesterol and blood sugar), would make the risk of heart disease between socioeconomic groups the same.[1] Figure 1.4 demonstrates that the risk of mortality from coronary heart disease is approximately 50% higher in the manual grades in comparison to senior administrators after statistical adjustment for known risk factors.[1] Adjusting for known risk factors explains less than a third of the social gradient in mortality from heart disease.[1]

Figure 1.4 Mortality from Coronary Heart Disease over Twenty-Five Years



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Some important questions still need to be reconciled. Why would behaviours such as smoking, reduced exercise and poor diet appear to be a) more common and b) more harmful in lower-status groups than in higher status groups?[1] It cannot be a coincidence that people in lower socioeconomic groups are more likely to choose to smoke and it surely cannot be coincidence that lower socioeconomic groups are more likely to suffer from poor health as a result.[1] If smoking, lack of exercise and poor diet are causes of ill health, then we have to look at the causes of the causes of poor health, or the determinants of risk behaviour that lead to poor

health. In other words, socioeconomic status is associated with both poor health status and risk behaviours that lead to poor health status.

1.2. Socioeconomic Status, Cultural Status and Health

As stated previously, it is not difficult to find a government agency in Canada reporting that Aboriginal cultural status is associated with poor health.[2,3] For example, the Health Canada website reports that First Nations peoples are more likely to experience poor health outcomes in essentially every indicator possible.[24] The following are some of the highlights from Health Canada's *A Statistical Profile on the Health of First Nations in Canada for the year 2000* report:

- The life expectancy at birth for the Registered Indian population was estimated at 68.9 years for males and 76.6 years for females. This reflects a reduction of 7.4 years and 5.2 years in life expectancy in comparison to the Canadian population.[19]
- In First Nations populations, potential years of life lost from injury was almost 3.5 times that of the national average.[19]
- Compared with the overall Canadian population, First Nations had elevated rates of pertussis (2.2 times higher), rubella (7 times higher), tuberculosis (6 times higher), shigellosis (2.1 times higher) and Chlamydia (7 times higher).[19]
- First Nations hospitalization rates were higher than Canadian rates for all causes except cancers. Where the principal hospital discharge diagnosis was respiratory disease, digestive disease, or injuries and poisonings, the rates were approximately two to three times higher than the national averages.[19]

One of the concerns associated with the discussion above is that it gives policy makers and the public at large the impression that health disparity is not preventable because a major determinant of health and behaviour (cultural status) is not modifiable. In the United States and Canada, cultural status is strongly correlated with socioeconomic status.[20] In 1990, the *Canadian Aboriginal Peoples Survey* concluded that:

- 28.0% of all Aboriginal adults relied on social assistance for at least part of the year in comparison to 8.1% of the national average.[21]
- the overall Aboriginal unemployment rate was 19.4%, which was more than double the general population. The rate of on-reserve Aboriginal unemployment was even higher at 31.0%.[21]

The Department of Indian and Northern Development has projected that social assistance dependency rates among Canada's First Nations will increase from 150,000 beneficiaries in 1997 to 250,000 in 2010.[22] According to the 2001 Census of Canada, on-reserve Registered Indians rate lower than the general Canadian population on all educational attainment indicators including secondary school completion rates, postsecondary education admissions and completion of university degrees.[19] In 2000/01, Indian and Northern Affairs Canada indicated that 15.7% of homes on First Nations reserves were in need of major repairs, and 5.3% were no longer habitable or had been declared unsafe or unfit for human habitation.[19]

There is growing awareness, however, that the association between cultural status, SES, and health status is neither simple nor straightforward. For example, one paper analyzed the relationship between education, income and occupation with psychiatric illness separately for the black and white sub-samples of the American ECA study.[23] They found that cultural status was not a predictor of mental health status after controlling for SES.[23] In Canada, one paper reviewed data from the *National Population Health Survey* in 1997 with a sample size of 81,804.[24] The baseline analysis revealed that Aboriginal Canadians experienced significantly more depressive symptoms that other Canadians.[24] The authors found that increases in family income reduced the

level of depression and the risk of a major depressive episode.[24] After multivariate adjustment, the authors concluded that socioeconomic variables were responsible for mental health disadvantages between cultural groups.[24]

A literature review summarized the influence of cultural status and poverty on the mental health of children.[25] This review found that 1) children whose parents are in poverty or who have experienced severe economic losses are more likely to report higher rates of depression, anxiety, and antisocial behaviours, and 2) after controlling for socioeconomic status, African American, Native American, and Hispanic children are actually less likely to report mental health problems.[25]

A Canadian study found that lower self report health and diabetes prevalence were not associated with Aboriginal cultural status after controlling for socioeconomic confounders.[26] At baseline, self-reported health status was uniformly worse for Aboriginal residents but the differences disappeared with adjustments for socioeconomic confounders.[26]

There is an important point to discuss at this stage. To date, many researchers have viewed cultural status as either a proxy for SES or regard SES as a confounder of the relationship between cultural status and health. Others argue, however, that SES is part of the casual pathway by which cultural status affects health.[24,27-30] In other words, cultural status is an antecedent or determinant of SES and, as such, SES acts as a pathway between the relationship of cultural status and health status.[24,27-30] As such, understanding the role of societal discrimination is required in order to understand how cultural status can be initially associated with lower health status.[24,27-30]

Definitions: Race, Ethnicity and Culture

Precise definitions of the terms “race,” “ethnicity,” and “culture” are elusive. As social concepts, they have many different meanings.[31]

Most people think of race as a biological category in order to divide and label different groups according to a set of common biological traits.[31] Despite this popular view, there are no biological criteria for dividing races into distinct categories.[31] There is overwhelmingly greater genetic variation within a racial group than across racial groups.[31] The concept of race is especially relevant when certain social groups are separated, treated as inferior or superior, and given differential access to power and other valued resources.[31]

Ethnicity refers to a common heritage shared by a particular group. Heritage includes similar history, language, rituals, and preferences for music and foods.[31]

Cultural status is broadly defined as a common heritage or set of beliefs, norms, and values.[31] It refers to the shared attributes of a group of people.[31]

For the purpose of this thesis, the term cultural status will be used instead of the terms race or ethnicity based on consultation with the local Aboriginal community.

1.3. Explanations of Socioeconomic Inequality in Health

Two general types of social theories have been put forth to explain health disparity: 1) selection and 2) social causation. Selection refers to the idea that those with existing health disorders are less likely to obtain high levels of income, education or occupational status.[32,33] Social causation suggests that health disparity can result when a society offers differential access to resources like education and employment to certain groups; which results is lower health status.[32,33]

Macro Social Theory

There are two main competing theories for explaining social causation.[34] The first explanation arises from the sociological theory of functionalism.[33] Functionalists argue that some occupations require an extensive amount of skill and intelligence whereas other occupations can be

performed by almost anyone.[33] In order for society to function properly, rewards and resources must be distributed unequally in order to attract those believed to have the most intelligence and skill into formal education programs and occupations that have the most importance to society.[33] The second main explanation for the existence of social causation comes out of the conflict paradigm.[33] According to this theory, individuals and groups already higher up in the social hierarchy intentionally restrict access to rewards and resources to others in order to maintain their advantage within society.[33]

If an individual inherits their social position from their parents, regardless of their personal attributes, then the social class system is closed and support is given to the conflict theory.[33] If an individual can increase their social position regardless of their background, then the social class system is open and support is given to the functional theory.[33] There is evidence that both theories have been observed in the past century.[33]

Micro Social Theory

Increased stress is the most widely accepted causal explanation for higher rates of mental disorder among those with lower socioeconomic status.[33] Stress evolves from the discrepancy between the demands of the environment and the potential responses of the individual.[33]

Within the topic of stress theory, one important issue to discuss is how people exposed to the same stressors are not necessarily affected in the same manner. There are two main modifiable variables, stressors and moderators, within the stress process that can influence mental health outcome.[33]

Within the stressors, status strains suggest that some individuals have unequal access to resources and opportunities.[3] Contextual strains suggest that the local environment (i.e. neighbourhood effects) can influence outcome.[33] The three main moderators are coping, social support and mastery.[33] Coping is what individuals do on their own to minimize stress.[33] Social support is access to social support networks.[33] Mastery refers to a sense of control over the external environment.[33] Mastery is also related to attributional theory whereby it is suggested that successful individuals attribute outcomes to individual efforts and unsuccessful individuals attribute outcomes to social structure.[35]

Although stress theory is the predominant theory explaining mental health disparity, other theories do exist. Some suggest income inequality translates into inequity in access to material conditions like adequate nutrition, housing and protection. This theory is called materialist/structuralist.[36] Others suggest lower income groups tend to exhibit higher prevalence of risk behaviours harmful to health. This theory is called cultural/behavioural.[37] Lastly, a review on health disparity in Canada argues that colonialism, oppression, racism and discrimination are linked to unequal access to resources, education and employment for Aboriginal people in Canada and that these factors result in poor health.[22]

1.4. Structure of the Thesis

Overall, the primary purpose of the thesis is to determine if socioeconomic status is associated with poor health status in Saskatoon residents. The second purpose of the collection of papers is to determine if Aboriginal cultural status is independently associated with poor health outcomes after multivariate adjustment for other factors like socioeconomic status. The thesis begins with two systematic literature reviews reviewing the strength of the association in other jurisdictions, followed by four papers of original research quantifying the magnitude of the association specific to Saskatoon with the final paper reviewing public support for health disparity intervention.

In total, there are seven research papers that form the body of the thesis:

A. The first paper was a systematic literature that reviewed depressed mood or anxiety by socioeconomic status in youth aged 10-15 years.

B. The second paper was a systematic literature that reviewed marijuana and alcohol risk behaviour by socioeconomic status in youth aged 10-15 years.

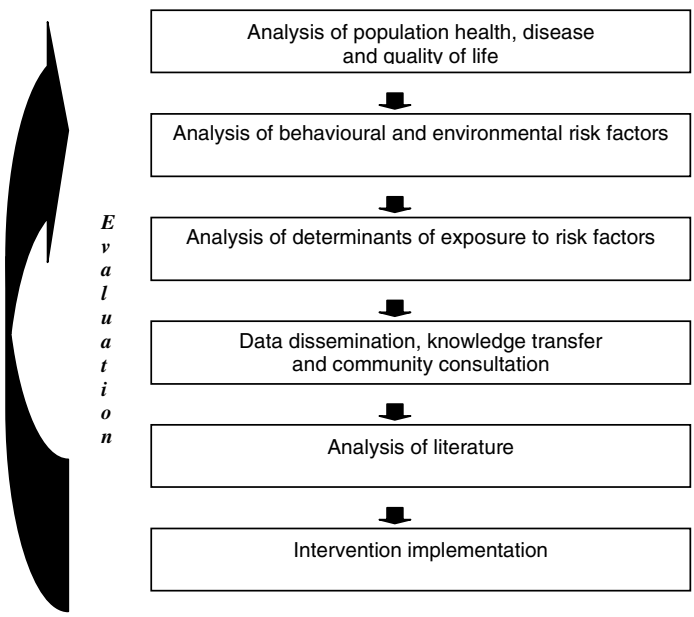
C. The third paper was a cross sectional ecological study that reviews all hospital discharges, physician visits, medication utilisation, public health information and vital statistics for Saskatoon by neighbourhood income status.

D. The fourth paper reviewed risk indicators for self report health, heart disease prevalence, diabetes prevalence and lifetime suicide ideation in Saskatoon.

E. The fifth study reviewed child immunization coverage rates at age two to determine if they were less in the low income neighbourhoods of Saskatoon.

F. The sixth paper was a school health survey for students in grades 5-8 in the City of Saskatoon.

G. The seventh paper was a cross sectional random survey of Saskatoon residents to determine knowledge about health determinants and then determine public support for various interventions to address health disparity.



The first and second papers discuss the analysis of the literature prior to intervention. The third, fourth, fifth and sixth research papers provide analysis on population health and quantify the level of health disparity in the Saskatoon population by socioeconomic status. The fourth and sixth papers review the influence of behaviours on health outcomes. Community consultation is discussed in the seventh paper. Considerable knowledge transfer has occurred since the publication of the studies. This has resulted in significant community based intervention of which the major intervention is a multi-disciplinary school based program. The thesis concludes with a review of health disparity and poverty reduction plans in other jurisdictions.

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2. Socioeconomic Status and Health Status

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Abstract

Introduction

A majority of population based studies suggest prevalence of depressed mood and anxiety is most common during late adolescence to early adulthood. Mental health status has been linked previously to socioeconomic status in adults. The purpose of this systematic literature review is to clarify if socioeconomic status (SES) is a risk indicator of depressed mood or anxiety in youth between the ages of 10 to 15 years old.

Methods

We performed a systematic literature review to identify published or unpublished papers between January 1, 1980 and October 31, 2006 that reviewed depressed mood or anxiety by SES in youth aged 10-15 years.

Results

We found nine studies that fulfilled our inclusion criteria and passed the methodological quality review. The prevalence of depressed mood or anxiety was 2.49 times higher (95% CI- 2.33-2.67) in youth with low SES in comparison to youth with higher SES.

Discussion

The evidence suggests that low SES has an inverse association with the prevalence of depressed mood and anxiety in youth between the ages of 10 to 15 years old. Higher rates of depressed mood and anxiety among lower socioeconomic status youth may impact emotional development and limit future educational and occupational achievement.

Conclusion

Lower socioeconomic status is associated with higher rates of depressed mood and anxiety in youth.

Introduction

The mental health of children and youth is an area warranting continued scientific and public health attention.[1] The World Health Organization predicts that by the year 2020, childhood and adolescent mental health problems will become one of the leading causes of morbidity, mortality and disability among children worldwide.[2]

A majority of population based studies suggest prevalence of depressed mood is most common during late adolescence to early adulthood. A national survey from Canada determined that prevalence of depression was highest in the 15-19 age group (9.2%; 95% CI- 7.1-11.3) with a prevalence rate of 2.7% in the 12-14 age group.[3] A review of three American population based studies suggests that most depressive symptoms start at approximately age 12 and peak between the ages of 15 and 17.[4] Regrettably, first-onset depression is being manifested at a younger age than observed previously.[5] The prevalence of depressed mood in youth is higher than depressive disorder; with prevalence rates of depressed mood among youth ranging from 21% to 50%.[6, 7]

Depression has a wide array of symptoms effecting somatic, cognitive, affective, and social processes. The consequences of depression include academic failure, poor peer relations, behavioural problems, conflict with parents and authority figures, low self esteem, substance abuse and interruption in development.[5,8-11] Up to 41% of youth with depressive disorder report suicide ideation and 21% of depressed youth attempt suicide.[6] The Ontario Child Health Study found that only 16.1% of children with mental health disorders receive mental health or social service attention.[12]

The identification of anxiety disorders, and how they influence children and adolescence, has been very much undervalued.[13] In children and youth, approximately 20% of youth suffer from at least one anxiety disorder.[6]

Given that youth onset of depression and anxiety disorders are a major risk factors for adult disorder, and that life events experienced in youth are associated with depression in adulthood, it is important to understand risk indicators of mental health status in youth.[14-20] Socioeconomic status is believed to be a key risk indicator although some authors suggest the findings are inconsistent.[1,6,21]

The objective of this systematic literature review was to determine the association between socioeconomic status and depressed mood or anxiety in youth aged 10-15 years old.

Methods

An epidemiologist and a senior librarian performed a systematic literature review utilizing the databases PubMed, PsycINFO, CINAHL, EMBASE, and HealthSTAR from January 1980 to October 2006. Subject descriptors included the MeSH terms: depressive disorder, depression, long term depression, depressive disorder major, depression chemical, adjustment disorders, anxiety, anxiety disorders, mental health, socioeconomic factors, social class, health behaviour, population characteristics, poverty, poverty areas, educational status, employment and occupations. Limits terms included: child 6-12 years, youth 13-18 years, humans and English language.

We also sought information pertaining to governmental or non-published papers (grey literature). In total, 261 e-mail requests were sent out to all relevant health, mental health, social science and education department heads of Canadian Universities, urban Health Regions, Provincial and Federal ministries, Canadian Mental Health Associations and independent research agencies

(i.e., Statistics Canada). Each of the contacts was asked to forward the e-mail request to any colleague that worked within the area of mental health and youth. The original e-mails were sent out in October of 2006. From this process, 23 responses were received.

Two epidemiologists independently screened titles and abstracts of published and unpublished literature for relevance. The following inclusion and exclusion criteria were used:

Inclusion criteria:

1. Published or unpublished literature that examined depressed mood or anxiety by SES in youth between the ages of 10 and 15 years old. Studies were accepted if the age range crossed an age period that included, but was not exclusive, to youth between the ages of 10 to 15 years old (e.g., 15 to 17 years old).
2. Population based cross sectional surveys or cohort/longitudinal studies.
3. Use of a validated screening scale for depressed mood or anxiety (e.g., CES-D).
4. Defined SES as parental income, education, employment status or occupational classification.
5. Data from Canada, United States, Western Europe, Australia or New Zealand.
6. Articles published in English language.

Exclusion Criteria:

1. Opinion papers, letters to the Editor, case reports, case studies or natural experiments.
2. Randomized trials or clinical settings.
3. Any paper where the baseline data was not presented or available upon request.

Articles were reviewed in full when criteria within the Abstract did not provide enough detail to make a decision. Reference lists of articles were examined. Full articles were reviewed independently by a panel of three reviewers consisting of two epidemiologists and a medical health officer. The panel independently appraised the methodological quality of a study with pre-established criteria in two stages: 1) assess the presence of selection, information or confounding bias and 2) review the study design, study population, variable definition, participation rate, sample size, measurement technique, and analysis strategy (Table 1).[22] Except for major violations, a study required an overall score of at least 10 out of 15 to be accepted and agreement between all three reviewers.

The statistical basis for the meta-analysis was taken from Fleiss with the statistical assumptions that data analysis included the total number of studies found in comparison to a sample and that the sample sizes from each of the reviewed studies were assumed to be large.[23] A computer program was built that utilized the following formulas:[23]

The fixed effects model was chosen with:

effect size	standard error	and 95% confidence interval (ψ)
$\overline{Y} = \frac{\sum W_c Y_c}{\sum W_c}$	$SE\left(\overline{Y}\right) = \left(\sum W_c\right)^{-1/2}$	$Y - z_{\alpha/2} / \sqrt{\sum W_c} \leq \psi \leq \overline{Y} + z_{\alpha/2} / \sqrt{\sum W_c}$

The meta-analytic approach took a weighted average of each study result (slope or β). The study weight (W) was the inverse of the variance computed from the estimated standard error or $SE(\beta)$ as $1/SE(\beta)^2$ and where Y was the effect size. Weighted slopes were calculated by weighting each β as follows:

$$\beta_w = \sum \left[\beta^* \ 1 \ / \mathrm{var}(\beta)\right] / \sum 1 / \mathrm{var}(\beta) \quad \text{where} \quad \mathrm{var}(\beta) = SE(\beta)^2$$

The pooled estimate of the $SE(\beta_w)$ was: $1/\sqrt{\sum W_i}$

The pooled estimate of the 95% confidence interval of β_w was: $\beta_w \pm 1.96^* SE(\beta_w)$.

Because the rate ratio is less prone to artificial appearance of inter-study heterogeneity the adjusted rate ratio is presented with 95% confidence intervals.[23]

The assumption of homogeneity of variance is given by: $\chi^2 = \sum W(\beta - \beta_w)^2$ which, if the studies are estimating the same value for the effect, has a chi square distribution with degrees of freedom one less than the number of studies.[24] Sensitivity analysis was reviewed by looking at the individual influence of a study and then repeating the analysis without studies with the largest weights. If this produced little change in inference (less than 15% change in rate ratio), it was determined that inclusion of the study would not warrant caution in the interpretation.[24] The point estimates of individual studies were plotted against the inverse of their variance or sample size in order to visualize a funnel shape scattered around the true value of the point estimate.[24] This funnel plot was used to assess publication bias.[24]

Results

The results of the systematic literature review are summarized in Table 2. Pubmed, PsycINFO, CINAHL, EMBASE and HealthSTAR identified 9185 titles which were screened for relevance. The grey literature search resulted in an additional 9 titles. From the total of 9194 titles screened for relevance, the overall search yielded 560 abstracts. Of the 560 abstracts, 231 articles were selected for full review including reference sections. Out of the 231 articles selected for review, nine met the inclusion criteria and passed the methodological quality review. These nine studies were forwarded for statistical pooling.

Of the nine pooled studies, five were American, three were Canadian, and one was European (Table 2).[3,25-32] Four studies were national samples and five were provincial/state or regional. All studies used depressed mood as an outcome measure and one study also included anxiety. Parental income was used as the socioeconomic indicator in seven studies and employment status and occupational classification were used in the other two studies. Two studies also included parental education as a secondary SES indicator. Sample sizes varied from 741 to 14,500.

In total, the overall sample size used for the meta-analysis was 34,752 youth (Table 3). The statistical pooling of the nine studies resulted in an overall rate ratio of 2.49 with a 95% confidence interval of 2.33 to 2.67. All nine studies and thirteen results (additional stratifications by gender) reported an inverse association between socioeconomic status and depressed mood or anxiety. The rate ratios ranged from a low of 1.07 to a high of 6.11. Only four individual results out of thirteen had lower confidence limits that crossed 1.[3,26,32] The result of the overall test of homogeneity of variance was $p < 0.001$, suggesting highly significant heterogeneity between studies. Stratification by gender on three studies revealed no statistically significant difference between male and female youth (Table 2).[26,30,32] No other stratification was able to fully reveal the source of heterogeneity. Sensitivity analysis individually removed two studies with relative weights of 0.26 and 0.21.[29,30] The changes in the rate ratio and 95% confidence intervals were not statistically significant. There were not enough studies accepted in order to visualize a funnel shape to the data to assess publication bias.

The results are presented schematically in Figure 1.

Discussion

The Minister of National Health and Welfare for Canada reported in Mental Health for Canadians: Striking a Balance that social and economic conditions are contributing factors to mental health and that social and economic inequity between groups is one of three main central challenges to policy development.[21] The Canadian Senate Committee on Transforming Mental Health, Mental Illness and Addiction Services in Canada reported that social factors were the most important determinants associated with mental illness.[33] This systematic literature review found that youth with low socioeconomic status are approximately two and a half times more like to suffer from depressed mood or anxiety than other youth with higher socioeconomic status.

Of the nine studies that were forwarded for statistical pooling, four studies had rate ratios greater than 3.0, two studies had rate ratios between 2.0 and 3.0 and the remaining three studies had rate ratios between 1.0 and 2.0. The discrepancies between the higher and lower rate ratios may be due to differences in methodology or the characteristics of the various populations surveyed. As reported, gender is a not a likely explanation for heterogeneity. This finding is important because gender differences in rates of depressed mood emerge around the age of 13 years.[6] Stratifications by study design, year of publication, geographical coverage, scale to measure depressed mood or anxiety, construct used to measure parental socioeconomic status did not significantly explain heterogeneity between studies. However, the two smallest rate ratios are from Europe where SES was measured in terms of occupational class.[32] This finding might suggest cross Atlantic differences in magnitude of inequalities or it might suggest that occupational class is somewhat different from other constructs to measure SES.

There are several limitations to discuss. First, the review of the grey literature is mainly influenced by contact with Canadian researchers. Second, publication bias is suspected but we were unable to formally test this assumption due to a limited number of accepted studies. The rate ratio from the only unpublished study (1.22) was much smaller than the rate ratios from the other North American studies that were published.[3] Third, there were four studies that included ages above the age range of 10 to 15 years old. The authors were unable to separate age groupings. Fourth, the authors did not examine causation or selection. Fifth, only one study was found that addressed anxiety, and, as such, caution is recommended in interpretation.

Socioeconomic status is one variable that should be further explored as a risk indicator for increased depressed mood or anxiety among youth. The identification of pathways, and how socioeconomic status impacts mental health status in youth, should become an important public health priority in Canada.

Table 1 Methodological Evaluation Criteria[22]

1. Research question is well stated.
2. Source population is identified and appropriate.
3. Inclusion criteria are described and appropriate.
4. Exclusion criteria are described and appropriate.
5. Participation rate is reported and appropriate.
6. Sample size is pre-planned and provides adequate statistical power.
7. Baseline comparability of various groups is reported.
8. Same data collection method is used for all respondents.
9. Important baseline variables are measured, valid, and reliable.
10. Outcome is defined and measurable.
11. Outcome measure is validated.
12. Outcome assessment was blind or free from bias.
13. Statistical analysis is appropriate.
14. Adjustment is made for important covariates.
15. The results are verifiable from the baseline data

Table 2 **Flow Chart Describing the Systematic Literature Review and Selection of Articles**

PubMed	PsycINFO	CINHAL	Embase	Healthstar	Grey Literature	Total
2284 Titles	953 Titles	2752 Titles	853 Titles	2343 Titles	9	9194
Screen 1- Review of Abstracts:						
246	161	77	30	37	9	560
Screen 2- Review of Full Articles:						
93	83	27	13	6	9	231
Screen 3- Met Inclusion Criteria and Passed Methodological Review:						
4	3	0	0	0	2	9
Statistical Pooling of nine papers.						

Table 3 Summary of Results of Meta-Analysis

Study	RR (95% CI)	ln (RR)	Relative weight	Sample size	Country of origin	Study design	Geographical coverage	Scale	Outcome measure	SES indicator
Bergeron L (2000) [25]				741	Canada	Cross Sectional	Provincial	Dom	Dep/Anx	Income
M/F age 12 – 14	3.72 (1.65, 8.50)	1.31	0.01							
StatCan NPHS (1999) [26]				1847	Canada	Cross Sectional	National	CES-D	Dep	Income
Female age 12-14	5.24 (1.96, 14.02)	1.66	0.00							
Female age 15-19	6.11 (2.59, 14.42)	1.81	0.01							
Male age 12-19	3.71 (0.93, 14.73)	1.31	0.00							
StatCan NLSCY (2006)* [3]				1401	Canada	Longitudinal	National	CES-D	Dep.	Income
M/F age 12 – 18	1.22 (0.75, 1.69)	0.20	0.04							
Goodman E (2003) [27]				14500	USA	Longitudinal	National	CES-D	Dep.	Income
M/F age 12 – 19	2.07 (1.73, 2.47	0.73	0.14							
Roberts R (1997) [28]				4456	USA	Cohort	Regional	DISC	Dep.	Income
M/F age 12 – 14	5.17 (4.46, 5.88)	1.64	0.26							
Hammack P (2004) [29]				1704	USA	Cohort	Regional	CES-D	Dep.	Income
M/F age 13 - 18	2.14 (1.81, 2.47)	0.76	0.21							
Kubic M (2003) [30]				3621	USA	Cross Sectional	Regional	CES-D	Dep.	Employ education
Female age 12 & 13	1.90 (1.44, 2.50)	0.64	0.06							
Male age 12 & 13	1.77 (1.33, 2.33)	0.57	0.06							
Costello E (1996) [31]				4500	USA	Cohort	Regional	CAPA	Dep	Income
M/F age 9, 11, & 13	3.20 (2.30, 4.40)	1.16	0.04							
Undlheim A (2005) [32]				1982	Norway	Longitudinal	National	MFQ	Dep.	Occupation classification
Female age 12-15	1.06 (0.50, 1.63)	0.06	0.02							
Male age 12-15	1.07 (0.80, 1.34)	0.07	0.08							
POOLED ESTIMATE	**2.49** (2.33, 2.67)	0.91223	1.00	34752						

*N.B. all studies were published papers except for StatCan NLSCY (2006), where data was requested. [3]

The overall pooled variance of the log of the Rate Ratios was 0.91223

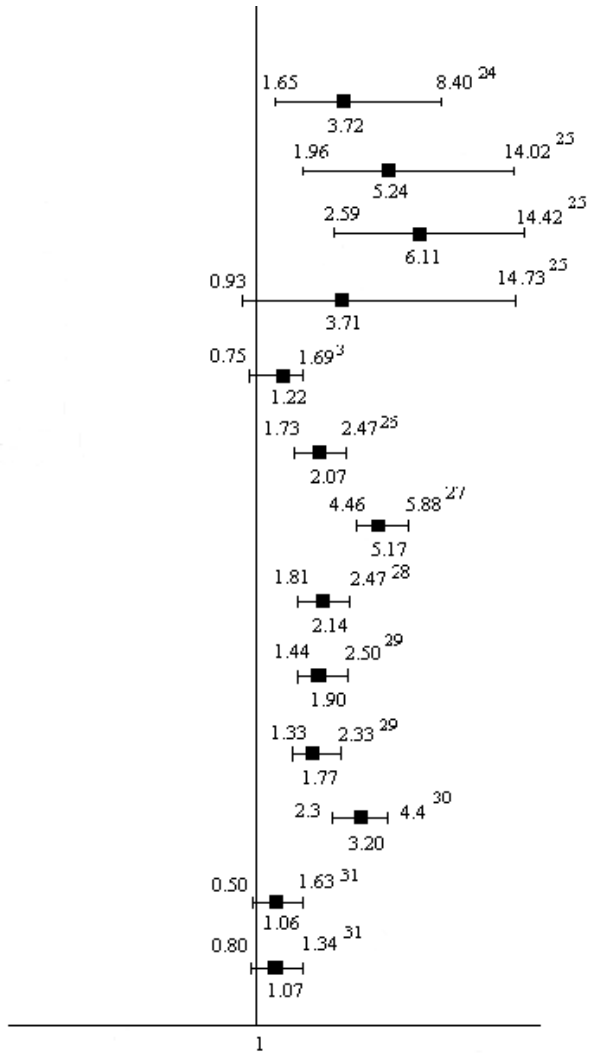

Figure 1. Rate Ratios and Confidence Intervals for nine studies forwarded for statistical pooling.

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Abstract

Introduction
A majority of population based studies suggest prevalence of drug and alcohol risk behaviour increases during late adolescence to early adulthood. The purpose of this systematic literature review is to clarify if socioeconomic status (SES) is a determinant of marijuana and alcohol risk behaviour in adolescents between the ages of 10-15 years.

Methods
We performed a meta-analysis to identify published or unpublished papers between January 01, 1980 and February 09, 2007 that reviewed marijuana and alcohol risk behaviour by SES in adolescents aged 10-15 years.

Synthesis
We found nine studies that fulfilled our inclusion criteria and passed the methodological quality review. The prevalence of marijuana and alcohol risk behaviour was 22% higher, (RR = 1.22; 95% CI 1.14, 1.31) in adolescents with low SES in comparison to adolescents with higher SES. Stratification by country of origin revealed that American and New Zealand studies had statistically significant variability in the reported effects as compared to European and UK studies.

Discussion
The evidence suggests that low SES has an inverse association with the prevalence of marijuana and alcohol risk behaviour in adolescents between the ages of 10 to 15 years. Higher rates of marijuana and alcohol risk behaviour among lower SES adolescents may impact emotional development, limit future educational and occupational achievement and increase the likelihood for adult marijuana and alcohol addiction.

Conclusion:
Lower SES adolescents have higher rates of marijuana and alcohol risk behaviour than higher SES adolescents.

Introduction

Unhealthy behaviours, such as excessive consumption of alcohol, are one of the main determinants through which socioeconomic status (SES) health differences develop.[1-7] Explanations for SES differences in unhealthy behaviour have mainly focused on adults, although lifestyle patterns are largely developed during adolescence.[8] Although the importance of individual lifestyle behaviours in promoting health and preventing disease has long been accepted, little is known about how SES affects the distribution of lifestyle behaviours among children and adolescents.[9-19]

Alcohol is the drug of choice among North American adolescents and it is used by more young people than tobacco or illicit drugs.[20-22] Alcohol plays a role in adverse health outcomes including being the leading contributor to death from injuries.[23-27] For example, morbidity and mortality rates increase 200% from middle childhood to late adolescence/early adulthood.[28] This substantial rise is attributable in large part to the increase in risk taking, sensation seeking and erratic behaviour that follows the onset of puberty.[29] Underage drinking is associated with academic failure, illicit drug use, tobacco use, risky sexual behaviour and increases the risk of physical and sexual assault.[30-34] Underage drinking can cause alterations in the structure and function of the developing brain and may have consequences reaching far beyond adolescence.[35-41] According to data from the 2005 National Survey on Drug Use and Health (NSDUH), 5.5% of youth between the ages of 12–17 years meet the diagnostic criteria for alcohol abuse or dependence.[20]

The prevalence of marijuana and alcohol risk behaviour among youth has been steadily increasing since the 1980s with sharp inclines during the early 1990s.[42-52] A World Health Organization cross-national study suggests that for Canadian youth in the 15 year age group, prevalence of alcohol use is 25% for males and 19% for females.[45] Prevalence of alcohol use for the Canadian 11-13 year age group is 12% for males and 8% for females.[45] A review of American population based studies suggests that drug and alcohol risk behaviours start at approximately age 10 years and peak between the ages of 14-15 years.[46,47] The prevalence of alcohol use is higher than drug use amongst adolescents.[53-56]

The objective of this meta-analysis was to determine the association between SES and marijuana and alcohol risk behaviour among adolescents aged 10-15 years.

Methods

An epidemiologist and a senior librarian performed a systematic literature review utilizing the databases PubMed, PsycINFO, CINAHL and EMBASE from January 01, 1980 to February 09, 2007. Subject descriptors included the MeSH terms: Ethanol, Alcohol Related Disorders, Alcohol Drinking, Alcohol Induced Disorders, Fetal Alcohol Syndrome, Alcoholism, Alcoholic Intoxication, Alcoholic Beverages**,** Socioeconomic**,** Socioeconomic Factors, Social Class, Health Behaviour, Population Characteristics, Poverty, Educational Status, Occupations, Employment**,** Drugs, Non Prescription, Street Drugs, Designer Drugs, Psychotropic Drugs, Physiological Effects of Drugs, Marijuana Smoking, Substance Use, Substance Related Disorders, Substance Abuse Detection, Behaviour, Addictive, Social Problems. Limits terms included: Child: 6-12 years, Adolescent: 13-18 years, Publication date 1980-2007, Clinical Trial, Meta-Analysis, Practice Guideline, Randomized Controlled Trial, Review Humans and English language.

We also sought information pertaining to governmental or non-published papers (grey literature). In total, 251 e-mail requests were sent out to all relevant health, mental health, social science and education department heads of Canadian Universities, urban Health Regions, Provincial and Federal Ministries, School Boards, Canadian Mental Health Associations, researchers involved in projects from the National Longitudinal Survey of Children and Youth and independent research agencies (i.e., Statistics Canada). Each of the contacts was asked to forward the e-mail request to any colleague that worked within the area of risk behaviour and adolescents. The original e-

mails were sent out during the time period between November 22, 2006 and January 15, 2007. From this process, 13 responses were received.

Two epidemiologists independently screened titles and abstracts of published and unpublished literature for relevance. Inclusion and exclusion criteria were developed and used to assist in the selection of articles for inclusion in the meta-analysis (Table I). Articles were reviewed in full when criteria within the abstract did not provide enough detail to make a decision. Reference lists of articles were examined. Full articles were reviewed independently by a panel of three reviewers consisting of two epidemiologists and a medical health officer. The panel independently appraised the methodological quality of a study with pre-established criteria in two stages: 1) assess the presence of selection, information or confounding bias and 2) review the study design, study population, variable definition, participation rate, sample size, measurement technique, and analysis strategy (Table II).[57] Except for major violations, a study required an overall score of at least 10 out of 15 to be accepted. The statistical basis for the meta-analysis was taken from Fleiss 1993.[58] Data analysis included the total number of studies found in comparison to a sample.[58] The sample sizes from each of the reviewed studies had the statistical assumption that they were large.[58] A computer program was built that utilized the following formulas: [58]

The fixed effects model was chosen with:

effect size $\overline{Y} = \frac{\sum W_c Y_c}{\sum W_c}$

standard error $SE\left(\overline{Y}\right) = \left(\sum W_c\right)^{-1/2}$

and 95% confidence interval (ψ) $Y - z_{\alpha_{/2}} / \sqrt{\sum W_c} \leq \psi \leq \overline{Y} + z_{\alpha_{/2}} / \sqrt{\sum W_c}$

The meta-analytic approach took a weighted average of each study result (slope or β). The study weight (W) was the inverse of the variance computed from the estimated standard error or $SE(\beta)$ as $1/SE(\beta)^2$ and where Y was the effect size. Weighted slopes were calculated by weighting each β as follows:

$$\beta_w = \sum \left[\beta^* \ 1 \ / \mathrm{var}(\beta)\right] / \sum 1 / \mathrm{var}(\beta) \quad \text{where} \quad \mathrm{var}(\beta) = SE(\beta)^2$$

The pooled estimate of the $SE(\beta_w)$ was: $1/\sqrt{\sum W_i}$

The pooled estimate of the 95% confidence interval of β_w was: $\beta_w \pm 1.96^* SE(\beta_w)$.

Because the rate ratio (RR) is less prone to artificial appearance of inter-study heterogeneity the adjusted RR is presented with 95 percent CIs.[58]

The assumption of homogeneity of variance is given by: $\chi^2 = \sum W(\beta - \beta_w)^2$ which, if the studies are estimating the same value for the effect, has a chi square distribution with degrees of freedom one less than the number of studies.[59]

Sensitivity analysis was reviewed by looking at the individual influence of a study and then repeating the analysis without studies with the largest weights. This produced change in inference (greater than 15 percent change in RR), it was therefore determined that inclusion of the study warrants caution in the interpretation.[59] The point estimates of individual studies were plotted against the inverse of their variance or sample size in order to visualize a funnel shape scattered around the true value of the point estimate.[59] This funnel plot was used to assess publication bias.[59]

Results

The selection of articles for the systematic literature review is summarized in Table III. Pubmed, PsycINFO, CINAHL and EMBASE identified 8897 titles which were screened for relevance. The grey literature search resulted in one additional title. An additional 490 titles were identified from reference sections in reviewed papers from the above databases. From the total of 9388 titles screened for relevance, the overall search yielded 1327 abstracts. Of the 1327 abstracts, 629 articles were selected for full review including reference sections. Out of the 629 articles selected for review, nine met the inclusion criteria and passed the methodological quality review. These nine studies were forwarded for statistical pooling.

Of the nine pooled studies, three were American, five were European and one international study included both of these geographic locations (Table IV).[8,11,60-66] Seven studies were national samples and two were provincial/state or regional. All studies used marijuana and or alcohol risk behaviour as an outcome measure. Parental income was used as the socioeconomic indicator in five studies, occupational classification was used in two studies, parental education was used in two studies and one study also included parental education as a secondary SES indicator. Sample sizes varied from 1000 to 162,305.

In total, the overall sample size used for the meta-analysis was 219,517 adolescents (Table IV). The statistical pooling of the nine studies resulted in an overall RR of 1.22 with a 95% CI of 1.14 to 1.31. Six studies out of nine and seven results (additional stratifications by gender and age) reported an inverse association between SES and marijuana and alcohol risk behaviour. The rate ratios ranged from a low of 0.09 to a high of 1.85. Nine individual results out of 16 had lower confidence limits that crossed 1. The result of the overall test of homogeneity of variance was $p < 0.00$, suggesting highly significant heterogeneity between studies. Stratifications by study design, year of publication, and scale to measure risk behaviour and construct used to measure parental SES did not significantly explain heterogeneity between studies. Stratification by gender on two studies revealed no statistically significant difference between male and female adolescents (Table IV).

Sensitivity analysis individually removed one study comprised of two results with relative weights of 0.25 and 0.31. With all studies included, the pooled RR was 1.22, (95% CI 1.14, 1.31) in comparison to a pooled RR of 1.03, (95% CI 0.93, 1.14) when one well designed study with narrow confidence intervals was removed. The changes in the RR and 95% CI were statistically significant therefore caution is recommended when interpreting the results. There were not enough studies accepted in order to visualize a funnel shape to the data to formally assess publication bias.

Discussion

This meta-analysis found that adolescents with low SES are 22% more likely to engage in marijuana and alcohol risk behaviour than other adolescents with higher SES.

As reported, gender is not a likely explanation for heterogeneity in the estimate. This finding is relevant because gender differences in rates of marijuana and alcohol risk behaviour emerge around the age of 11 years and continue through to age 15 years or older.[66-70] Stratification by country of origin revealed that American and New Zealand studies (inverse association) had statistically significant variability in the reported effects as compared to European and UK studies (mostly no association). The differences between the cultural norms and expectations of these two geographical locations regarding marijuana and alcohol risk behaviour may, in part, explain the heterogeneity between studies included in the analysis.[65] Overall, the papers have contradictory and negative results so publication bias is not suspected.

There are several limitations to discuss. First, the review of the grey literature is mainly influenced by contact with Canadian researchers. Second, there were two studies that included ages above the age range of 10 to 15 years. The authors were unable to separate age groupings. Third, the authors did not examine causation or selection. Fourth, measurement scales for marijuana and alcohol use vary between studies. Fifth, the results of the meta-analysis were highly influenced by one study.

The association between SES and drug and alcohol risk behaviour is well known for adult populations.[1,8] We found a correlation between SES and marijuana and alcohol risk behaviour for adolescents aged 10-15 years. Prevention or cessation strategies for youth that do not address SES as a component of intervention would likely be met with limited success. SES is one variable that should be further explored as a mediating or explanatory factor for increased marijuana and alcohol risk behaviour among adolescents. The identification of determinants, and how SES impacts risk behaviour in adolescents, should become an important public health priority in Canada.

Inclusion criteria:

1. Published or unpublished literature that examined risk behavior (drug use once per month or more and or one full alcohol drink per month or more) by SES in adolescents between the ages of 10 and 15 years. Studies were accepted if the age range crossed an age period that included, but was not exclusive, to adolescents between the ages of 10 to 15 years (e.g. 15 to 17 years).
2. Population based cross sectional surveys or cohort/longitudinal studies.
3. Defined SES as parental income, education, employment status or occupational classification.
4. Data from Canada, United States, Western Europe, Australia or New Zealand.
5. Articles published in English language.

Exclusion Criteria:

1. Opinion papers, letters to the Editor, case reports, case studies or natural experiments.
2. Randomized trials or clinical settings.
3. Any paper where the baseline data was not presented or available upon request.

Table I: Inclusion and Exclusion Criteria.

1. Research question is well stated.
2. Source population is identified and appropriate.
3. Inclusion criteria are described and appropriate.
4. Exclusion criteria are described and appropriate.
5. Participation rate is reported and appropriate.
6. Sample size is preplanned and provides adequate statistical power.
7. Baseline comparability of various groups is reported.
8. Same data collection method is used for all respondents.
9. Important baseline variables are measured, valid, and reliable.
10. Outcome is defined and measurable.
11. Outcome measure is validated.
12. Outcome assessment was blind or free from bias.
13. Statistical analysis is appropriate.
14. Adjustment is made for important covariates.
15. The results are verifiable from the baseline data.

Table II: Methodological Evaluation Criteria

PubMed	PsycINFO	CINHAL	Embase	Grey Lit	Reference List	Total
2733 Titles	685 Titles	3660 Titles	1819 Titles	1 Titles	490 Titles	9388 Titles
Screen 1- Review of Abstracts:						
327	225	254	256	1	264	1327
Screen 2- Review of Full Articles:						
94	117	76	77	1	264	629
Screen 3- Met Inclusion Criteria and Passed Methodological Review:						
0	2	0	1	0	6	9
Statistical Pooling of 9 papers.						

Table III. Flow Chart Describing the Systematic Literature Review and Selection of Articles.

Study	RR (95% CI)	ln (RR)	Relative weight	Sample size	Country of origin	Study design	Geographical coverage	Outcome measure	SES indicator
Elgar F (2005)				162,305	34 Countries	Cross Sect	International	Alcohol	Income
M/F age 11									
Low vs High	0.95 (0.43, 2.11)		0. 01						
Low vs Med	2.01 (1.21, 3.33)								
M/F age 13									
Low vs High	0.93 (0.54, 1.62)		0. 01						
Low vs Med	1.59 (0.96, 2.65)								
M/F age 15									
Low vs High	0.53 (0.31, 0.90)		0. 02						
Low vs Med	0.74 (0.41, 1.35)								
Boys A (2003)				2,624	UK	Cross Sect	National	Drugs Alcohol	Income
M/F age 13 - 15									
Drugs									
Low vs High	0.2 (0.28, 0.68)		0. 00						
Alcohol									
Low vs High	0.09 (0.05, 0.23)		0. 00						
Low vs Med	0.54 (0.07, 1.09)								
Droomers M (2003)				1,000	New Zealand	Longitudinal	Regional	Alcohol	Father's Occupation
M/F age 11									
Low vs High	1.85 (1.32, 2.60)		0. 04						
Blenkinsop S (2001)				9,000	UK	Cross Sect	National	Alcohol	Income
Male age 11- 15									
Low vs High	0.62 (0.03, 1.20)		0. 01						
Low vs Medium	0.83 (0.60, 1.07)								
Female age 11 - 15									
Low vs High	0.28 (0.37, 0.93)		0. 00						
Low vs Medium	0.44 (0.25, 1.13)								
Lintonen T (2000)				6,321	Finland	Cross Sect	National	Alcohol	Parental Education
Male age 9 - 13									
Low vs High	1.1 (0.9, 1.5)		0. 05						
Wallace J (1999)				25,000	USA	Cohort	National	Alcohol	Education
Male age 13									
Low vs High	0.98 (0.75, 1.27)		0. 07						
Male age 15									
Low vs High	1.08 (0.81, 1.44)		0. 05						
Miller D (1997)				1,725	USA	Cross Sect	National	Drugs	Income
M/F age 11-17									
Low vs High	1.72 (0.80, 3.70)		0. 01						
Lowry R (1996)				6,321	USA	Cross Sect	National	Alcohol	Education
M/F age 12-17									Income
Income									
Low vs High	1.35 (1.17, 1.52)		0. 31						
Education									
Low vs High	1.47 (1.25, 1.68)		0. 25						
Donato F (1995)				5,221	Italy	Cross Sect	Regional	Alcohol	Occupational Category
Males age 14	1.0 (0.8, 1.2)		0. 13						
Females age 14	1.4 (1.0, 1.9)		0. 05						
POOLED ESTIMATE	1. 22 (1.14, 1. 31)	0. 20115	1.00						
The overall pooled variance of the log of the Rate Ratios was			0. 00114						

Table IV. Summary of Results of Meta-Analysis.

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Abstract

Introduction

Canadian cities are becoming more segregated by income. As such, investigation is required into the magnitude of health disparity between low, average and high income neighbourhoods in order to quantify the level of health disparity at the scale of an urban city.

Methods

A cross sectional ecological study design was used to review all hospital discharges, physician visits, medication utilisation, public health information and vital statistics for an entire city by neighbourhood income status. Postal code information was used to identify six existing contiguous residential neighbourhoods in the city of Saskatoon that were defined as low income cut-off neighbourhoods (N= 18,228). There were two comparison groups: all other Saskatoon residents (N= 184,284) and the five most affluent neighbourhoods in Saskatoon (N=16,683).

Results

Statistically significant differences in healthcare utilization by neighbourhood income status were observed for suicide attempts, mental disorders, injuries and poisonings, diabetes, chronic obstructive pulmonary disease, coronary heart disease, Chlamydia, gonorrhea, hepatitis C, teen birth, low birth weight, infant mortality and all-cause mortality. The rate ratios increased in size when comparing low income neighbourhoods to high income neighbourhoods. No clear trend was observed for stroke or cancer.

Discussion

The findings suggest that low income neighbourhoods are associated with increased healthcare utilization in Saskatoon.

Introduction

Many studies from different countries and diverse settings have found a strong correlation between life expectancy and socioeconomic status (SES).[1-5] Historically; most of the studies reviewing SES and health status are at the individual rather than the neighbourhood level.[3,6-13] Recent studies suggest that neighbourhood SES can independently influence individual health above and beyond individual SES.[9-13] As such, research on the independent effect of individual and neighbourhood SES on health status is fairly well documented. Although the previous research is very important, there are several considerations: 1) most peer reviewed research is American or British, 2) most papers use national level census data with analysis at the national or provincial level, 3) when national level census data is broken down into regional data, the census tract boundaries can create proxies for neighbourhoods that might not be meaningful, 4) analysis at the regional level normally results in very small sample size and 5) health information is normally self reported.[6,9-16]

Almost all Canadian cities are becoming more segregated by income.[14] As such, investigation is required into the magnitude of health disparity between low, average and high income neighbourhoods in order to quantify the level of health disparity at the scale of an urban city.[14] The objective of the current research is to use a cross sectional ecological study design to determine the association between neighbourhood income and healthcare utilization in the city of Saskatoon, Canada (N = 202,512).

Methods

The last census in Canada was performed in 2001.[17] Postal code information from the census was used to identify six existing residential neighbourhoods in the city of Saskatoon that were defined as “low income cut-off neighbourhoods” by Statistics Canada.[18] All six neighbourhoods were touching or contiguous pre-existing municipal boundaries (Figure 1). A neighbourhood is designated low income (or high poverty) when more than 30% of the families in the neighbourhood meet the definition of low income cut-off. A family is designated low income when they spend more than 70% of family income on basic necessities like food, shelter and clothing. Cut-off points are adjusted for family size, population of city or area of residence, urban/rural differences and consumer price index. Additional socioeconomic information from the census was collected including neighbourhood education status and employment status (Table 1).

Healthcare utilization information in Saskatchewan includes location of residence by postal code. As such, specific health information was collected on residents that lived in the low income neighbourhoods (N= 18,228). Two comparison groups were established. The first comparison group was all other Saskatoon residents (N= 184,284). The second comparison group was the five most affluent neighbourhoods in Saskatoon identified by Statistics Canada census information on income status. The five neighbourhoods in the affluent group were also contiguous municipal boundaries and had similar population size (N=16,683) as the low income neighbourhoods (Figure 1).

Saskatchewan has universal health coverage for all residents with a centralized administrative database that collects information on all hospital discharges or separations, physician visits, medication usage, public health information and vital statistics. Information was collected on the eight most common diseases and disorders in Saskatoon (suicide attempt, mental disorder, injuries and poisonings, diabetes, chronic obstructive pulmonary disorder, coronary heart disease, stroke and cancer) resulting in hospital discharge by most responsible diagnosis (ICD9 codes[19]) for the year 2001 (to coincide with the latest census year). The positive predictive value of a primary diagnosis from hospital data in Saskatchewan is 90%.[20] Information on the same diseases (excluding suicide attempts) was collected for overall physician visits in 2001.

Medication information was collected for all prescriptions filled in 2001 for the entire population for mental disorders (antidepressants and antipsychotic agents) and diabetes (insulin pork/human biosynthetic and oral hypoglycemics). Medication data required an extra data request from Health Canada as the federal government in Canada is responsible for payment of medication expenses for Registered Indians (a historical legal term for treaty purposes).

Missing data is unlikely because documentation for hospital visits, physician visits and medication payments are required for administrative, legal and financial reasons. Misclassification at point of data entry is unlikely due to double data entry and verification procedures.

Public health information was collected on the three most common infectious diseases in 2001 (Chlamydia, gonorrhea and hepatitis C). The rates for these diseases were based on positive provincial lab test counts for new cases in 2001 and not for investigations or treatment. Vital statistics information included teen births (15-19 years old) and low birth weights (less than 2500 grams). All cause mortality and infant mortality for the year 2001 were also included. Public Health and vital statistics information were generated by Saskatchewan Health and verified by Population Health Surveillance at the Saskatoon Health Region.

Age standardized rates were computed for the diseases and disorders mentioned above for the low income neighbourhoods, the rest of Saskatoon and the affluent neighbourhoods. Age standardization used a direct method with the 2001 Canadian population as the standard. The denominator was per 100,000 population in 2001 for all variables except teen birth and infant mortality (per 1000 live births). Population size was based on the population covered by Saskatchewan Health insurance. Ninety-five percent confidence intervals were built around all rates. Rate ratios were computed for healthcare utilization data (hospital discharge, physician visit, medication usage) and incidence rate ratios were computed for incidence data (public health and vital statistics) for the year 2001.[21] Rate ratios were computed between 1) the low income neighbourhoods and the rest of Saskatoon and 2) the low income neighbourhoods in comparison to the affluent neighbourhoods. Ninety-five percent confidence intervals were built around the rate ratios.

Healthcare utilization information submitted to the research team was de-identified and in aggregate form. The project received ethics approval from the University of Saskatchewan Behavioural Research Ethics Board.

Results

The low income neighbourhoods are significantly different in income status in comparison to the rest of Saskatoon and the affluent neighbourhoods as well as education status and employment status (Table 1). There were no statistically significant socioeconomic differences between the six low income neighbourhoods themselves or the five affluent neighbourhoods.

Comparing 2001 age-standardized hospital separations between the low income neighbourhoods and the rest of Saskatoon, the rate ratio was significantly different for suicide attempts (RR=3.75), mental disorders (RR=1.85), injuries and poisonings (RR=1.54), diabetes (RR=3.98), chronic obstructive pulmonary disease or COPD (RR=1.38) and coronary heart disease or CHD (RR=1.34). Comparing the low income neighbourhoods to the affluent neighbourhoods, significant differences were observed for suicide attempts (RR=15.58), mental disorders (RR=4.27), injuries and poisonings (RR=2.46), diabetes (RR=12.86) and CHD (RR= 1.70). There were no statistically significant differences observed for stroke or cancer (Table 2).

For overall number of physician visits in 2001, the rate ratio between the low income neighbourhoods and the rest of Saskatoon had significant differences for mental disorders (RR= 1.52), injuries and poisonings (RR= 1.35), diabetes (RR= 1.71), COPD (RR= 1.43) and CHD (RR= 1.12). Comparing the low income neighbourhoods to the affluent neighbourhoods,

significant rate ratios were observed for mental disorders (RR= 2.28), injuries and poisonings (RR= 1.91), diabetes (RR= 2.11), COPD (RR= 2.42), CHD (RR= 1.44) and stroke (RR= 1.58). Overall cancer treatments by physicians were lower in the low income neighbourhoods in comparison to the rest of Saskatoon (RR= 0.77) (Table 2).

The rate ratio for prescriptions filled for mental disorders in the low income neighbourhoods to the rest of Saskatoon was significant (RR= 1.21) as was diabetes medications (RR= 1.80). Comparing the low income neighbourhoods to the affluent neighbourhoods, significant differences were observed for both mental disorders (RR= 1.62) and diabetes medications (RR= 2.60) (Table 2).

Reviewing public health information, we found that comparing the low income neighbourhoods to the rest of Saskatoon resulted in incidence rate ratios of 4.32 for Chlamydia, 7.76 for gonorrhea and 8.04 for hepatitis C. Comparing the low income neighbourhoods to the affluent neighbourhoods, the rate ratio for Chlamydia was 14.89 and 34.60 for hepatitis C. There was no gonorrhea diagnosed in the affluent neighbourhood in 2001 (Table 2).

Significant differences were observed in rate ratios comparing the low income neighbourhoods to the rest of Saskatoon for teen births (RR= 4.21), low birth weight (RR= 1.46) and infant mortality (RR= 5.48). Significant differences were also found comparing the low income neighbourhoods to the affluent neighbourhoods for teen births (RR= 16.49), low birth weight (RR= 1.10), infant mortality (RR= 3.23) and all cause mortality (RR= 2.49) (Table 2).

Discussion

Previous reports have found associations between neighbourhood socioeconomic status and all cause mortality, infant mortality, infant birth weight, suicide, long term illness, coronary heart disease, disability, chronic conditions and depression.[11,13] The neighbourhood effects found in previous multivariate analysis studies that control for individual SES are modest and at times contradictory.[9,11-16,22]

The investigators reviewed cross sectional ecological data to determine the association between neighbourhood income and healthcare utilization in the city of Saskatoon. Significant differences were found for suicide attempts, mental disorders, injuries and poisonings, diabetes, chronic obstructive pulmonary disease, coronary heart disease, Chlamydia, gonorrhea, hepatitis C, teen birth, low birth weight, infant mortality and all cause mortality. The rates ratios were larger when comparing low income neighbourhoods to high income neighbourhoods. No clear or consistent pattern was observed for stroke or cancer. This finding for cancer has been demonstrated previously.[7]

There are several limitations that must be discussed. First, the study design is cross sectional. Any finding must be seen as associative and not cause and effect. Second, information on individual income was not collected. The study design was not intended to review the independent effect of neighbourhood income while controlling for individual income status or other covariates. Third, the study only gathered data on those who presented to healthcare and as such there is no way of knowing true disease prevalence or incidence. Finally, the authors do not address the issue of selection: does income cause health or does health cause income?

Most researchers conclude that where you live matters to health but not as much as who you are.[23] Rather than being a single universal neighbourhood effect on health, there appears to be some area effects on some health outcomes, in some population groups, and in some types of areas.[23] That said, Canadian neighbourhoods have become increasingly polarized among income lines.[14] As such, neighbourhoods might become more important in explaining health inequalities in the future.[14] In Saskatoon, low income neighbourhoods were associated with

increased healthcare utilization and, as such, neighbourhoods might have an important independent effect in a multivariate model currently being developed.

In summary, one review suggests Canada still has a poor conceptualization of the influence of income on health.[24] The current study represents a simple yet effective way to assess and quantify the magnitude of health disparity in an urban setting. The findings suggest that low income neighbourhoods are associated with increased healthcare utilization in Saskatoon.

Table 1 Comparison of Socioeconomic Status in Saskatoon Neighbourhoods

	Core	Rest of Saskatoon	Affluent
Population size*	18,228	184,284	16,683
Incidence low income, % (CI)**	44.0 (42.5-45.6)	12.3 (12.0-12.6)	3.7 (3.2-4.3)
Less than grade 9 education, % (CI)	14.8 (14.2-15.5)	5.3 (5.1-5.4)	2.2 (2.0-2.5)
Unemployment, % (CI)	18.1 (17.2-19.1)	6.5 (6.3-6.6)	4.3 (3.9-4.7)

Information Source: 2001 Statistics Canada Census
* Population size is based on the Saskatchewan Health covered population
** (CI) refers to 95% confidence interval

Table 2 Health Disparity by Neighbourhood Income in Saskatoon

Disease category and ICD9 code range	2001 Age-standardized rate (95% confidence intervals)			Ratios (95% CI)	Ratios (95% CI)
	Low Income Neighbourhoods	Rest of Saskatoon	Affluent Neighbourhoods	Low:Rest	Low:Affluent
	N = 18,228	N = 184,284	N = 16,683		
Number of Hospital Separations*:					
Suicide Attempt (E950-959, E980-989)	242.88 (171.12-314.65)	64.82 (53.17-76.47)	15.59 (-2.05-33.22)	3.75 (2.65-5.30)	15.58 (4.84-50.16)
Mental Disorders (290-318)	885.42 (746.49-1024.37)	479.90 (448.30-511.50)	207.20 (129.05-285.36)	1.85 (1.56-2.19)	4.27 (2.84-6.43)
Injuries and Poisonings (E800-999)	2019.94 (1813.56-2226.32)	1307.59 (1256.13-1359.05)	819.79 (674.32-965.26)	1.54 (1.39-1.72)	2.46 (2.01-3.02)
Diabetes (250)	212.43 (143.03-281.82)	53.41 (42.99-63.82)	16.52 (3.30-29.74)	3.98 (2.72-5.82)	12.86 (5.42-30.51)
Chronic Obstructive Pulmonary Disorder (490-496)	251.05 (173.25-328.85)	181.54 (162.54-200.53)	163.80 (88.13-239.47)	1.38 (1.01-1.92)	1.53 (0.88-2.67)
Coronary Heart Disease (410-414)	533.27 (418.55-648.00)	399.04 (371.20-426.89)	313.54 (208.15-418.93)	1.34 (1.07-1.68)	1.70 (1.14-2.53)
Stroke (430-438)	204.29 (131.18-277.39)	154.18 (136.82-171.54)	112.29 (42.69-181.89)	1.33 (0.91-1.93)	1.82 (0.89-3.72)
Cancer (140-.0-239.9)	428.42 (323.46-533.38)	479.90 (448.30-511.50)	421.17 (302.02-540.31)	0.89 (0.69-1.15)	1.02 (0.70-1.48)
Discrete Physician Visits*:					
Mental Disorders (290-318)	18419.05 (17790.80-19047.31)	14834.93 (14659.99-15009.87)	10324.28 (9830.58-10817.98)	1.24 (1.20-1.28)	1.77 (1.56-2.01)
Injuries and Poisonings (E850-999)	19558.08 (18959.11-20157.05)	18513.29 (18316.76-18709.83)	14031.17 (13504.34-14558.00)	1.06 (1.03-1.09)	1.38 (1.08-1.76)
Diabetes (250)	4080.39 (3767.89-4392.88)	2747.00 (2673.45-2820.56)	2295.18 (2034.59-2555.77)	1.49 (1.37-1.61)	1.77 (1.53-2.06)
Chronic Obstructive Pulmonary Disorder (490-496)	10124.6 (9705.50-10543.70)	8272.19 (8140.86-8403.51)	5021.66 (4711.96-5331.36)	1.22 (1.17-1.28)	1.98 (1.84-2.13)
Coronary Heart Disease (410-414)	2796.69 (2531.42-3061.96)	2650.73 (2578.79-2722.66)	2318.35 (2033.80-2602.91)	1.06 (0.96-1.16)	1.20 (1.04-1.39)
Stroke (430-438)	694.13 (561.98-826.27)	813.33 (773.39-853.27)	694.71 (525.82-863.60)	0.85 (0.70-1.04)	1.00 (0.82-1.21)
Cancer (140.0-239.9)	1716.09 (1508.69-1923.50)	2245.54 (2179.21-2311.87)	1947.55 (1694.75-2200.35)	0.76 (0.68-0.86)	0.88 (0.77-0.99)
Overall Number of Physician Visits*:					
Mental Disorders (290-318)	94707.59 (93273.31-96141.87)	62232.75 (61875.27-62590.23)	41261.54 (40256.35-42266.74)	1.52 (1.51-1.53)	2.28 (2.12-2.45)
Injuries and Poisonings (E850-999)	35776.38 (34953.35-36599.41)	26436.80 (26201.98-26671.62)	18444.12 (17845.01-19043.22)	1.35 (1.33-1.38)	1.91 (1.68-2.18)
Diabetes (250)	15804.63 (15187.06-16422.20)	9244.56 (9109.66-9379.46)	7456.22 (6979.05-7933.39)	1.71 (1.64-1.78)	2.11 (1.92-2.32)
Chronic Obstructive Pulmonary Disorder (490-496)	22853.39 (22234.48-23472.29)	15954.49 (15772.73-16136.25)	9277.95 (8840.36-9715.53)	1.43 (1.40-1.47)	2.42 (2.30-2.54)
Coronary Heart Disease (410-414)	9978.65 (9474.00-10483.31)	8911.89 (8780.12-9043.65)	6893.25 (6391.47-7395.03)	1.12 (1.06-1.18)	1.44 (1.33-1.56)
Stroke (430-438)	3776.37 (3465.53-4087.21)	4313.55 (4221.77-4405.33)	2391.42 (2080.32-2702.52)	0.88 (0.81-0.95)	1.58 (1.45-1.72)
Cancer (140.0-239.9)	4027.99 (3708.07-4347.91)	5233.69 (5132.43-5334.95)	4005.07 (3644.51-4365.63)	0.77 (0.71-0.83)	1.00 (0.92-1.09)

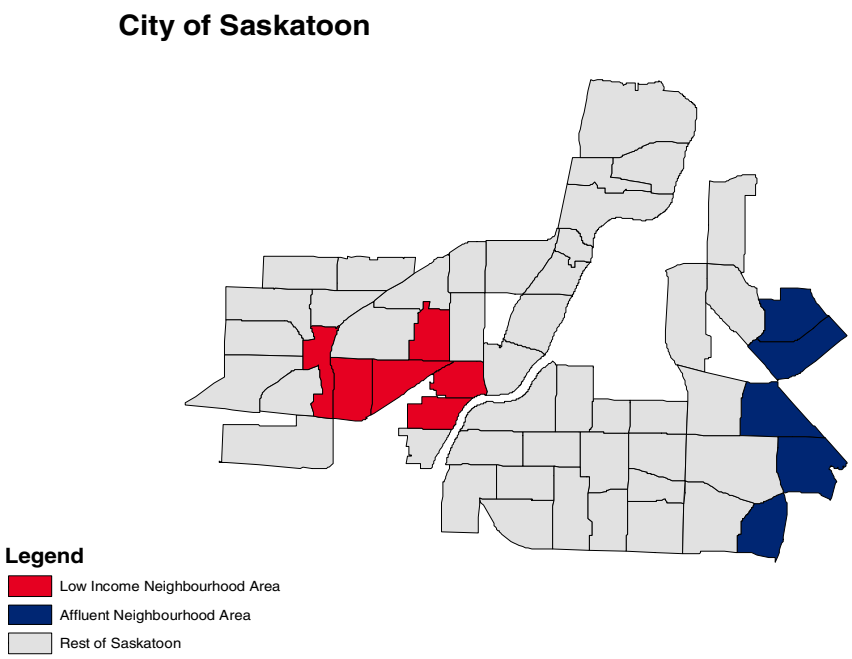
Table 2 Health Disparity by Neighbourhood Income in Saskatoon (Continued …)

Medication Usage*					
Mental Disorders	79154.85 (77823.42-80486.27)	65159.52 (64795.81-65523.23)	48990.73 (47871.85-50109.61)	1.21 (1.20-1.23)	1.62 (1.60-1.63)
Diabetes	42902.94 (41889.07-43916.80)	23819.21 (23602.35-24036.07)	16491.26 (15793.52-17189.00)	1.80 (1.77-1.84)	2.60 (2.52-2.69)
Public Health*:					
Chlamydia	1159.06 (1004.84-1313.27)	268.25 (244.33-292.17)	77.82 (35.52-120.12)	4.32 (3.68-5.07)	14.89 (8.51-26.06)
Gonorrhea	300.33 (221.67-379.00)	38.71 (29.64-47.78)	0	7.76 (5.46-11.02)	n/a
Hepatitis C (070.41,44,50,54)	399.27 (307.04-491.49)	49.66 (39.46-59.86)	11.54 (-4.63-28.60)	8.04 (5.90-10.95)	34.60 (8.49-140.99)
Vital statistics :					
Teen (15-19) Births**	98.13 (73.90-122.36)	23.33 (19.62-27.04)	5.95 (0.12-11.79)	4.21 (3.16-5.60)	16.49 (6.04-45.03)
Low Birth Weight (%)	9.2 (6.0-12.5)	6.3 (5.2-7.4)	8.4 (3.8-12.9)	1.46 (1.01-2.12)	1.10 (0.59-2.03)
Mortality					
Infant Mortality**	20.83 (5.40-36.27)	3.80 (1.17-6.43)	6.45 (-6.19-19.10)	5.48 (2.00-15.02)	3.23 (0.40-26.02)
All Cause Mortality	671.69 (548.93-794.46)	645.21 (609.79-680.62)	269.96 (164.15-375.81	1.04 (0.86-1.26)	2.49 (1.62-3.83)

* Age standardized rate per 100,000 population

** Rate per 1000 live birth population

Figure 1 **Statistics Canada Low Income Cut-Off Designation for Six Saskatoon Residential Neighbourhoods in 2001**



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Abstract

Introduction

The main purpose of the current study was to determine if Aboriginal cultural status is independently associated with four completely divergent health outcomes after controlling for other covariates; namely income status.

Methods

Data from three cycles of the Canadian Community Health Survey were merged with identical data collected by the Saskatoon Health Region in 2007. The four health outcomes included self report health, heart disease prevalence, diabetes prevalence and lifetime suicide ideation. The risk indicators included disease intermediaries, behaviours, life stress, healthcare utilization, socioeconomic status and cultural status.

Results

After cross tabulation, Aboriginal cultural status and income were strongly associated with almost all health outcomes, disease intermediaries, behaviours, life stress and healthcare utilization variables. After full multivariate adjustment, age and income had the strongest associations with the outcomes of lower self report health, diabetes prevalence, heart disease prevalence and suicide ideation. Aboriginal cultural status had a more limited association with poor health outcome after full multivariate adjustment for other covariates.

Conclusion

Reduction of health disparity in Aboriginal populations appears possible when social determinants of health are taken into consideration.

Introduction

In Canada, it is not difficult to find a government agency reporting that Aboriginal cultural status is associated with poor health.[1,2] For example, the Health Canada website reports that First Nations are more likely to experience poor health outcomes in essentially every indicator possible.[3] One of the concerns associated with this discussion is that it gives policy makers and the public at large the impression that health disparity is not preventable because a major determinant of health (cultural status) is not modifiable.

A comprehensive report on socioeconomic inequalities in health suggests that the main factors contributing to inequity include: behavioural factors (smoking, alcohol, exercise, fruit and vegetables, and obesity), psychological factors (stress), material or environmental factors (income, education, living in a disadvantaged neighbourhood and working conditions), access to health care and cultural status.[4] These specific risk indicators formed the basis of our study and analysis.

After determining the covariates associated with poor health outcome, the purpose of the current study was to determine if Aboriginal cultural status is independently associated with four completely divergent health outcomes in the Saskatoon Health Region after controlling for other covariates; namely income status.

Methods

The Canadian Community Health Survey (CCHS) is administered by Statistics Canada with the central objective of collecting health related data at the level of health regions; where an increasing number of decisions to improve population health are made in Canada.[5] The sample size for each health region is chosen to represent a sample large enough to provide valid and reliable information for a health region within any given cycle.[5] The decision to use this dataset was based on the fact that every health region in Canada would be able to replicate the study design in order to facilitate local decision making.

The CCHS consists of cross sectional surveys in 2000/01, 2003 and 2005. Data that was collected by Statistics Canada on all three cycles of the CCHS were merged with identical questions asked in February of 2007 by the Saskatoon Health Region (SHR). The four datasets were merged in order to gain precision on risk indicators for health outcomes. All four cycles were random phone survey samples. The target population included approximately 98% of the SHR. The methodology of the CCHS has been documented in detail previously.[5]

The health outcomes in the current study included self report health (excellent, very good, good, below average, poor), heart disease prevalence, diabetes prevalence and lifetime suicide ideation.

The baseline demographics included family income (0-$25,000, $25,001-$75,000 and above $75,000), neighbourhood income (six contiguous low income neighbourhoods defined by Low Income Cut-Off[6], rest of Saskatoon and rural), individual education (less than high school graduate, high school graduate, post secondary graduate), cultural status (Caucasian, Aboriginal or Other), age and gender. Disease intermediaries included high blood pressure diagnosed by a physician and a body mass index over 30. Behaviours included physical inactivity (composite index including multiple activities, frequency, duration and MET intensity), daily smoking, having more than five drinks of alcohol at one time at least once per week in the past twelve months and consuming less than five fruits and vegetables (within six different categories) on a daily basis. Life stress was measured by asking one question on current amount of stress in daily life. Consultations with a family physician and with a mental health worker (social worker, counsellor or psychologist) in the past year were also included. All of the main risk indicators for health

inequality mentioned in the introduction were able to be tested by using the CCHS except working conditions; which was not asked in the survey.[4]

Cross tabulations were computed between the demographics of income (family and neighbourhood), education and cultural status and the various health outcomes, disease intermediaries, behaviours, life stress and health care consultation variables. Four separate binary logistic regression models were built to describe the relationship between the four outcome variables of a) lower self report health (good, below average or poor), b) presence of heart disease, c) presence of diabetes and d) lifetime suicide ideation and all remaining covariates. A hierarchal well-formulated front-wise modeling approach was used instead of a computer generated stepwise algorithm.[7] In the final model, the unadjusted effect of each covariate was determined and then entered one step at a time based on changes in the –2 log likelihood and the Wald test.[8] The final models included factors with beta values for which the *p* values were less than 0.05.[8] Confounding was tested by comparing the estimated coefficient of the outcome variable from models containing and not containing the covariates.[8] Interaction was assessed with product terms.[8] R^2 was used to determine the proportion of variance in the outcome variable explained by the knowledge of the explanatory variables but not as a measure of the appropriateness of the final model.[8] Goodness-of-fit of the final model was assessed by the Hosmer-Lemeshow statistical test.[8] The final results were presented as adjusted odds ratios with 95 percent confidence intervals.[8] All analyses were performed with an SPSS 13.0 software package.[9]

The study design and the analysis plan were determined a priori as part of a Canadian Institutes of Health Research grant. Ethics approval was obtained from the University of Saskatchewan Behavioural Research Ethics Board.

Results

Over four cycles in 2001, 2003, 2005 and 2007, 7332 residents of SHR were asked to complete a health survey with 6127 agreeing to participate (83.6%) and valid data available on 5948 participants (81.1%). By individual cycle, the sample sizes were 1174, 1082, 1177 and 2515 which totals to 5948. Overall, the mean age was 46.3 (SD 20.32), females represented 55.2% of the sample and Caucasians represented 82.9% of the sample while Aboriginal people represented 10.4% of the sample. In comparison to 2001 census data for SHR, the sample had a statistically significant difference in age (22.0% of the sample was over the age of 65 in comparison to 13.2% of census) but not gender or cultural status. The only variable to have a statistically significant difference between the cycles was physical activity rates (higher in cycle four).

At the cross tabulation level, family income below $25,000 per year was associated with lower self report health, higher rates of diabetes, higher rates of suicide ideation, higher rates of heart disease, high blood pressure, physical inactivity, daily smoking, lower fruit and vegetable consumption, higher life stress and higher healthcare utilization. Living in one of six contiguous low income neighbourhoods was associated with lower self report health, higher rates of diabetes, higher rates of suicide ideation, physical inactivity, daily smoking, lower fruit and vegetable consumption and higher healthcare utilization. Aboriginal cultural status was associated with lower self report health, higher rates of diabetes, higher rates of suicide ideation, high blood pressure, high BMI, physical inactivity, daily smoking, higher alcohol consumption, lower fruit and vegetable consumption and higher healthcare utilization (Table 1).

The first stage of regression model building for the four health outcomes included the covariate of cultural status followed by either family income or neighbourhood income (depending on statistical significance). At this first stage of model building, the association between Aboriginal cultural status and poor health outcome reduced (Tables 2-5). Family income or neighbourhood

income acted as a confounder to the relationship between Aboriginal cultural status and lower self report health, suicide ideation, diabetes prevalence and heart disease prevalence.

In the final multivariate regression models, age and income had the strongest associations with lower self report health, diabetes prevalence, heart disease prevalence and suicide ideation. After full multivariate adjustment, Aboriginal cultural status had a reduced and statistically non significant association with all four health outcomes (Tables 2-5).

Interaction was present between family income and high blood pressure in its relationship with diabetes prevalence. Increased or decreased utilization of healthcare services was not associated with health outcomes and was not a factor in the association between Aboriginal cultural status and poor health outcomes. Life stress only had a statistically significant association with suicide ideation.

The R^2 for the final four regression models suggest reasonable explanation of the proportion of variance in the outcome variables explained by the knowledge of the explanatory covariates. The goodness-of-fit test results suggest that the final models are appropriate and that the predicted values are accurate representations of the observed values in an absolute sense (resulted listed at bottom of Tables 2-5).

Conclusions

There are few studies that review the association between Aboriginal cultural status and poor health outcome after multivariate adjustment for covariates like low income. One Canadian study found that lower self report health and diabetes prevalence were not associated with Aboriginal cultural status after controlling for socioeconomic confounders.[10] Another Canadian study found that after controlling for socioeconomic status, Aboriginal Canadians no longer differed from other Canadians in levels of depression.[11]

In our study, Aboriginal cultural status and income status were initially strongly associated with essentially all health outcomes, disease intermediaries, behaviours, life stress and healthcare utilization at the cross tabulation level. After full multivariate adjustment for covariates including income status, Aboriginal cultural status had a reduced and more limited association with the four health outcomes under review. Income acted as a direct confounder between the relationship of Aboriginal cultural status and the health outcomes of low self report health, diabetes prevalence and suicide ideation. Income status alone, however, was not able to explain all of the inequity between Aboriginal cultural status and other cultural groups. In each of the four health outcomes reviewed, behaviours, life stress and healthcare utilization played limited roles as risk indicators for health disparity after multivariate adjustment.

From the current study, it is clear that low income is associated with disparity in health outcomes, disease intermediaries and behaviours. There are various theories as to why. Some suggest income inequality translates into inequity in access to material conditions like adequate nutrition, housing and protection (materialist/structuralist).[12] Others suggest lower income groups tend to exhibit higher prevalence of risk behaviours harmful to health (cultural/behavioural).[13] Some suggest that low income groups are more likely to experience unequal levels of chronic stress (stress theory).[14] Others suggest neighbourhoods influence health.[6] A review on health disparity in Canada argues that colonialism, oppression, racism and discrimination are linked to unequal access to resources, education and employment for Aboriginal people and that these factors (not cultural status) result in poor health.[15]

A limitation of the study design is that it is cross sectional and can therefore only imply association and not causation.

One of the most vexing problems facing health disparity researchers is the confounding relationship between cultural status and socioeconomic status.[16] In his Pulitzer Prize winning novel, Diamond suggests that the biological explanation for inequalities between cultural groups is wrong but, unfortunately, we're not told what the correct explanation is.[17] Economic and political interests have always affected both the explanation of health disparities and responses to them.[18] The current study suggests that income status is the largest modifiable risk indicator for disparity in health status in the Saskatoon Health Region and that Aboriginal cultural status has a more limited association with poor health outcomes after full multivariate adjustment. While Aboriginal cultural status is not a major risk indicator for poor health once other covariates have been statistically controlled for, the reality is that Aboriginal cultural status is currently associated with poverty and impoverished social conditions and therefore acts as a pathway to poor health. As such, targeted policies to improve the social conditions for Aboriginal people in Canada, coupled with generic policies to reduce social inequalities, would provide helpful adjuncts to population based health strategies.

Table 1 Prevalence Rates for Health Outcomes, Disease Intermediaries, Behaviours, Life Stress and Healthcare Utilization by SES and Cultural Status

Variable	Self Repo - Poor / Fair / Good %	95 % CI	Has Diabetes %	95 % CI	Suicide Ideation %	95 % CI	Has Heart Disease	95 % CI	Has High BP %	95 % CI	BMI- Over wt / - Obese %	95 % CI	Life Stress Very much %	95 % CI
Family Income	.006		.000		.000		.000		.000		.528		.000	
0 – 25,000	54.2	51.5-56.8	9.8	8.2-11.5	21.1	18.7-23.7	9.8	8.3-11.5	21.8	19.6-24.1	55.1	52.2-57.9	24.7	22.3-27.1
25,001 – 75,000	44.4	42.4-46.5	5.7	4.8-6.8	10.1	8.7-11.7	5.6	4.7-6.7	15.7	14.2-17.3	56.6	54.4-58.8	18.8	17.1-20.5
> 75,000	35.6	32.4-38.7	3.7	2.6-5.1	6.9	5.2-8.9	2.6	1.7-3.8	11.2	9.2-13.4	57.5	54.1-60.8	25.7	22.8-28.7
NH Income Type	.006		.001		.000		.116		.131		.111		.355	
6 Low Income	53.8	48.7-58.9	10.4	7.4-13.9	26.9	21.7-32.6	4.4	2.5-7.0	13.4	10.1-17.3	59.6	54.1-64.9	23.6	19.3-28.5
Rest of Saskatoon	44.8	43.2-46.4	6.3	5.5-7.1	10.5	9.5-11.7	6.8	6.0-7.6	17.4	16.2-18.6	54.7	53.0-56.4	21.8	20.4-23.1
Rural	45.3	42.4-48.1	5.1	4.0-6.5	6.6	4.9-8.7	5.7	4.5-7.2	17.8	15.6-20.0	57.4	54.2-60.5	20.3	18.0-22.8
Education	.000		.000		.010		.000		.000		.213		.000	
< secondary	53.3	50.8-55.9	8.7	7.3-10.3	13.7	11.6-16.1	10.4	8.9-12.1	23.1	20.4-24.7	57.1	54.1-60.2	19.7	17.5-22.0
Secondary Grad	48.8	46.0-51.6	5.8	4.5-7.2	13.2	11.1-15.4	6.6	5.3-8.2	17.5	15.4-19.8	58.1	55.1-61.0	18.6	16.4-20.9
Post-sec/Graduate	42.5	40.8-44.2	5.6	4.9-6.5	10.5	9.3-11.8	4.3	3.6-5.1	14.3	13.1-15.5	55.2	53.4-57.0	23.4	22.0-25.0
Cultural Status	.002		.001		.000		.288		.046		.000		.082	
Caucasian	45.9	44.4-47.3	6.1	5.4-6.9	9.7	8.7-10.8	6.7	6.0-7.5	17.8	16.6-18.9	56.9	55.3-58.6	21.0	19.8-22.3
Aboriginal	55.4	51.1-59.6	10.6	8.0-13.7	29.3	24.9-33.9	5.1	3.3-7.4	13.9	11.0-17.3	62.0	57.3-66.5	24.6	20.8-28.8
Other	46.9	41.7-52.2	6.6	4.3-9.8	12.3	8.7-16.7	5.5	3.3-8.4	14.7	11.2-18.9	44.6	38.9-50.5	24.5	19.9-29.5

Variable	Physical In-Active %	95 % CI	Daily Smoker %	95 % CI	> 5 Drinks one time of Alcohol %	95 % CI	< 5 Fruit an Veggies/Day %	95 % CI	Consult Mental Health (Mean #	95 % CI	Consult Dr. (Mean #)	95 % CI
Family Income	.000		.000		.431		.000		.000		.000	
0 – 25,000	45.8	43.1-48.6	29.4	26.9-31.9	7.1	5.7-8.8	71.0	68.2-73.7	1.5	1.2-1.7	4.9	4.5-5.3
25,001 – 75,000	45.3	43.2-47.4	19.7	18.1-21.5	6.2	5.2-7.4	65.9	63.5-68.1	0.7	0.4-0.8	3.8	3.5-4.1
> 75,000	37.0	33.9-40.2	13.7	11.5-16.1	7.5	5.8-9.5	59.1	55.4-62.8	0.4	0.1-0.8	3.0	2.5-3.4
NH Income Type	.001		.000		.103		.000		.000		.040	
6 Low Income	42.2	37.1-47.5	43.9	38.7-49.1	7.5	4.9-11.0	76.6	71.5-81.1	1.8	1.3-2.3	4.7	4.0-5.3
Rest of Saskatoon	44.5	42.9-46.1	18.4	17.1-19.6	6.7	5.9-7.6	63.9	62.1-65.7	0.7	0.6-0.9	3.9	3.7-4.1
Rural	50.1	47.2-53.0	17.9	15.8-20.2	4.9	3.6-6.5	70.6	67.3-73.8	0.4	0.2-0.7	3.7	3.4-4.1
Education	.042		.000		.003		.000		.074		.127	
< secondary	48.0	45.3-50.7	23.9	21.8-26.2	7.0	5.5-8.8	73.2	70.4-75.9	0.6	0.4-0.9	4.1	3.8-4.4
Secondary Grad	44.8	41.9-47.6	25.8	23.3-28.3	8.6	7.0-10.4	71.2	68.2-74.0	1.0	0.8-1.3	4.1	3.7-4.5
Post-sec/Graduate	44.0	42.2-45.7	16.8	15.6-18.2	5.6	6.4-8.8	61.5	59.5-63.5	0.7	0.6-0.9	3.8	3.5-4.0
Cultural Status	.000		.000		.000		.000		.000		.000	
Caucasian	46.2	44.7-47.7	18.6	17.5-19.8	6.0	5.3-6.8	65.6	64.0-67.1	0.6	0.5-0.7	3.9	3.7-4.1
Aboriginal	36.3	32.1-40.8	44.7	40.2-49.2	10.5	7.9-13.7	75.4	71.2-79.2	2.4	2.0-2.8	5.2	4.6-5.8
Other	44.8	39.5-50.3	13.3	9.9-17.3	3.7	1.8-6.7	64.1	57.9-70.1	0.5	0.0-1.0	3.0	2.3-3.7

Table 2 Stepwise regression model for self rated health among adults in Saskatoon Health Region

	Model 0		Model 1		Model 2		Model 3		Model 4	
Independent Variable	Crude OR	95 % CI	Adjust OR	95% CI	Adjust OR	95% CI	Adjust OR	95% CI	Adjust OR	95% CI
Caucasian	.96	.77-1.19	.89	.68-1.15	.85	.64-1.12	.76	.59-1.05	.79	.58-1.05
Aboriginal	1.40	1.07-1.84	1.14	.84-1.56	1.29	.93-1.80	1.20	.85-1.71	1.19	.83-1.70
Family Inc- 0-25,000	2.14	1.80-2.54	1.83	1.52-2.21	1.70	1.39-2.08	1.59	1.28-1.97	1.50	1.21-1.87
Family Inc- 25,001-75,000	1.45	1.24-1.67	1.36	1.17-1.64	1.33	1.12-1.59	1.24	1.03-1.49	1.19	.99-1.44
Age 60 and above	3.00	2.44-3.70			3.44	2.52-4.68	3.31	1.98-5.54	3.17	1.89-5.32
Age 50-59	2.07	1.65-2.60			2.90	2.09-4.00	2.73	1.62-4.62	2.52	1.49-4.27
Age 40-49	1.76	1.41-2.20			2.43	1.77-3.34	2.34	1.39-3.92	2.19	1.30-3.69
Age 30-39	1.32	1.05-1.65			1.82	1.32-2.49	1.77	1.05-2.97	1.64	.97-2.77
Age 20-29	1.30	1.04-1.64			1.61	1.17-2.22	1.61	.96-2.71	1.52	.90-2.56
BMI – Over Wt./Obese	1.41	1.26-1.57					1.21	1.05-1.40	1.24	1.07-1.44
Smoker -Daily	1.40	1.22-1.58							1.21	1.02-1.43
Physically Inactive	1.39	1.25-1.54							1.18	1.03-1.36

Reference Category for Dependent Variable: poor/fair/good

Reference category for Independent Variables: Cultural Status – Non Caucasian/non-Aboriginal; Family Inc - > 75,000; Age - 12-19; BMI - Normal/Under weight; Smoker - Occasional/Former/Never; Physical Activity - Active

R^2=0.161; goodness of fit test result 0.280

Table 3 Stepwise regression model for suicide ideation among adults in Saskatoon

	Model 0		Model 1		Model 2		Model 3		Model 4		Model 5	
Independent Variable	Crude OR	95 % CI	Adjust OR	95% CI	Adjust OR	95% CI	Adjust OR	95% CI	Adjust OR	95% CI	Adjust OR	95% CI
Caucasian Aboriginal	.77 2.76	0.53-1.12 1.84-4.16	.84 2.06	.55-1.28 1.30-3.26	1.01 2.12	.62-1.66 1.23-3.67	1.05 1.72	.63-1.75 .98-3.02	1.13 1.83	.67-1.89 1.04-3.23	1.06 1.61	.63-1.78 .91-2.87
Family Inc- 0-25,000 Family Inc- 25,001-75,000	3.52 1.49	2.57-4.81 1.08-2.05	3.18 1.57	2.22-4.56 1.10-2.25	3.12 1.63	2.10-4.64 1.11-2.41	4.99 2.07	3.27-7.61 1.39-3.08	4.77 2.14	3.12-7.30 1.43-3.19	4.42 2.04	2.88-6.78 1.36-3.05
6 Low Inc NHs Rest of Saskatoon	5.12 1.68	3.44-7.62 1.22-2.29			2.82 1.48	1.67-4.77 .97-2.27	2.49 1.60	1.45-4.25 1.04-2.47	2.55 1.56	1.49-4.38 1.01-2.40	2.38 1.56	1.38-4.08 1.01-2.41
Age 60 and above Age 50-59 Age 40-49 Age 30-39 Age 20-29	.45 1.24 1.41 1.32 1.18	.28-.71 .78-1.95 .90-2.21 .84-2.08 .74-1.86					.36 1.27 1.28 1.36 .83	.17-.75 .62-2.61 .63-2.63 .67-2.78 .41-1.71	.35 1.13 1.20 1.21 .80	.17-.74 .55-2.34 .59-2.47 .58-2.47 .39-1.66	.34 1.01 1.07 1.11 .74	.16-2.71 .49-2.10 .52-2.20 .54-2.29 .36-1.53
Extreme Life stress	2.54	2.09-3.08							2.01	1.54-2.63	1.97	1.51-2.58
Smoker -Daily	2.79	2.30-3.38									1.67	1.28-2.19

Reference category for Dependent variable: Suicide Ideation = Yes
Reference category for Independent variables: Cultural status – Non-Caucasian/non-Aboriginal; Family income - > 75,000; Neighbourhood Income – Rural; Age – 12-19; Life stress – No life stress; Smoker – Occasional/Former/Never smoker
R^2=0.158; goodness of fit test results 0.105

Table 4 Stepwise regression for diabetes among adults in Saskatoon Health Region

	Model 0		Model 1		Model 2		Model 3	
Independent Variable	Crude OR	95 % CI	Adjust OR	95% CI	Adjust OR	95% CI	Adjust OR	95% CI
Caucasian	.91	.59-1.42	.85	.54-1.35	.70	.44-1.14	.57	.35-.95
Aboriginal	1.72	1.04-2.85	1.33	.76-2.32	1.90	1.05-3.45	1.48	.79-2.76
6 Low Inc NHs	2.25	1.49-3.41	2.05	1.28-3.28	2.60	1.59-4.26	2.96	1.74-5.04
Rest of Saskatoon	1.24	0.93-1.66	1.37	1.00-1.88	1.42	1.02-1.96	1.32	.92-1.91
Age 60 and above	17.16	7.03-41.87			17.01	6.91-41.85	5.32	1.27-22.28
Age 50-59	9.06	3.62-22.66			7.20	2.84-18.26	2.45	.58-10.43
Age 40-49	4.79	1.88-12.20			3.36	1.29-8.76	1.44	.33-6.24
Age 30-39	3.54	1.37-9.180			2.55	.96-6.76	1.08	.25-4.74
Age 20-29	1.56	.55-4.40			1.09	.37-3.21	.70	.15-3.26
Has High Blood Pressure	6.08	4.91-7.53					3.14	2.37-4.17
BMI – Over weight/Obese	3.39	2.58-4.45					2.67	1.93-3.71

Reference category: Diabetes prevalence = Yes

Reference category for Independent variables: Cultural status – Non-Caucasian/non-Aboriginal; Neighbourhood Income – Rural; Age – 12-19; Blood Pressure – No Blood Pressure; BMI – Normal/Under weight

R^2=0.263; goodness of fit test result 0.772

Table 5 Stepwise regression model building for heart disease among adults in Saskatoon Health Region

	Model 0		Model 1		Model 2		Model 3	
Independent Variable	Crude OR	95 % CI	Adjust OR	95% CI	Adjust OR	95% CI	Adjust OR	95% CI
Caucasian	1.25	.77-2.01	1.32	.76-2.32	.85	.46-1.60	.85	.45-1.60
Aboriginal	.84	.45-1.54	.53	.26-1.09	.98	.44-2.18	.96	.43-2.16
Family Income – 0-25,000	3.94	2.55-6.10	4.25	2.67-6.69	2.25	1.36-3.73	2.18	1.31-3.63
Family Income 25,001 – 75,000	2.15	1.39-3.33	1.98	1.26-3.10	1.22	.75-1.99	1.20	.73-1.96
Age 60 and above	64.17	31.68-130.01			67.54	27.47-166.01	50.39	20.31-125.04
Age 50-59	19.25	9.09-40.79			19.03	7.34-49.30	15.54	5.96-40.48
Age- 40-49	7.01	3.11-15.80			8.78	3.23-23.79	8.37	3.09-22.69
Gender - Male	1.31	1.06-1.62			1.74	1.30-2.33	1.76	1.31-2.37
Has High BP	5.85	4.71-7.26					2.13	1.58-2.86

Reference category for Dependent variable: Heart Disease Prevalence – Yes

Reference category for Independent variables: Cultural status – Non-Caucasian/non-Aboriginal; Family Income - > 75,000; Age – 12-39; Gender – Female; Blood Pressure – No blood pressure

R^2=0.272; goodness of fit test result 0.894

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Abstract

Introduction

Incomplete immunization coverage is common in low income and Aboriginal children in Canada.

Methods

We determined if child immunization coverage rates at age two were lower in low income neighbourhoods of Saskatoon. We then contacted parents that were behind and not behind in child immunization coverage to determine differences in knowledge, beliefs and opinions on barriers and solutions. We then built a multivariate regression model to determine if Aboriginal cultural status was associated with being behind in childhood immunizations after controlling for low income status.

Results

Reviewing the last five years in Saskatoon, the six low income neighbourhoods had complete child immunization coverage rates of 43.7% (95% CI-41.2-45.9) for MMR and 42.6% (95% CI-40.1-45.1) for DaPTP-Hib while the five affluent neighbourhoods had 90.6% immunization coverage rates for MMR (95% CI-88.9-92.3) and 78.6% for DaPTP-Hib (95% CI- 76.2-81.0). Parents that were behind in immunization coverage with their children were more likely to be single, be of Aboriginal or Other (non-Caucasian or non-Aboriginal) cultural status, have lower family income and have significant differences in reported beliefs, barriers and potential solutions. In the final regression model, Aboriginal cultural status was no longer associated with lower immunization status.

Discussion

Child immunization coverage rates in Saskatoon's six low income neighbourhoods are approximately half the rate of the affluent neighbourhoods. The covariates with the strongest independent association with complete childhood immunization status were low income and Other cultural status. Aboriginal cultural status was not associated with child immunization status after controlling for income status.

Introduction

Few measures in preventative medicine are of such proven value and as easy to implement as routine immunization against infectious disease.[1] Unfortunately, infectious disease outbreaks were observed in Canada for measles from 1989 to 1995, mumps in British Columbia in 1997 and Quebec in 1998 and rubella outbreaks were reported in Manitoba in 1997 and in Ontario in 2005.[1,2]

Previous reports indicate that low immunization coverage rates for children are associated with low socioeconomic status, urban dwelling, impoverished neighbourhoods, single parent families, mobile populations and minority cultural status.[3-11] A recent publication from Ontario indicates that 26.6% of urban children in the lowest income neighbourhoods did not have up to date immunizations in comparison to 14.3% of children in the most affluent neighbourhoods.[12] In contrast, a report from Manitoba found high child immunization coverage rates with very small socioeconomic disparities after introducing the Manitoba Immunization Monitoring System (MIMS) to inform health providers and parents which children are behind in order to actively track down children with incomplete coverage.[13]

There were four objectives to the current study: 1) to use the Saskatchewan Immunization Management System (SIMS) to determine if child immunization coverage rates at age two were lower in low income neighbourhoods of Saskatoon; 2) to use SIMS to identify and then contact parents that were behind and not behind in child immunization coverage to determine differences in awareness, knowledge, beliefs and opinions on barriers and solutions, 3) build a regression model to determine which demographic covariates were associated with parents that have incomplete immunization coverage for their children in order to 4) determine if Aboriginal cultural status is independently associated with low child immunization coverage rates after adjusting for low income status.

Methods

SIMS uses vital statistics and health insurance information to create a population database to determine the percentage of children that have the recommended number of immunizations for their age. The immunization coverage schedule specific to Saskatchewan includes the combination vaccine measles/mumps/rubella (MMR) at twelve months and eighteen months and the combination vaccine for diptheria/pertussis/tetanus/polio/heamophilius influenza typeB (DaPTP-Hib) at two months, four months, six months and eighteen months. The definition of complete coverage is therefore two MMR and four DaPTP-Hib immunizations by eighteen months old. Incomplete coverage is defined as less than six immunizations at two years old or at least six months behind the recommended schedule. The child immunization schedule is different in each province in Canada and, as such, this paper reviews the effectiveness of accomplishing goals specific to Saskatchewan alone. The SIMS database is on average more accurate and more complete than the clinical hard copies.[14]

Postal code information from the 2001 census was used to identify six existing residential neighbourhoods in the city of Saskatoon that were defined as “low income cut-off neighbourhoods” by Statistics Canada.[15,16] All six neighbourhoods were touching or contiguous pre-existing municipal boundaries (Figure 1). For the first objective, the percentage of two year old children that had their recommended number of immunizations for MMR and DaPTP-Hib in Saskatoon’s low income neighbourhoods (N = 16,683) were compared to the rest of the Saskatoon (N = 184,284) and five affluent contiguous neighbourhoods (N = 18,228). There was no statistically significant heterogeneity between the six low income neighbourhoods themselves or between the five affluent neighbourhoods themselves in neighbourhood income, education or employment. Complete immunization coverage rates with 95% confidence intervals were computed for the years 2001 to 2005.

For the second objective, a list of names was generated for all children that had their second birthday in 2004 or 2005 and were at least six months behind in immunizations as of June 2006 when the electronic database SIMS was accessed. The SIMS database has immunization information from all Saskatoon healthcare practitioners except First Nations practitioners from the Saskatoon Tribal Council. As such, Saskatoon children behind in their immunization coverage were manually cross referenced to children immunized on seven Reserve Communities adjacent to Saskatoon (five Saskatoon children immunized in 2004 and 2005). An equal number of names were chosen at random by computer from children who were up to date in immunization coverage on their second birthday in 2004 and 2005. Parents or guardians of children from both groups were asked to complete a telephone survey on their awareness, knowledge, beliefs and opinions on barriers and solutions. Parents were notified if their child was up to date upon completion of the phone survey or contact. Parents were contacted in June and July of 2006. Chi square tests were used to assess differences between groups without correcting for multiple comparisons.

For the third objective, binary logistic regression was used to describe the relationship between the outcome variable of a) a parent whose child was at least six months behind on childhood immunizations and b) a parent whose child was not behind in childhood immunizations and the explanatory demographic variables. Stratification was used to assess for confounding and effect modification in the first step of model building.[17] A hierarchal well-formulated front-wise modeling approach was used instead of a computer generated stepwise algorithm.[17] The unadjusted effect of each covariate was determined and then entered one step at a time based on changes in the –2 log likelihood and the Wald test.[18] The final model includes factors with beta values for which the *p* values were less than 0.05.[18] Confounding was tested by comparing the estimated coefficient of the outcome variable from models containing and not containing the demographic covariates.[18] Interaction was assessed with product terms.[18] R^2 was used to determine the proportion of variance in the outcome variable explained by the knowledge of the explanatory variables but not as a measure of the appropriateness of the final model.[18] Goodness-of-fit of the final model was assessed by the Hosmer-Lemeshow statistical test.[18] The final results were presented as adjusted odds ratios with 95 percent confidence intervals.[18] All analyses were performed with an SPSS 13.0 software package.[19] The research project received ethics approval from the University of Saskatchewan Behavioural Research Ethics Board.

Results

Reviewing the last five years in Saskatoon, the six low income neighbourhoods had child immunization coverage rates of 43.7% (95% CI-41.2-45.9) for MMR and 42.6% (95% CI- 40.1-45.1) for DaPTP-Hib while the rest of Saskatoon had 69.1% (95% CI- 68.2-70.0) for MMR and 71.9% (95% CI-71.0-72.8) for DaPTP-Hib. The five affluent neighbourhoods had 90.6% complete immunization coverage for MMR (95% CI-88.9-92.3) and 78.6% for DaPTP-Hib (95% CI- 76.2-81.0). Given that the coverage rates for the two immunizations are somewhat different, data are presented separately (Table 1).

The second objective was to contact parents that were behind and not behind in child immunization coverage to determine differences in awareness, knowledge, beliefs and opinions on barriers and solutions. There were 1047 children in 2004 and 2005 that were behind in either MMR or DaPTP-Hib immunizations. Of those, there were 274 disconnected phone numbers, 305 wrong numbers and 110 households with no answer after 10 attempts. Of the remaining 358 parents, 271 agreed to participate in the survey (75.7%). We chose 1047 parent names at random whose children were completely up to date in immunization coverage. Of those, there were 192 disconnected phone numbers, 188 wrong numbers and 121 households without any answer. Of the remaining 546, 418 parents were willing to complete the phone survey (76.6%). There was no difference in response rate between the two groups (75.7% and 76.6%) and there was no difference between responder and non-responder in terms of neighbourhood income or neighbourhood education levels.

Parents that were behind in immunization coverage for their children were more likely to have the demographic characteristics of being divorced/separated or single, Aboriginal (First Nations, Métis or self declared) or Other (non-Caucasian and non Aboriginal) cultural background and lower family income (Table 2).

Parents behind in immunization coverage were more likely to believe that immunizations weaken the immune system, natural medicines provide better and safer protection, their child will develop natural immunity and immunizations are associated with serious known and unknown side effects. Parents behind in immunization coverage were more likely to list barriers including lack of time, no location nearby, transportation problems, childcare issues, safety concerns for their child, lack of trust with the medical community, concerns about immunizations that have not been addressed and previous negative experience while immunizing their child (Table 3).

In terms of solutions, parents behind in immunization were more likely to suggest home visits by a nurse or doctor, the provision of a clinic in their neighbourhood, that only physicians immunize their child and that someone spend more time with them to talk about immunizations and the health of their child (Table 4). In an absolute sense, solutions with strong majority support from both groups of parents to keep their children up to date in immunization coverage included reminder telephone calls, reminder letters in the mail, reminders from healthcare practitioners when the parent is present for another matter, flexible walk in scheduling and extended clinical hours on weekends and evenings (Table 4).

It is of particular interest that 63.9% of parents whose child was behind in immunization coverage believed that their child was fully up to date (Table 3). Of the parents that believed their child was up to date, 27.7% indicated that they simply forgot to immunize their child in comparison to 47.4% of the parents that did not believe their child was up to date ($p = 0.002$). In other words, most parents did not forget that their child was behind- they simply did not know that their child was not fully immunized. Of the same parents whose child was behind in immunization coverage but the parent believed their child was up to date, 91.0% would have liked a reminder telephone call, 87.3% would have liked a reminder letter and 81.2% would have liked to have been reminded by their doctor or nurse while present for another matter.

It is also of interest to review the parents who were behind in immunization coverage but knew their child was behind. The greatest barrier is that 44.8% believe immunizations are associated with serious know side effects and 32.2% believe that immunizations are associated with serious unknown side effects.

For the third objective, binary logistic regression was used to determine if any demographic variable had an independent effect on the outcome of a child falling behind on immunization coverage. Variables with the strongest unadjusted association during model building included parent cultural status (Aboriginal and Other), lower household income status and being a single parent. In the final regression model, Aboriginal cultural status no longer had a statistically significant association with the outcome; but Other cultural status remained (OR = 2.259; 95% CI-1.306-3.909). Low income acted as a confounder for Aboriginal cultural status. Lower income status remained statistically significant in the final model (OR = 1.721; 1.164-2.545) (Table 5). The variable of single parent lost its statistical significance after controlling for other covariates. There was no effect modification. The R^2 of the final model was .390 suggesting reasonable explanation of the proportion of variance in the outcome variable explained by the knowledge of the explanatory variables. The goodness-of-fit test result ($p = .975$) suggests that the final model is appropriate and that the predicted values are accurate representations of the observed values in an absolute sense.

Discussion

Child immunization coverage rates are routinely lower in Saskatoon's six low income neighbourhoods in comparison to the rest of the city and are approximately half the rate of the affluent neighbourhoods. Although this trend is consistent with other jurisdictions in Canada, the magnitude of the disparity is disproportionate.[12] Similar to other reports, Saskatoon parents that were behind in immunization coverage with their children were more likely to have the demographics of being divorced/separated or single, Aboriginal or Other culture, have lower family income and list barriers including risk of adverse effects, access problems, distrust of the medical community, lack of knowledge about immunizations and had a desire for clinicians to spend more time with them.[3-11,20,21] The authors caution that some of the relative differences observed are small in an absolute sense.

Perhaps surprisingly, 63.9% of parents with children who were at least six months behind in immunization coverage believed their children were up to date. This is a new finding that suggests the need to use a reminder system in Saskatoon. Approximately 90% of those behind in coverage that believed their children were up to date would have liked a reminder phone call or letter to keep them up to date. This request from Saskatoon parents is evidence based. A meta-analysis on patient reminder systems to improve immunization rates in children found these systems to be effective (OR = 1.45; 95% CI- 1.28-1.66).[4] As well, a report from Manitoba indicates that their electronic monitoring system has actually been used to remind parents and practitioners to track down children with incomplete coverage in order to reduce socioeconomic disparities in childhood immunization.[13]

Previous reports indicate that Aboriginal children in Canada are more likely to be behind in immunization coverage but the authors were not able to find a study that statistically controlled for potential confounding variables like low income status.[22] Although Aboriginal cultural status was initially strongly associated with child immunization status in our study, Aboriginal culture did not have a statistically significant association with incomplete immunization coverage in children after adjusting for low income status. This is a new finding and is important because it prevents the negative stereotype that it is more difficult to immunize Aboriginal children. Aboriginal children in Alaska routinely have immunization coverage rates in excess of 90% despite traditional risk factors like poverty, a higher proportion of uneducated mothers and remote access. High child immunization coverage rates in Alaska is the result of the utilization of an electronic monitoring system, collaboration between the state government and local tribal councils, willingness of public health nurses to perform home visits and making vaccination delivery a high priority.[23,24]

There is a study limitation to discuss. A majority of parents were not able to be contacted. This introduces a potential selection bias that we are unable to control for in our analysis. Once parents were contacted, response rates were similar. This finding does suggest, however, that more efforts are required to keep telephone numbers current if telephone reminders are to be used to keep parents and their children up to date in immunization coverage. The only question with a response rate below 80% was income status of parents with children who were up to date. Using neighbourhood income as a proxy for individual income did not significantly influence the final regression model.

Future research should evaluate if a reminder system in Saskatoon is effective in increasing overall immunization coverage rates up to the national goal of 95%.[1]

Table 1 Complete Immunization Coverage Percentages of Two Year Old Children by Neighbourhood Income

	Immunization Coverage Rates (95% CI)		
Measles/ Mumps/ Rubella (Two doses)			
	Low Income Neighbourhoods	Rest of Saskatoon	High Income Neighbourhoods
2001	134/289	1517/2232	225/236
	46.4% (40.7-52.1)	68.0% (66.1-69.9)	95.3% (92.7-97.9)
2002	144/341	1480/2218	227/227
	42.2% (38.5-45.9)	66.7% (64.7-68.7)	100% (98.7-101.3)
2003	136/362	1482/2040	184/214
	37.6% (32.7-42.5)	72.6% (70.7-74.5)	86.0% (81.4-90.6)
2004	140/292	1421/2092	229/257
	47.9% (42.2-53.6)	67.9% (65.9-69.9)	89.1% (85.3-92.9)
2005	124/266	1427/2028	147/183
	46.6% (40.6-52.6)	70.3% (68.3-72.3)	80.3% (74.5-86.1)
Total 2001-2005	678/1550	7327/10610	1012/1117
	43.7% (41.2-45.9)	69.1% (68.2-70.0)	90.6% (88.9-92.3)
Diptheria/Tetanus/Pertussis/Polio/Influenza B (Four doses)			
2001	136/289	1663/2232	211/236
	47.1% (41.4-52.8)	74.5% (72.7-76.3)	89.4%(85.5-93.3)
2002	133/341	1663/2218	183/227
	39.0% (33.8-44.2)	75.0% (73.2-76.8)	80.6% (75.5-85.7)
2003	130/362	1483/2040	166/214
	35.9% (31.0-40.8)	72.7% (70.8-74.6)	77.5% (71.9-83.1)
2004	134/292	1360/2092	166/257
	45.9% (40.2-51.6)	65.0% (63.0-67.0)	64.6% (58.8-70.4)
2005	128/266	1457/2028	152/183
	48.1% (42.1-54.1)	71.8% (69.8-73.8)	83.1%(77.7-88.5)
Total 2001-2005	661/1550	7626/10610	878/1117
	42.6% (40.1-45.1)	71.9% (71.0-72.8)	78.6% (76.2-81.0)

Table 2 **Demographic Differences between Parents with Children that are Up-To-Date in Immunization Coverage in Comparison to Parents with Children that are Behind in Immunization Coverage**

	Child Immunization Status N = 271	N = 418	
Demographic Information	Behind	Up to Date	Significance
A. Respondent/ Primary Care Giver			
Gender, Female	34/265 (88.3%)	369/405 (91.1%)	.239
Marital Status			**.034**
Divorced or Separated	17/259 (6.6%)	15/401 (3.7%)	
Married or Common Law	00/259 (77.2%)	341/401 (85.0%)	
Single	42/259 (16.2%)	45/401 (11.2%)	
Education Level			.069
Did not Complete High School	20/258 (7.8%)	20/400 (5.0%)	
Completed High School	59/258 (22.9%)	71/400 (17.8%)	
University or Tech Diploma	179/258 (69.4%)	309/400 (77.3%)	
Occupation			.100
Clerical/Sales/Service	74/261 (28.4%)	117/400 (29.3%)	
Homemaker	68/261 (26.1%)	104/400 (26.0%)	
Manual/Construction/Farmer/Transport	8/261 (3.1%)	29/400 (7.3%)	
Professional/ Management	75/261 (28.7%)	112/400 (28.0%)	
Student	11/261 (4.2%)	15/400 (3.8%)	
Unemployed	4/261 (1.5%)	8/400 (2.0%)	
Other	21/261 (8.0%)	15/400 (3.8%)	
Cultural Background			**.000**
Caucasian	179/258 (69.4%)	336/399 (84.2%)	
Aboriginal	35/258 (13.6%)	32/399 (8.0%)	
Other	44/258 (17.1%)	31/399 (7.8%)	
Annual Family Income			**.006**
Less than $25,000	54/234 (23.1%)	51/320 (15.9%)	
$25,000 - $49,999	76/234 (32.5%)	80/320 (25.0%)	
$50,000 - $99,999	73/234 (31.2%)	141/320 (44.1%)	
Above $100,000	31/234 (13.2%)	48/320 (15.0%)	

Table 2 **Demographic Differences between Parents with Children that are Up-To-Date in Immunization Coverage in Comparison to Parents with Children that are Behind in Immunization Coverage (Continued …)**

B. If Spouse or Common Law Present in Home			
Education Level			.208
Did not Complete High School	13/193 (6.7%)	12/338 (3.6%)	
Completed High School	52/193 (26.9%)	86/338 (25.4%)	
University or Tech Diploma	128/193 (66.3%)	240/338 (71.0%)	
Occupation			**.005**
Clerical/Sales/Service	46/192 (24.0%)	69/339 (20.4%)	
Homemaker	7/192 (3.6%)	5/339 (1.5%)	
Manual/Construction/Farmer/Transport	42/192 (21.9%)	117/339 (34.5%)	
Professional/ Management	72/192 (37.5%)	120/339 (35.4%)	
Student	6/192 (3.1%)	7/339 (2.1%)	
Unemployed	2/192 (1.0%)	9/339 (2.7%)	
Other	17/192 (8.9%)	12/339 (3.5%)	
Cultural Background			**.001**
Caucasian	148/196 (75.5%)	290/337 (86.1%)	
Aboriginal	12/196 (6.1%)	21/337 (6.2%)	
Other	36/196 (18.4%)	26/337 (7.7%)	

Table 3 Beliefs and Barriers towards Child Immunizations between Parents that are Behind and Parents that are not Behind in Child Immunizations

	Child Immunization Status N = 271	N = 418	
	Behind	**Up to Date**	**Significance**
Do you believe that your infant child is fully up to date			**.000**
with immunization coverage?, Yes	168/263 (63.9%)	388/406 (95.6%)	
Beliefs about Immunizations			
1. Immunizations are no longer necessary because the diseases			.314
they protect against have been eliminated from society, True	9/259 (3.5%)	8/404 (2.0%)	
2. Immunizations weaken the immune system, True	38/243 (15.6%)	21/396 (5.3%)	**.000**
3. Natural medicines provide better and safer protection			**.000**
than immunizations, True	47/235 (20.0%)	32/382 (8.4%)	
4. I believe my child will develop natural immunity if we			**.004**
do not immunize, True	39/252 (15.5%)	31/388 (8.0%)	
5. I do not think you should immunize when a child has			**.005**
a minor illness like a cold, True	183/251 (72.9%)	242/390 (62.1%)	
6. Immunizations are associated with serious known			**.000**
side effects, True	112/250 (44.8%)	109/389 (28.0%)	
7. Immunizations are associated with serious unknown			**.007**
side effects, True	78/242 (32.2%)	85/383 (22.2%)	
Barriers toward Immunizations			
1. I simply forget to immunize my child, Yes	91/261 (34.9%)	115/403 (28.5%)	.087
2. I do not have enough time in my busy day, Yes	36/262 (13.7%)	31/402 (7.7%)	**.017**
3. I do not have a location nearby, Yes	24/261 (9.2%)	15/403 (3.7%)	**.006**
4. I do not have access to transportation, Yes	28/262 (10.7%)	18/402 (4.5%)	**.003**
5. I have other children to attend to, Yes	62/261 (23.8%)	46/402 (11.4%)	**.000**
6. I would prefer another healthcare practitioner to perform			.090
my child's immunization, Yes	34/260 (13.1%)	35/401 (8.7%)	
7. I fear for the safety of my child, Yes	70/262 (26.7%)	60/402 (14.9%)	**.000**
8. I do not like seeing my child in pain or crying, Yes	55/261 (21.1%)	82/401 (20.4%)	.845
9. I have cultural barriers that discourage immunization, Yes	11/259 (4.2%)	10/401 (2.5%)	.257
10. I do not trust the medical community, Yes	31/257 (12.1%)	22/401 (5.5%)	**.003**
11. I have concerns about immunizations that have not been			**.001**
addressed to my satisfaction, Yes	70/258 (27.1%)	64/401 (16.0%)	
12. I had a previous negative experience with immunizing			**.003**
my child, Yes	31/259 (12.0%)	22/401 (5.5%)	13.
13. I have concerns about immunizations that have not been			**.001**
addressed to my satisfaction, Yes	70/258 (27.1%)	64/401 (16.0%)	

Table 3 Beliefs and Barriers towards Child Immunizations between Parents that are Behind and Parents that are not Behind in Child Immunizations (Continued …)

14. I had a previous negative experience with healthcare, Yes	37/259 (14.3%)	46/402 (11.4%)	.282
15. I had a previous negative experience with immunizing my child, Yes	31/259 (12.0%)	22/401 (5.5%)	**.003**
16. Where did the negative immunization experience with your child occur?			.789
Public Health Clinic	23/31 (74.2%)	16/22 (72.7%)	
Physician's Clinic	8/31 (25.8%)	6/22 (27.3%)	
Paediatrician's Clinic	0/31 (0.0%)	0/22 (0.0%)	

Table 4 Solutions Listed by Parents to Increase Child Immunization Coverage Rates

	Child Immunization Status N = 271 Behind	N = 418 Up to Date	Significance
Solutions to Keep Children Up-To-Date			
1. Reminder telephone calls, Yes	216/262 (82.4%)	349/401 (87.0%)	.117
2. Reminder letters in mail, Yes	208/262 (79.4%)	345/401 (86.0%)	**.032**
3. Home visits by nurse or doctor, Yes	97/261 (37.2%)	101/398 (25.4%)	**.002**
4. Reminded by my doctor or nurse when I am present for another matter, Yes	189/260 (72.7%)	335/402 (83.3%)	**.001**
5. General advertising, Yes	117/261 (44.8%)	232/400 (58.0%)	**.001**
6. Flexible walk in scheduling, Yes	186/260 (71.5%)	319/402 (79.4%)	**.025**
7. Extended clinical hours on weekends, Yes	187/260 (71.9%)	316/402 (78.6%)	.051
8. Extended clinical hours at night, Yes	198/261 (75.9%)	316/401 (78.8%)	.391
9. Reduced waiting times in clinic, Yes	153/260 (58.8%)	208/401 (51.9%)	.079
10. Provide child with other health services at same time as immunization, Yes	176/259 (68.0%)	261/401 (65.1%)	.500
11. Provide a clinic in your neighbourhood, Yes	160/261 (61.3%)	205/401 (51.1%)	**.011**
12. Provide transportation to nearest clinic, Yes	79/261 (30.3%)	106/402 (26.4%)	.288
13. Provide babysitting at clinic, Yes	96/259 (37.1%)	145/400 (36.3%)	.869
Preferences to Keep Children Up-To-Date			
1. Prefer only public health nurses to immunize my child, Yes	89/261 (34.1%)	127/403 (31.5%)	.498
2. Prefer only physicians to immunize my child, Yes	62/261 (23.8%)	70/403 (17.4%)	**.047**
3. Prefer only Paediatricians to immunize my child, Yes	48/260 (18.5%)	55/403 (13.6%)	.100
4. Prefer someone spend more time with me to talk about child immunizations during my appointment, Yes	109/259 (42.1%)	134/401 (33.4%)	**.026**
5. Prefer that someone spend more time with me to talk about health of my child during immunization appointment, Yes	138/258 (53.5%)	168/401 (41.9%)	**.004**
6. Prefer that someone spend more time with me to talk about my health during child immunization appointment, Yes	63/258 (24.4%)	78/402 (19.4%)	.144
7. Prefer someone spend more time with me to talk about child immunizations during my appointment, Yes	109/259 (42.1%)	134/401 (33.4%)	**.026**
8. Prefer that someone spend more time with me to talk about health of my child during immunization appointment, Yes	138/258 (53.5%)	168/401 (41.9%)	**.004**
9. Prefer that someone spend more time with me to talk about my health during child immunization appointment, Yes	63/258 (24.4%)	78/402 (19.4%)	.144

Table 5 Independent Variables Associated with Parents whose Child was not Up to Date in Immunization Coverage

Dependent Variable:
Child Behind in Immunization Coverage.
N = 689.

Independent Variables:	Beta	SE	Unadjusted OR	Adjusted OR (95% CI)	Significance
1. Cultural Status of Parent					
Caucasian (Ref*)					
Aboriginal	.348	.293	2.053	1.417 (0.797-2.517)	.235
Other (Non-Caucasian or Non Aboriginal)	.815	.280	2.664	2.259 (1.306-3.909)	**.004**
2. Income of Family					
More than $100,000 per year (Ref*)					
Less than $50,000 per year	.543	.200	1.917	1.721 (1.164-2.545)	**.007**
$50,000- $99,999 per year	.225	.274	1.247	1.252 (0.732-2.143)	.412

* Reference Category

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Abstract

Introduction

There have been too few studies on urban Aboriginal youth to permit inferences about depressed mood in this subgroup. The purpose of the current study was to determine if Aboriginal cultural status is independently associated with moderate or severe depressed mood in youth after controlling for other covariates; including socioeconomic status.

Methods

Every student in grades 5-8 in the City of Saskatoon, Canada, was asked to complete a questionnaire in February of 2007. Depressed mood was measured with a 12 question depression scale derivative of the 20 question CES-D.

Results

4093 youth participated in the school health survey. For Aboriginal youth, the prevalence rate of moderate or severe depressed mood was 21.6% in comparison to 8.9% for Caucasian youth (RR=2.43; 95% CI 1.92-3.08). Aboriginal cultural status was not associated with depressed mood after multivariate adjustment for other covariates in the final multivariate model (OR= 1.132; 95% CI 0.682-1.881). Parental educational status and gender were confounders to the association between Aboriginal cultural status and depressed mood.

Discussion

The recognition that Aboriginal cultural status is not independently associated with moderate or severe depressed mood in youth after full multivariate adjustment allows policy makers to acknowledge that mental health disparity prevention is possible because the determinants of health (i.e., education) are modifiable (in comparison to Aboriginal cultural status).

Introduction

In Canada, it is not difficult to find a government agency reporting that Aboriginal cultural status is associated with poor health.[1-3] One of the concerns associated with this discussion is that it gives policy makers and the public at large the impression that health disparity is not preventable because a major determinant of health and behaviour (cultural status) is not modifiable.

There is growing awareness that the association between cultural status, socioeconomic status and mental health status is neither simple nor straightforward, especially for youth.[4] Unfortunately, there is limited data to test this specific hypothesis. Data from the Canadian Community Health Survey is too limited to examine specific sub-groups like the Aboriginal adolescent population.[5] A review on depression in adolescence concluded that too few studies have included subgroup analysis to permit drawing inferences about depression in Native American adolescents.[6]

The purpose of the current study was to determine if Aboriginal cultural status is independently associated with moderate or severe depressed mood in youth after controlling for other covariates; including socioeconomic status.

Methods

Every student attending school in the city of Saskatoon, Canada, in grades 5-8 was asked to complete a questionnaire in February of 2007. There were 9958 youth registered in these grades. The survey instrument used in the study was taken from the National Longitudinal Survey for Children and Youth (NLSCY) developed by Statistics Canada.[7,8] The scope of the NLCSY is comprehensive dealing with multiple health, social and educational outcomes that have been validated for Canadian youth aged 10/11 and 12/13.[7,8]

Depressed mood was measured in the NLSCY with a 12 question depression scale derivative of the 20 question CES-D.[9] In terms of content validity, the CES-D-12 and the 20-item CES-D correspond well to each other and to the DSM-IV symptoms of major depressive disorder.[10,11] Almost all of the somatic symptoms of depressed mood are represented in the scale except irritability, which could result in the underestimation of the prevalence of depression among adolescents.[10] The CES-D-12 has good internal consistency with a Cronbach alpha of 0.85 and demonstrates good discrimination in terms of categorizing depressive symptoms.[10] The outcome for the study was moderate or severe depressed mood, which required a score of 16 or above on the CES-D-12.

Socioeconomic status was measured by parental educational status (coded as university education or not), parental occupational classification (coded as employed in a professional trade/management or not) and neighbourhood income status. Neighbourhood income status was calculated with census information to identify six contiguous low income cut-off neighbourhoods.[7] Cultural status was stratified by Caucasian, Aboriginal (First Nation or Métis) and Other (coded as non-Caucasian and non-Aboriginal) cultural status.

A five stage informed consent protocol was employed. Written consent was obtained from both Public and Catholic School Boards. Verbal consent was obtained from the principal of each individual school and the teacher from each individual classroom. Written informed consent was obtained from each parent. If the parent consented, written informed consent was obtained from each youth. The classroom teacher (not the researchers) asked the students to complete the questionnaire in the classroom. At that time, the students were given additional information that they were free to consent or not consent and were free to not complete any question that made them feel uncomfortable. This information was also on the questionnaire. Students provided

written informed consent that they understood the study, its voluntary nature and were willing to participate. Students and parents that chose to not participate were not isolated in any way.

Cross tabulations were computed between moderate and severe depressed mood and parental educational status, parental occupational classification, neighbourhood income status and cultural status. Stratification was used to assess for confounding and effect modification in the first step of model building.[12] Binary logistic regression was used to describe the relationship between the outcome variable of a) moderate or severe depressed mood and b) no moderate or severe depressed mood and all remaining covariates. A risk hazard model was built to determine the independent effect of cultural status and parental educational status on a logistic regression model of depressed mood that includes age and gender.[13,14] A hierarchal well-formulated front-wise modeling approach was used instead of a computer generated stepwise algorithm.[12] The unadjusted effect of each covariate was determined and then entered one step at a time based on changes in the –2 log likelihood and the Wald test.[15] The final model included factors with beta values for which the *p* values were less than 0.05.[15] Confounding was tested by comparing the estimated coefficient of the outcome variable from models containing and not containing the covariates.[15] Interaction was assessed with product terms.[15] R^2 was used to determine the proportion of variance in the outcome variable explained by the knowledge of the explanatory variables but not as a measure of the appropriateness of the final model.[15] Goodness-of-fit of the final model was assessed by the Hosmer-Lemeshow statistical test.[15] The final results were presented as adjusted odds ratios with 95 percent confidence intervals.[15] All analyses were performed with an SPSS 13.0 software package.[16]

The study design and the analysis plan were all determined a priori as part of a Canadian Institutes of Health Research grant. Ethics approval was obtained from the University of Saskatchewan Behavioural Research Ethics Board (BEH# 06-237).

Results

Of 9958 eligible respondents, 4093 youth participated in the school health survey (41.1%). The demographics of the participants are presented in Table 1. There were statistically significant differences between respondents and non-respondents by gender and neighbourhood income. In Saskatoon, 51.2% of youth aged 5-14 are male in comparison to 46.5% of the sample and 9.9% of youth live in one of six low income neighbourhoods in comparison to 2.5% of the sample.

In the Saskatoon School Health Survey, 9.8% of the youth aged 9-15 had moderate or severe depressed mood. For youth aged 9-12, the prevalence of moderate or severe depressed mood was 9.1% in comparison to youth aged 13-15, where the prevalence rate was 12.0% (RR=1.32; 95% CI 1.09-1.60). The prevalence rate for moderate or severe depressed mood for females was 12.5% in comparison to 7.2% for males (RR=1.74; 95% CI 1.43-2.12). For youth whose parents did not have a professional occupation, the prevalence rate of moderate or severe depressed mood was 10.7% in comparison to 8.1% for youth whose parents had a professional occupation (RR=1.32; 95% CI 1.07-1.63). For youth whose parents did not have a university education, the prevalence rate of moderate or severe depressed mood was 14.4% in comparison to 7.9% for youth whose parents had a university education (RR=1.82; 95% CI 1.48-2.24). For youth who lived in a low income neighbourhood, the prevalence rate of moderate or severe depressed mood was 16.3% in comparison to 9.8% for youth who did not live in a low income neighbourhood (RR=1.66; 95% CI 1.05-2.62). For youth whose parents were of Aboriginal cultural status, the prevalence rate of moderate or severe depressed mood was 21.6% in comparison to 8.9% for youth whose parents were Caucasian (RR=2.43; 95% CI 1.92-3.08).

Stratification was used to disentangle the complex relationship between socioeconomic status, cultural status and moderate or severe depressed mood. Youth whose parents had a non-professional occupation and who had Aboriginal parents were 73% more likely to have depressed

mood in comparison to youth whose parents also had non-professional occupations but whose parents were of Caucasian cultural status (RR=1.73; 95% CI 1.13-2.64). Youth whose parents did not have a university degree and who had Aboriginal parents were 38% more likely to have depressed mood in comparison to youth whose parents also did not have a university degree but whose parents were of Caucasian cultural status (RR=1.38; 95% CI 0.89-2.14). The results are not statistically significant. Youth whose parents lived in one of six contiguous low income neighbourhoods and who had Aboriginal parents were 178% more likely to have depressed mood in comparison to youth that also lived in the low income neighbourhoods but whose parents were of Caucasian cultural status (RR=2.78; 95% CI 0.68-11.4).

It appears that of the three socioeconomic variables, parental education status is the most likely to have either an effect modifier or confounding relationship with the association between Aboriginal cultural status and moderate or severe depressed mood. Both effect modification and confounding were formally assessed. There was a difference between the rate ratio of low education by cultural status (RR=1.3) and the rate ratio of high education by cultural status (RR=2.85). As such, effect modification by education status is present. There was a difference between the two rate ratios of low education by cultural status and high education by cultural status in comparison to the overall rate ratio (RR=2.42). As such, confounding is suspected. However, the presence of effect modification means it is much more difficult to determine if confounding is present. It is therefore necessary to compare the prevalence rate of depressed mood in the non-exposed and look at exposure between the cultural groups by educational status. In both cases, confounding is suspected.

The first stage of model building included adding age and gender because they had associations with moderate or severe depressed mood after cross tabulation and this finding was supported by the literature. The next step was to add cultural status and the socioeconomic status variable of parental educational status. As can be seen by the results of Table 2, the introduction of age, gender and parental education status into the logistic regression model acted as confounders between the relationship of cultural status and outcome of moderate or severe depressed mood. After the introduction of four covariates, the independent effect of Aboriginal cultural status on the outcome of depressed mood was reduced, but not eliminated, from a crude odds ratio of 2.812 to an adjusted odds ratio of 2.355. In other words, age, gender and parental educational status were not able to fully explain the association between Aboriginal cultural status and depressed mood in the first stages of model building.

A risk hazard model was built to determine the independent effect of cultural status and parental educational status on a logistic regression model of moderate or severe depressed mood that includes age and gender. Table 3 demonstrates a larger direct and independent effect of parental educational status (18%) in comparison to the independent effect of cultural status (6.2%) in explaining the association between the demographic variables of age and gender on depressed mood.

In the final adjusted logistic regression model, moderate or severe depressed mood was more likely to be associated with female gender, low self esteem, feeling like an outsider at school, being bullied within the past year, alcohol usage, high levels of anxiety, suicide ideation, being hungry some or most of the time and parents having a lower education status. Aboriginal cultural status was not associated with higher levels of moderate or severe depressed mood after adjustment for other covariates in the final multivariate model (OR= 1.132; 95% CI 0.682-1.881). Age was also dropped from the final model. The results are presented in Table 4.

Confounding was tested by comparing the estimated coefficient of the outcome variable from models containing and not containing the covariates. Although gender and parental education status were confounders to the relationship between Aboriginal cultural status and moderate or severe depressed mood, it was not until the introduction of other covariates, which were also potentially influenced by gender and parental educational status, that the association between Aboriginal cultural status and moderate or severe depressed mood became non-statistically

significant. There was no effect modification in the final model. The estimated slope coefficients and standard errors presented are small so co-linearity is not suspected in the final model.

The R^2 for the final model was .504 suggesting reasonable explanation of the proportion of variance in the outcome variable explained by the knowledge of the explanatory covariates. The goodness-of-fit test result (p = .410) suggests that the final model is appropriate and that the predicted values are accurate representations of the observed values in an absolute sense.

Discussion

In the Saskatoon School Health Survey, 9.8% of the youth aged 9-15 had moderate or severe depressed mood. Depressed mood was 32% more common in youth aged 13-15 than youth aged 9-12. A review of three American population based studies suggests that depressive symptoms start at approximately age 12 and peak between the ages of 15 and 17.[17] Depressed mood was 74% more common in female youth than male youth. Gender differences in rates of depressed mood have been found to emerge around the age of 13 years of age.[18-21]

In our study, moderate or severe depressed mood was 32% more common in youth whose parents did not have a professional occupation, 82% more common in youth whose parents did not have a university diploma, 66% more common in youth who lived in one of six contiguous low income neighbourhoods and 143% more common in Aboriginal youth in comparison to Caucasian youth. The association between socioeconomic status and depressed mood in youth has demonstrated previously.[22-30] Regrettably, there is limited data from Canada or the United States regarding depressed mood in Aboriginal youth, let alone sub-group analysis by socioeconomic status.[5,6] The lack of research in this area provides a rational for the current study.

All three socioeconomic variables (parental educational status, parental occupational status and neighbourhood income) and Aboriginal cultural status had important associations with moderate or severe depressed mood after cross tabulation. The main objective of the study was to determine if socioeconomic status was a confounder or effect modifier of the association between depressed mood and cultural status in youth. After stratification, it was determined that parental educational status was both a confounder and an effect modifier. In the first stage of model building, age, gender and parent educational status reduced the association between Aboriginal cultural status and depressed mood but did not eliminate it. After full multivariate adjustment, gender and parental educational status were confounders to the relationship between Aboriginal cultural status and depressed mood but not effect modifiers. The unadjusted odds ratio for the association between Aboriginal cultural status and depressed mood was 2.812 (95% CI 2.097-3.771) and was subsequently reduced to 1.132 (95% CI 0.682-1.881) after full multivariate adjustment in the final logistic regression model. In other words, Aboriginal cultural status was strongly associated with moderate or severe depressed mood after cross tabulation, stratification and the first stages of model building but was not associated with moderate or severe depressed mood after full multivariate adjustment.

As mentioned, parental educational status was the only socioeconomic variable associated with outcome after multivariate adjustment. Education is the most common overall index of social class in psychiatric epidemiology and public health research.[31] The stability of education over adult life – as well as its reliability, efficiency of measurement, and good validity – are presumably the main reasons for its popularity.[32]

It is perhaps somewhat surprising that neighbourhood income and parental occupational status were not associated with depressed mood in youth after multivariate adjustment. Some suggest that very young people, whose lives are substantially confined to the boundaries of a community and its schools, may be more sensitive to strains within this context than those less confined.[33] In

the Whitehall studies, occupational status was a better predictor of depression in adults than years of education.[34]

The authors were unable to find any high quality studies that reviewed the relationship between Aboriginal cultural status, socioeconomic status and depressed mood in youth. The authors were able to find studies that examined this complex relationship in adults. For example, one study reviewed data from the Canadian National Population Health Survey with a sample size of 81,804. The baseline analysis revealed that Aboriginal Canadians and French Canadians experience significantly more depressive symptoms than English Canadians. After multivariate adjustment, the authors found that an increase in family income reduces the level of depression and the risk of a major depressive episode. After controlling for socioeconomic status, Aboriginal Canadians and French Canadians no longer differed from English Canadians in levels of depression or risk of a major depressive episode.[35]

The other associations found between the covariates in the multivariate model and depressed mood in youth have been demonstrated previously. Low self esteem is seen as both a cause and consequence of depression.[18,36-39] The association between depression and exposure to violence is well established for youth.[40-42] More specifically, bullying has been identified as a risk factor in the development of depression in youth with the greatest incidence occurring as a result of social isolation.[43] Depressive symptoms have also been linked previously to substance abuse.[36-39,44,45] Co-morbidity between depression and anxiety is well documented and established.[20,46,47] Adolescent depression has been associated with suicide.[48-58] Up to 41% of adolescents with depressive disorder report suicide ideation and 21% of depressed youth attempt suicide.[18] Hunger and living in disadvantaged circumstances have also been found to be associated with greater levels of depression and emotional distress in adolescents.[59-61]

There is a study limitation to discuss. Written consent was obtained for 41.1% of eligible students. It appears the study does not have adequate representation from males and low income neighbourhoods. The under representation of males tends to overestimate the prevalence while the under representation of low income youth tends to underestimate the prevalence. Combined, it is hoped that the estimate is valid; although it is impossible to know with certainty.

Economic and political interests have always affected both the explanation of health disparities and responses to them.[62,63] As such, it will be important to transfer knowledge that Aboriginal cultural status is not associated with poor mental health outcome in youth after controlling for other covariates; including socioeconomic status.

In summary, all of society feels the impact of health disparities – directly and indirectly.[1] Health disparities are inconsistent with Canadian values.[1] In addition to the excess burden of illness on those who are already disadvantaged, health disparities threaten the cohesiveness of community and society, challenge the sustainability of the health system and have an impact on the economy.[1] These consequences are avoidable and can be successfully addressed.[1]

Table 1 Demographics of School Health Survey Respondents

Grade	
Grade 5	1078/4093 (26.3%)
Grade 6	969/4093 (23.7%)
Grade 7	925/4093 (22.6%)
Grade 8	869/4093 (21.2%)
Missing	252/4093 (6.2%)
Age Group	
9-10	369/4093 (9.0%)
11	1287/4093 (31.4%)
12	993/4093 (24.3%)
13-15	1290/4093 (31.5%)
Missing	154/4093 (3.8%)
Gender	
Male	1903/4093 (46.5%)
Female	2131/4093 (52.1%)
Missing	59/4093 (1.4%)
Cultural Status	
Caucasian	3170/4093 (77.4%)
Aboriginal	324/4093 (7.9%)
Other (Non-Caucasian/Non-Aboriginal)	457/4093 (11.2%)
Missing	142/4093 (3.5%)
Father's Occupation	
Professional	1097/4093 (26.8%)
Non-Professional	2263/4093 (55.3%)
Missing	733/4093 (17.9%)
Mother's Occupation	
Professional	1338/4093 (32.7%)
Non-Professional	2116/4093 (51.7%)
Missing	639/4093 (15.6%)
Father's Education	
Less than High School/ High School	1411/4093 (34.5%)
University	2006/4093 (49.0%)
Missing	676/4093 (16.5%)
Mother's Education	
Less than High School/ High School	1244/4093 (30.4%)
University	2311/4093 (56.5%)
Missing	538/4093 (13.1%)
Neighbourhood Income	
Six contiguous low income	103/4093 (2.5%)
Rest of neighbourhoods	3990/4093 (97.5%)

Table 2 **First Stage of Logistic Regression Model Building including Age, Gender, Parental Educational Status and Cultural Status on Moderate or Sever Depressed Mood**

Variable	Crude OR	95 % CI	Sig.	Beta	S.E.	Adjusted OR	95 % CI	Sig.
Age 13-15	1.364	1.100-1.692	.005	.232	.124	1.261	0.988-1.609	.062
Females	1.840	1.480-2.286	.000	.650	.127	1.915	1.494-2.454	.000
Non- Aboriginal/Non- Caucasian	0.915	0.640-1.309	.672	-.207	.210	0.813	0.539-1.226	.324
Aboriginal	2.812	2.097-3.771	.000	.857	.175	2.355	1.672-3.318	.000
Parents' Low Education	1.963	1.549-2.489	.000	.598	.126	1.819	1.421-2.329	.000

Reference categories: Age: 9-12 yrs; Gender: Males; Cultural Status: Caucasian; Parents' Education: High Education (University Degree)

Table 3 **Risk Hazard Model to Determine Independent Effect of Parental Education Status and Cultural Status on Model of Moderate or Severe Depressed Mood with Age and Gender**

Age	Base Model = Age + Gender Model 1	Model 1 + Cultural Status = Model 2	Model 1 + Education = Model 3	Full Model = Model 4	Independent effect of cultural Status	Overlap effect of Education	Independent effect of Education
	1.00	1.00	1.00	1.00			
Age 13-15	1.366 (1.100-1.697)	1.327 (1.062-1.658)	1.284 (1.010-1.632)	1.261 (0.988-1.609)	28.6 – 22.4 = 6.2	10.6 – 6.2 = 4.4	22.4 – 4.4 = 18
% Change		10.6	22.4	28.6			

Calculating % Change = (RH Model 1) - (RH Model 2, 3 or 4) / [(RH Model 1) -1]

Model 1 = Age + Gender
Model 2 = Age + Gender + Cultural Status
Model 3 = Age + Gender + Parental Education
Model 4 = Age + Gender + Cultural Status+ Parental Education

Independent effect of Culture = Model 4 – Model 3
Overlap effect of Parental Education = Model 2 – Independent effect of Culture
Independent effect of Parental Education = Model 3 – Overlap of Parental Education

Table 4 **Final Logistic Regression Model with Crude and Adjusted Estimates for Moderate or Severe Depressed Mood**

Covariate	Crude OR	95 % CI	Sig.	Beta	S.E.	Adjusted OR	95 % CI	Sig.
Female	1.840	1.480 -2.286	.000	.510	.176	1.665	1.179-2.352	.004
Low Self Esteem	11.028	8.565 -14.199	.000	1.159	.217	3.185	2.084-4.870	.000
Felt Like an Outsider at School	6.713	5.340 -8.438	.000	1.213	.175	3.364	2.386-4.743	.000
Was Bullied at School and Outside	4.062	3.150 -5.236	.000	.631	.196	1.879	1.278-2.761	.001
Alcohol Use	3.744	3.008 -4.735	.000	.923	.192	2.518	1.730-3.666	.000
High Anxiety	53.318	38.391 -74.050	.000	3.099	.228	22.171	14.170-34.690	.000
Suicide Ideation	12.883	10.033 -16.534	.000	1.317	.204	3.734	2.502-5.572	.001
Was Hungry - Some/Most of Time	3.577	2.788 -4.590	.000	.728	.216	2.071	1.357-3.162	.001
Parents' Low Education	1.963	1.549 -2.489	.000	.408	.175	1.503	1.066-2.120	.020
Aboriginal Cultural Status	2.812	2.097 -3.771	.000	.124	.259	1.132	0.682-1.881	.631

Reference Categories: Gender: Male; Alcohol: None; Suicide: No; Self-Esteem: High; School-Outsider: Rarely/Never; Anxiety: Low; Bullying: No; Parents' Education: University Graduate; Hunger: Never/Rarely; Culture: Caucasian

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Abstract

Introduction

A number of reports suggest that we need to determine public understanding about the broad determinants of health and also determine public support for actions to reduce health disparities in Canada.

Methods

A cross sectional random survey of 5000 Saskatoon residents was used to determine knowledge about health determinants and health disparity and then determine public support for various interventions to address health disparity.

Results

Saskatoon residents understand most of the determinants of health except they understate the importance of social class and gender. Saskatoon residents do not have a good understanding of the magnitude of health disparity between income groups. A majority believe risk behaviours are mostly individual choices and are not associated with income status. Most residents believe even small differences in health status between income groups are unacceptable and a majority believe that something can be done to address health disparity by income status. Interventions proposed by residents to alleviate health disparity were evidence based including work earning supplements and strengthening early intervention programs. Logistic regression revealed that greatest support for transferring money from healthcare treatment to health creation services (like affordable housing and education) came from young Aboriginal males with low income.

Discussion

Saskatoon residents have knowledge of health determinants and have a strong desire to support health disparity intervention. More knowledge transfer is required on the magnitude of health disparity based on income status. Broad based health disparity intervention in Saskatoon appears possible.

Introduction

A wide range of factors other than health care have an impact on health. These factors include, but are not limited to, income, social status, education, employment, working conditions, social support networks, physical environment, genetics, personal health practices, healthy child development, genetics, gender and the communities we live in.[1-14]

Health disparities refer to differences in health status that occur among population groups defined by specific characteristics.[4] A limited number of determinants contribute the most to health disparities.[4] Income status is recognized as one of those key determinants.[1,3,4] A recent report from Saskatoon found vast disparity in health status by neighbourhood income for numerous disorders.[12]

The British Medical Journal called income inequality and health "the Big Idea" and suggested that the health of a society is not overall wealth but more how evenly that wealth is distributed through taxes and transfers.[15] For example, 58.2% of Canada's seniors would live in poverty without government transfers. As a result of government programs, only 5.7% of seniors in Canada live in poverty.[1] As such, there is good reason to believe that by addressing a few but important conditions we can reduce health disparities.[4]

Prior to initiating action, it is important to determine the degree of consensus on public values and priorities for reducing health disparities.[4] One federal/provincial committee recommended to strengthen public understanding about the broad determinants of health and to determine public support for actions to reduce health status disparities.[3] Another national report concluded that little is known about 1) the Canadian public's views on what factors influence health and if 2) people consider that factors like income, education, housing or social support could influence health and whether 3) the public believes that health could be improved by addressing these factors.[5]

One paper from Canada suggests that the most important factors that contribute to health are diet (82%), physical activity (70%) and proper rest (13%).[5] When prompted, only one in three reported that economic and social conditions had an impact on health.[5] Another paper suggests 19.6% of residents in Alberta view income and social status as contributors to health status.[16] No papers were found that reviewed public knowledge on magnitude of health disparity between population groups. One paper from Canada reviewed poverty related policies and found greatest public support for child care programs and least support for increased welfare allowance.[17]

The purpose of the current study was to randomly contact Saskatoon residents to determine their knowledge of health determinants and health disparity and then determine which public policy actions they would support to help alleviate health disparity by income and socioeconomic status.

Methods

Sample size for the telephone survey was calculated with the following assumptions: 1) the standard error, variance and coefficient of variation should not exceed 0.075 of the proportion, 2) the smallest value of the proportion for which the required precision was to apply was 0.05 and 3) the population size of the Saskatoon Health Region was 287,448 in 2004.[18] With these assumptions, a sample size of at least 3,512 was required. Since a high level of precision was desired, a decision was made to use a sample size of 5,000.

Names and telephone numbers of 10,000 Saskatoon residents were generated by a third party specializing in random lists of phone numbers. The original sample included an equal gender split and equal numbers of residents from each of the ten electoral wards in Saskatoon. The

questionnaire was pre-tested with residents with low education status. From April to July of 2006, five contract workers randomly contacted 5,000 Saskatoon residents. Each household was contacted up to five times before discontinuing. Respondents who answered the telephone were asked to participate if they were over the age of 18. The survey was conducted in English. Information on gender was collected on those who refused to participate.

The questionnaire had five sections: a) which factors affect how healthy we are.[1] b) are people with low income more or less likely to suffer medical conditions in comparison to people with middle income, c) are certain behaviours individual choices or do they result from how much money we make, d) which interventions would help address health disparity in groups with low income and e) what are acceptable levels of health disparity by income, can something be done about health disparity, how would we pay for new services and would you support limiting health care treatment expenditures in order to transfer money to health prevention services or health creation services like education and affordable housing.

Binary logistic regression was used to describe the relationship between the outcome variable of answering yes or no to "would you support transferring money from health care treatment resources to health creating services like education and affordable housing" and all demographic explanatory variables. Stratification was used to assess for confounding and effect modification in the first step of model building.[19] A hierarchal well-formulated front-wise modeling approach was used instead of a computer generated stepwise algorithm.[19] The unadjusted effect of each covariate was determined and then entered one step at a time based on changes in the –2 log likelihood and the Wald test.[20] The final model includes factors with beta values for which the *p* values were less than 0.05.[20] Confounding was tested by comparing the estimated coefficient of the outcome variable from models containing and not containing the covariates.[20] Interaction was assessed with product terms.[20] R^2 was used to determine the proportion of variance in the outcome variable explained by the knowledge of the explanatory variables but not as a measure of the appropriateness of the final model.[20] Goodness-of-fit of the final model was assessed by the Hosmer-Lemeshow statistical test.[20] The final results were presented as adjusted odds ratios with 95 percent confidence intervals.[19] All analyses were performed with an SPSS 13.0 software package.[21]

Ethics approval was obtained from the Behavioural Ethics Committee of the University of Saskatchewan.

Results

We contacted 7699 Saskatoon residents in order to obtain a sample size of 5,000 (65% overall response rate). There was a difference between responders and non-responders in terms of gender (males 62%, females 69%; $p = 0.000$). Responder demographics were similar to 2001 census information except gender, which had significantly more representation from females (Table 1).

More than 75% of residents believed that income, education, employment, housing, the community you live in, recreation, nutritious food and gender are associated with health. The factors with the largest support were nutritious food (97.9%) and recreation (90.9%). The variables with the least support were social status (58.7%) and gender (31.1%) (Table 2).

A majority of residents believed that disease incidence was equally likely between income groups for mental illness, injuries and poisonings, breathing problems, heart disease, stroke and cancer. A majority of residents believed suicide attempts, diabetes, sexually transmitted infections and HIV/AIDS were more likely in low income groups (Table 3).

Behaviours like alcohol abuse, illegal drug use, smoking and lack of physical activity were believed to be mostly individual choices (49.6% to 67.7% support) and not associated with income status (Table 4).

Residents believed that the interventions that would help the most to address health disparity in groups with low income include creating work earning supplements for welfare recipients (84.1%), strengthening early intervention programs for infants (83.8%), providing more subsidized trades training for adults (82.3%) and providing more health prevention programs (82.0%). The interventions with the least support included increasing union membership for workers (33.4%) and more control for Aboriginal groups over their own land base, their own health programs and their own social programs (42.8% to 53.6% support) (Table 5). Stratification on these final three questions revealed significant differences based on responder cultural status (on average 25% more support from Aboriginals in comparison to Caucasians; $p = 0.000$ for all three questions).

A majority of residents believed that even small differences in health status between income groups is unacceptable (most prefer 0%) and also believed that something can be done to address health disparity by income status (83.2%). Measures taken to address health disparity should come from re-distribution of current taxes (69.8%) but not new taxes. Assuming limited financial resources to pay for new services, 34% of residents supported transferring money from health care treatment resources to either health prevention services or health creating services like education or affordable housing (Table 6).

Binary logistic regression was used to determine if any variable had an independent effect on the outcome of answering yes to the question "would you support transferring money from health care treatment resources to health creating services like education and affordable housing". In the final regression model, females, Caucasians and cultural groups other than Aboriginals, those with family income higher than $25,000 per year and age groups greater than 40 years of age were significantly less likely to support transferring money from health care treatment to health creation services. In the final model, gender was not a confounder but cultural status was. The R^2 of the final model was .448 suggesting reasonable explanation of the proportion of variance in the outcome variable explained by the knowledge of the explanatory variables. The goodness-of-fit test result ($p = .903$) suggests that the final model is appropriate and that the predicted values are accurate representations of the observed values in an absolute sense (Table 7).

Discussion

It appears that most Saskatoon residents understand most of the determinants of health although there is an emphasis on behaviours like eating nutritious food and being physically active. The importance of social class and gender are understated.[4,8] No attempts were made to question how poverty influences health.

Saskatoon residents are correct about the non-association between cancer and income status[10]. They are not correct that disease incidence is equally likely between income groups for mental illness, injuries and poisonings, breathing problems, heart disease and stroke.[6,10,12-14] The magnitude of the association between suicide attempts, diabetes, sexually transmitted infections and HIV/AIDS and income status is underestimated.[12-14] For example, Chlamydia incidence is 332% higher and gonorrhoea incidence is 676% higher in Saskatoon's low income neighbourhoods in comparison to the rest of the city.[12]

As well, it appears that Saskatoon residents are not aware of the social determinants of behaviour choosing instead to believe that behaviours like smoking are mostly individual choice. In terms of proposed interventions, Saskatoon residents were most willing to support earning supplements for welfare recipients and strengthen early intervention programs for infants. Both are evidence-based. Two successful pilot programs for earning supplements were recently

completed in British Columbia and New Brunswick.[22,23] Early childhood development programs obtain short and long term health and social benefits while saving up to eight dollars for every dollar invested.[1] Comparatively, less support was observed for subsidized food and recreation despite the near unanimous opinion that these are major determinants of health. Unfortunately, some Saskatoon residents do not understand the benefits of Aboriginal self determination. The Royal Commission on Aboriginal Peoples recommended Aboriginal control over services as one of four key principles for any health strategy to reduce disparity.[24]

Large increases in healthcare expenditure (up 55% from 1997 to 2003 in Canada) have not reduced health disparities.[4] As well, it is estimated that over 20% of all health care spending is attributable to income disparities.[4] As such, a regression equation was used to help explain which demographic groups would support transferring money from healthcare treatment to health creation services like affordable housing and education. Greatest support was obtained from young Aboriginal males with low income. The least support came from middle age Caucasian females with middle income.

One limitation of the study is a large refusal rate of respondents to disclose family income. In response, neighbourhood income is provided as a proxy.

In summary, Saskatoon residents have a reasonable understanding of health determinants and support evidence based interventions to address health disparity. Additional knowledge transfer is required on the magnitude of health disparity between income groups and the importance of self determination for Aboriginal Peoples.

Table 1 Demographics Characteristics of Random Phone Survey Sample

Age Group	
18-39	326/5000 (26.5%)
40-64	2064/5000 (41.3%)
65 and above	1169/5000 (23.4%)
Refused	441/5000 (8.8%)
Gender	
Male	1529/5000 (30.6%)
Female	3471/5000 (69.4%)
Education Status	
Did not complete high school	696/5000 (13.9%)
High school completed	1281/5000 (25.6%)
University degree or technical diploma	2631/5000 (52.6%)
Refused	392/5000 (7.8%)
Employment Status	
Professional/ Management	821/5000 (16.4%)
Clerical/ Sales/ Service	774/5000 (15.5%)
Student/ Homemaker	619/5000 (12.4%)
Manual/ Construction/ Transport/ Farmer	362/5000 (7.2%)
Retired/ Semi Retired	1439/5000 (28.8%)
Unemployed	202/5000 (4.0%)
Other	363/5000 (7.3%)
Refused	420/5000 (8.4%)
Cultural Status	
Caucasian	3746/5000 (74.9%)
Aboriginal (First Nations or Métis)	346/5000 (6.9%)
Other	493/5000 (9.9%)
Refused	415/5000 (8.3%)
Annual Family Income	
Less than $25,000	820/5000 (16.4%)
$25,000 - $49,999	944/5000 (18.9%)
$50,000 - $99,999	829/5000 (16.6%)
Above $100,000	268/5000 (5.4%)
Refused	2139/5000 (42.8%)
Neighbourhood Income[12] (Proxy for Individual Income)	
Low Income Neighbourhoods (LICO)[25]	587/5000 (11.7%)
Medium Income Neighbourhoods	4055/5000 (81.1%)
High Income Neighbourhoods	358/5000 (7.2%)
Missing	N/A
Urban or Rural	
Urban	4748/5000 (95.0%)
Rural	252/5000 (5.0%)

Table 2 Which Factors Affect How Healthy We Are?

Variable	Number/ Total Number (%)
Income	4117/5000 (82.3%)
Education	4255/5000 (85.1%)
Employment	4277/5000 (85.5%)
Social Status	2933/5000 (58.7%)
Housing	4063/5000 (81.3%)
Community you live in	3802/5000 (76.0%)
Recreation	4543/5000 (90.9%)
Nutritious Food	4893/5000 (97.9%)
Gender	1553/5000 (31.1%)
Genetics	4295/5000 (85.9%)

Table 3 **Are People with Low Income More or Less Likely to Suffer From the Following Conditions in Comparison to People with Middle Income?**

Condition	Much Less Likely	Less Likely	Equally Likely	More Likely	Much More Likely	Do Not Know
Mental Illness	56/5000 (1.1%)	433/5000 (8.7%)	2427/5000 (48.5%)	1535/5000 (30.7%)	211/5000 (4.2%)	338/5000 (6.8%)
Suicide Attempt	36/5000 (0.7%)	325/5000 (6.5%)	1837/5000 (36.7%)	2121/5000 (42.4%)	293/5000 (5.9%)	388/5000 (7.8%)
Injuries	38/5000 (0.8%)	398/5000 (8.0%)	2177/5000 (43.5%)	1767/5000 (35.3%)	170/5000 (3.4%)	450/5000 (9.0%)
Diabetes	23/5000 (0.5%)	254/5000 (5.1%)	1814/5000 (36.3%)	2293/5000 (45.9%)	317/5000 (6.3%)	299/5000 (6.0%)
Breathing Problems	26/5000 (0.5%)	260/5000 (5.2%)	2452/5000 (49.0%)	1744/5000 (34.9%)	173/5000 (3.5%)	345/5000 (6.9%)
Heart Disease	19/5000 (0.4%)	300/5000 (6.0%)	2578/5000 (51.6%)	1617/5000 (32.3%)	164/5000 (3.3%)	322/5000 (6.4%)
Stroke	20/5000 (0.4%)	350/5000 (7.0%)	2892/5000 (57.8%)	1246/5000 (24.9%)	124/5000 (2.5%)	368/5000 (7.4%)
Cancer	19/5000 (0.4%)	270/5000 (5.4%)	3598/5000 (72.0%)	682/5000 (13.6%)	73/5000 (1.5%)	358/5000 (7.2%)
Sexually Transmitted Infections	16/5000 (0.3%)	156/5000 (3.1%)	1617/5000 (32.3%)	2441/5000 (48.8%)	393/5000 (7.9%)	377/5000 (7.5%)
HIV/AIDS	15/5000 (0.3%)	126/5000 (2.5%)	1790/5000 (35.8%)	2267/5000 (45.3%)	395/5000 (7.9%)	407/5000 (8.1%)

Table 4 **Do You Believe That Certain Behaviours are Individual Choices or Do They Result From How Much Money That We Make?**

Behaviour	Mostly Individual Choice	Mostly How Much Money We Make	Both	Do Not Know
Alcohol abuse	2482/5000 (49.6%)	104/5000 (2.1%)	1683/5000 (33.7%)	731/5000 (14.6%)
Illegal Drug use	2779/5000 (55.6%)	100/5000 (2.0%)	1455/5000 (29.1%)	666/5000 (13.3%)
Smoking	3383/5000 (67.7%)	46/5000 (0.9%)	995/5000 (19.9%)	576/5000 (11.5%)
Lack of Physical Activity	3158/5000 (63.2%)	131/5000 (2.6%)	1162/5000 (23.2%)	549/5000 (11.0%)

Table 5 If Health Status Does Differ by Income, Which Variables Would Help Address Health Disparity in Groups with Low Income?

Variable Number (%)	Number/ Total
Employment equity programs	3374/5000 (67.5%)
Increasing minimum wage	3566/5000 (71.3%)
Increasing union membership for workers	1668/5000 (33.4%)
Increasing pension amounts to seniors	3907/5000 (78.1%)
Increasing welfare amounts to above poverty level	2764/5000 (55.3%)
Increasing welfare amounts to above poverty level for parents with children	3304/5000 (66.1%)
Creating work earning supplements for welfare recipients	4205/5000 (84.1%)
Strengthening early intervention programs for infants	4190/5000 (83.8%)
Create more subsidized daycares and pre-schools	3298/5000 (66.0%)
Increase funding for education	3836/5000 (76.7%)
Create more after school or after work literacy programs	3833/5000 (76.7%)
Provide more subsidized trades training for adults	4115/5000 (82.3%)
Provide more health care treatment programs	3581/5000 (71.6%)
Provide more health prevention programs	4099/5000 (82.0%)
More subsidized quality housing	3338/5000 (66.8%)
More subsidized quality housing for parents with children	3743/5000 (74.9%)
More subsidized transit	3427/5000 (68.5%)
More subsidized recreation	3246/5000 (64.9%)
More subsidized nutritious food	3235/5000 (64.7%)
More subsidized nutritious food for children	3850/5000 (77.0%)
Create more community groups and social support networks	3434/5000 (68.7%)
Encourage more volunteers in community	3618/5000 (72.4%)
More ability to influence government decisions	3822/5000 (76.4%)
More control for Aboriginal groups over Aboriginal land base	2142/5000 (42.8%)
More control for Aboriginal groups over Aboriginal health programs	2320/5000 (46.4%)
More control for Aboriginal groups over Aboriginal social programs	2678/5000 (53.6%)
More self determination for Aboriginal groups	3004/5000 (60.1%)

Table 6 Policy Implications for Health Disparity Action

1. If health status does differ by income level, what would be an acceptable amount of difference in disease incidence between low income groups and middle income groups?

0 percent difference	1805/5000 (36.1%)
10 percent difference	469/5000 (9.4%)
25 percent difference	680/5000 (13.6%)
50 percent difference	816/5000 (16.3%)
100 percent difference	171/5000 (3.4%)
200 percent difference	21/5000 (0.4%)
Do not know	1038/5000 (20.8%)

2. If health status does differ by income level, can something be done to address health disparity?

Yes	4160/5000 (83.2%)
No	378/5000 (7.6%)
Do not know	462/5000 (9.2%)

3. Which measures would you support to address health disparity by income level?

Increase taxes	452/5000 (9.0%)
Do not increase taxes but re-distribute current taxes	3490/5000 (69.8%)
Neither. Nothing can be done.	316/5000 (6.3%)
Do not know	742/5000 (14.8%)

4. Assuming limited financial resources to pay for new services, would you support transferring money from health care treatment resources to health prevention services?

Yes	1686/5000 (33.7%)
No	2415/5000 (48.3%)
Do not know	899/5000 (18.0%)

5. Assuming limited financial resources to pay for new services, would you support transferring money from health care treatment resources to health creating services like education and affordable housing?

Yes	1679/5000 (33.6%)
No	2384/5000 (47.7%)
Do not know	937/5000 (18.7%)

Table 7 Independent Variables Associated with Supporting the Transfer of Money from Health Care Treatment to Health Creating Services

Dependent Variable:
Answering yes or no to the question "would you support transferring money from health care treatment resources to health creating services like education and affordable housing"

Independent or Explanatory Variables:

	Beta	SE	Unadjusted OR	Adjusted OR (95% CI)	Significance
1. Gender					
Male (Ref*)					
Female	0.211	0.088	1.258	1.235 (1.038 – 1.468)	0.017
2. Cultural Status					
Aboriginal (Ref*)					
Caucasian	0.783	0.147	3.246	2.189 (1.639 – 2.922)	0.000
Other	0.528	0.192	2.136	1.696 (1.165 – 2.470)	0.006
3. Annual Family Income					
Less than $25,000 (Ref*)					
$25,000 - $49,999	0.317	0.108	1.530	1.373 (1.111 – 1.696)	0.003
$50,000 - $99,999	0.518	0.116	1.883	1.679 (1.338 – 2.106)	0.000
Above $100,000	0.470	0.159	1.805	1.600 (1.171 – 2.185)	0.003
4. Age Group					
18 - 39 (Ref*)					
40 - 64	0.220	0.092	1.545	1.246 (1.040 – 1.494)	0.017
Above 65	0.299	0.122	1.507	1.349 (1.061 – 1.714)	0.014

* Reference category

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3. General Discussion

3.1. Summary of the Results

The main research question is whether or not socioeconomic status (SES) is associated with health status in Saskatoon residents. The original research results suggest that SES is associated with multiple health outcomes in both adults and youth in Saskatoon. The systematic literature reviews confirmed SES is associated with poor mental health outcomes and risk behaviours across jurisdictions. The second main research question reviewed whether or not Aboriginal cultural status was associated with poor health status after multivariate adjustment for other covariates like SES. The results suggest that although Aboriginal cultural status is strongly associated with multiple poor health outcomes and behaviours at the univariate level, Aboriginal cultural status had a more limited association with poor health outcomes and behaviours in adults and youth after multivariate adjustment for other covariates including SES. The final original research paper determined that a majority of Saskatoon residents support health disparity intervention.

A. A systematic review of depressed mood and anxiety by socioeconomic status in adolescents aged 10-15 years (2.1) and
B. A systematic literature review of drug and alcohol use by socioeconomic status in adolescents aged 10-15 years (2.2).

The first two papers were systematic literature reviews that examined mental health outcome (depressed mood or anxiety) and risk behaviours (marijuana and alcohol usage) by socioeconomic status in youth aged 10-15 years. The prevalence of depressed mood or anxiety, and the prevalence of marijuana and alcohol risk behaviour, was higher in youth with low SES in comparison to youth with higher SES.

C. Health disparity by neighbourhood income (2.3).

The third paper compares the health status of residents within Saskatoon's six low income contiguous neighbourhoods to the rest of the city and found substantial disparities in the incidence of public health indicators as well as rates of healthcare utilization.

D. Health disparity: a more limited association with Aboriginal cultural status (2.4).

The fourth paper describes prevalence of heart disease, diabetes, suicide ideation and self report health in Saskatoon adults. After cross tabulation, Aboriginal cultural status and income status were strongly associated with essentially all health outcomes, disease intermediaries, behaviours, life stress and healthcare utilization variables. After multivariate adjustment, age and income had the strongest associations while Aboriginal cultural status had a more limited association with the four health outcomes reviewed. Behaviours, life stress and healthcare utilization played limited roles as risk indicators for health disparity after multivariate adjustment.

E. Disparity in childhood immunizations: a more limited association with Aboriginal cultural status (2.5).

The fifth paper demonstrates that child immunization coverage rates are routinely lower in Saskatoon's six low income neighbourhoods in comparison to the rest of the city. Although Aboriginal cultural status was initially strongly associated with child immunization status, Aboriginal culture status had a more limited association with incomplete immunization coverage in children after adjusting for low income status.

F. Risk indicators for depressed mood in youth: lack of association with Aboriginal cultural status (2.6).

In the sixth paper, all three socioeconomic variables and Aboriginal cultural status had important associations with moderate or severe depressed mood after cross tabulation. The unadjusted odds ratio for the association between Aboriginal cultural status and depressed mood was significantly reduced after full multivariate adjustment in the final logistic regression model.

G. Health disparity knowledge and support for intervention in Saskatoon (2.7).

The seventh paper describes health disparity knowledge and support for intervention in Saskatoon. A majority of Saskatoon residents understand most of the determinants of health but do not have a good understanding of the magnitude of health disparity between income groups. Most residents believe even small differences in health status between income groups is unacceptable and that something can be done to address health disparity. Interventions proposed by residents to alleviate health disparity were evidence based including work earning supplements and strengthening early intervention programs.

3.2. Limitations

There are several limitations with the studies that must be discussed.

First, the studies are cross sectional and not prospective. Findings must be seen as associations at a single point in time in comparison to causation through longitudinal follow-up. Given that exposure and outcome are assessed at the same point in time in cross sectional surveys, we can not distinguish whether the exposure preceded the outcome or whether the outcome preceded the exposure.

Second, two studies have low participation rates. This is a general complication found in population based research where residents are free to participate (or not) instead of recruiting volunteers for protocols like randomized trials. This introduces a potential selection bias. As well, some studies had large refusal rates to disclose personal income; a theme consistent with other research findings. This introduces a potential for information bias and adds a concern to the analysis as income is one of the major variables under review. In response, information on neighbourhood income was also collected.

Third, one of the main priorities of the report was to determine if Aboriginal cultural status is associated with poor health outcome after controlling for other covariates, including socioeconomic status. The results of the studies do demonstrate that Aboriginal cultural status has a more limited association with poor health outcome after controlling for other covariates. That said, there are a number of key points to address. In most studies, Aboriginal cultural status retains an important association with poor health outcome after multivariate adjustment; even though the association may not be statistically significant. This finding suggests that the associations could have been statistically significant if the sample sizes of the studies were larger. As such, it is possible that Aboriginal cultural status does have an association with poor health outcome; although the association is reduced after controlling for other covariates and is not as large as originally believed.

The challenge in understanding the implications of social causation of health disparity is to trace the processes through which macro structures become important in the micro conditions in the lives of individuals.[1] Social inequality can influence the experiences of daily life through intermediaries.[1] These social forces (poverty, segregation, isolation, prejudice, stigma and constrained opportunities) determine how much access individuals have to resources, power and

autonomy.[1] Members of lower status groups face more stressors than members of higher status groups but, at the same time, have fewer coping resources.[2] The mismatch between demands and capacity generates stress and psychological distress.[2]

Lastly, we must discuss that Aboriginal cultural status is associated with lower educational status, lower occupational status and lower income in Canada. The true association between socioeconomic status and poor health remains intact but Aboriginal cultural status can act as a confounder between socioeconomic status and poor health outcome. Prospective, longitudinal research will be required to investigate this phenomenon in more detail.

3.3 Comparison of Results with Previous Studies

The first and second research papers in section 2.1 and 2.2 systematically review the association between mental health and then drug and alcohol use by socioeconomic status in adolescents aged 10-15 years. The rational for the studies was that systematic reviews on these specific topics have never been completed before for youth and it served as useful background information prior to designing the community based school health intervention.

The third research paper in section 2.3 compares the health status of residents within Saskatoon's six low income contiguous neighbourhoods to the rest of the city. The result is not a new finding: low income neighbourhoods were associated with poor health outcomes. What is perhaps surprising is the magnitude of the disparity. Previous reports have found associations between neighbourhood socioeconomic status and all cause mortality, infant mortality, infant birth weight, suicide, long term illness, coronary heart disease, disability, chronic conditions and depression.[3,4] The neighbourhood effects found in previous multivariate analysis studies that control for individual SES are modest.[5-10]

The fourth, fifth and sixth research papers in sections 2.4, 2.5 and 2.6 review the independent association between Aboriginal cultural status and poor health outcome. Regardless of health outcome or age group, Aboriginal cultural status had a more limited association with the outcomes reviewed after multivariate adjustment for covariates like socioeconomic status. This is an important finding that needs further discussion because there is not an ample amount of research that has specifically addressed this topic previously.

The fourth paper in section 2.4 describes health disparity in Saskatoon adults. After multivariate adjustment in each of the four health outcomes under review, age and income were the strongest risk indicators in the final regression models while Aboriginal cultural status had a more limited association. Regrettably, there are few studies that review the association between Aboriginal cultural status and poor health outcome after multivariate adjustment for covariates like socioeconomic status. One Canadian study found that lower self report health and diabetes prevalence were not associated with Aboriginal cultural status after controlling for socioeconomic confounders.[11]

The fifth paper in section 2.5 reviews disparity in childhood immunizations in Saskatoon. Although Aboriginal cultural status was initially strongly associated with child immunization status at the univariate level, Aboriginal culture status had a more limited association with incomplete immunization coverage in children after adjusting for low income status. Previous reports indicate that Aboriginal children in Canada are more likely to be behind in immunization coverage but there are no studies that statistically control for potential confounding variables like low income status.[12] In comparison, Aboriginal children in Alaska in the United States routinely have immunization coverage rates in excess of 90% despite traditional risk factors like poverty, a higher proportion of uneducated mothers and remote access.[13] High child immunization coverage rates in Alaska is the result of the utilization of an electronic monitoring system,

collaboration between the state government and local tribal councils, willingness of public health nurses to perform home visits and making vaccination delivery a high priority.[14]

The sixth paper in section 2.6 reviews mental health disparity in Saskatoon youth. In this study, Aboriginal cultural status was not associated with moderate or severe depressed mood after full multivariate adjustment. A review on depression in adolescence concluded that too few studies have included subgroup analysis to permit drawing inferences about depression in Native American adolescents.[15] There was, however, a high quality study that examined this complex relationship in adults in Canada. Analysis from data from the Canadian National Population Health Survey revealed that adult Aboriginal Canadians experience significantly more depressive symptoms than English Canadians at the univariate level. After multivariate adjustment, the authors found that an increase in family income reduces the level of depression and the risk of a major depressive episode. After controlling for socioeconomic status, Aboriginal Canadians no longer differed from English Canadians in levels of depression or risk of a major depressive episode.[16]

The seventh paper in section 2.7 describes health disparity knowledge and support for intervention in Saskatoon. It appears that a majority of Saskatoon residents understand most of the determinants of health although there is an emphasis on behaviours like eating nutritious food and being physically active. Most Saskatoon residents believe even small differences in health status between income groups is unacceptable and a majority believe that something can be done to address health disparity by income status. Interventions proposed by residents to alleviate health disparity were evidence based including work earning supplements and strengthening early intervention programs. Prior to starting the project, a national report from Canada concluded that little is known about 1) the Canadian public's views on what factors influence health and if 2) people consider that factors like income, education, housing or social support could influence health and whether 3) the public believes that health could be improved by addressing these factors.[17]

3.4. Evidence Based Reviews to Reduce Health or Social Disparity

This report suggests that there is significant health disparity in the city of Saskatoon. In the past, research has been criticized for identifying problems but not helping in implementing the solutions. As such, a comprehensive literature review was initiated to identify what other jurisdictions have done to alleviate health and social disparity. This thesis will only briefly discuss global comparisons of plans to reduce poverty or health disparity. A separate report will be written to discuss more specific recommendations to reduce disparity in income, education, employment, housing and access to health services in the City of Saskatoon. These separate recommendations are beyond the scope of this thesis.

Health is higher on the international agenda than ever before and improving the health of the poor is becoming a central issue in policy development in many countries.[18] Europe, in particular, has taken the lead in reducing health inequities. The following section focuses on comprehensive poverty reduction strategies currently in place in Europe and two provinces in Canada. In these jurisdictions, policies have been put in place to improve health services for the poor. However, ensuring that the poor have access to affordable, quality health services is not enough by itself to improve health because the major determinants of disparity in health lie outside the health sector.[18]

Two epidemiologists and a senior librarian performed a comprehensive literature review utilizing the databases PubMed, PsycINFO, CINAHL, ERIC, ISI Web of Knowledge and First Nations Periodical Index. Subject descriptors included the MeSH terms: Socioeconomic, Social Class, Income, Poverty, Poverty Areas, Vulnerable Populations, Education, Schools, Student Dropout,

Occupation, Occupational Groups, Employment, Unemployment, Public Assistance, Social Support, Housing, Public Housing, Population Characteristics, Cohort Studies, Cross-over Studies, Randomized Trials, Cross Sectional Studies, Treatment Outcomes, Health Care Evaluation, Program Evaluation, Evaluation Studies, Health Care Quality, Health Services Research, Health Behaviour, Quality of Life, Quality Indicators and Quality of Health Care.

We also sought information pertaining to governmental or non-published papers (grey literature). In total, 284 e-mail requests were sent out to all relevant health, mental health, social sciences, social services and education department heads of Canadian Universities, urban Health Regions, Municipal, Provincial and Federal ministries, Canadian health associations and independent research agencies (i.e., Statistics Canada). Each of the contacts was asked to forward the e-mail request to any colleague that worked within the area of health, social or educational policy as it related to disparity. From this process, 28 relevant responses were received.

Two epidemiologists independently screened titles and abstracts of published and unpublished literature for relevance. Inclusion and exclusion criteria were developed and used to assist in the selection of articles for inclusion in the report. Articles were reviewed in full when criteria within the abstract did not provide enough detail to make a decision. The reference list of each article was also examined.

In the end, 10,048 publications and 28 non published papers were reviewed for a total of 10,076 articles. The 10,076 articles were then screened for relevance and reviewed for scientific quality; of which 244 articles were accepted for inclusion. As mentioned previously, this report will limit discussion to global recommendations to reduce poverty and will not include specific recommendations to reduce health or social disparity in Saskatoon.

European Poverty Reduction Plans

A. Ireland

In 1997 Ireland became the first country in the European Union to set an explicit anti-poverty target.[19] Ireland's National Anti-Poverty Strategy outlines strategies for all aspects of poverty, but focuses on three main areas: income, unemployment and education.[19]

For income, the target set in 1997 was to reduce the percentage of the population recognized as poor from 15% to 10% of the population by 2007. By 2001, the poverty rate had already fallen from 15% to 5%.[19] For unemployment, the target in 1997 was to decrease unemployment from 11.3% to 6% and long term employment from 7% to 3.5%. By 2000, unemployment was at 4% while long term unemployment dropped to 1.2%.[19] For education, the target was to eliminate school aged children leaving school prior to completion of the junior leaving certificate by 2007 and the rate of students continuing senior schooling to 90% in 2000 and 98% in 2007. By 2001 these rates had not been achieved but had remained constant.[19] The results clearly demonstrate the importance of establishing objective goals and working collaboratively to achieve them. Other initiatives undertaken in Ireland include putting more money into skills training; raising welfare payments and building more affordable housing. One initiative that proved successful in Ireland was to encourage local partnerships with business leaders, activists and low income residents. As of 2007, 93 of these partnerships had been formed.[20,21]

B. The Netherlands

Unlike other countries that have developed plans for poverty reduction as a whole, the Netherlands has produced an action plan specifically focused on reducing health inequalities. This plan is unique in that it is based on extensive research of the nature and background of socioeconomic inequalities in health in the Netherlands, as well as an evaluation of existing

interventions and policy measures.[22] The plan consists of four strategies with 26 recommendations and 11 quantitative policy targets.[23] All of these strategies and recommendations are geared towards reaching the overall target set by the World Health Organization of achieving a 25% reduction in socio-economic inequalities in health by 2020.[22]

Compared to other western countries, the Netherlands is characterised by a relatively strong redistribution of income, and consequently a relatively small income inequity and low prevalence of poverty. Therefore, their plan differs from other countries in that there is not a large emphasis placed on policies related to income.[22]

An important aspect of the plan is the acknowledgement that not one of the four strategies outlined is powerful enough to create a substantial reduction in health inequalities by itself. In addition, the Programme Committee states that "given the diversity of causes for the development of socio-economic inequalities in health, a further reduction of such variations will require efforts in a great many policy areas. This is not a task…for the health care sector alone."[22]

The four strategies of the Netherlands plan to reduce socio-economic inequities in health are listed below.[22]

1. Reduction of inequalities in education, income, and other socioeconomic factors by:
a) Continuation of the education policy targeted at disadvantaged youths in order to increase the percentage of children from the lower socio-economic classes who leave school with a secondary education diploma to 25% or higher in 2020 and b) Further experiment in the public health care sector with targeted measures to counteract the negative health effects of poverty, such as the direct allocation of a special welfare allowance (i.e., to families with children).

2. Reduction of the negative effects of health problems on socioeconomic position by:
a) Maintaining the level of benefit for the chronically ill at the level of 2000 and b) Expanding the opportunities for chronically ill and disabled persons to hold on to or find gainful employment. Specifically, the goal is to increase the percentage of chronically ill persons between the age of 25 and 64 in paid employment from 48% in 1995 to 57% or higher in 2020.

3. Reduction of the negative effects of socioeconomic position on health by:
a) Making it a high priority in low SES groups to promote health behaviours, improve working conditions and to improve housing and b) Eliminate barriers to healthy behaviours while also encouraging healthy behaviours, such as fresh fruit programs at school or a further increase on the duty on tobacco.

4. Improve access and quality of healthcare for lower socioeconomic groups by:
a) Overcoming the shortage of GPs in low income areas and b) Acknowledging that more is needed than assuring good access to health care facilities alone. Persons from lower socio-economic groups may require a different approach to care to achieve similar health effects to those achieved among persons in higher socio-economic groups.

C. Sweden

Sweden's Strategy Report for Social Protection and Social Inclusion 2006-2008 focuses on social connections (i.e., social capital, supportive social environment, secure bond between children and their parents) and a sense of morality (sense of solidarity, no discrimination).[24] The four priority objectives up until 2008 are:[25]

1. Promote work, education and training for everyone
2. Increase integration
3. Combat homelessness and exclusion from the housing market
4. Strengthen groups in particularly vulnerable situations

The foundation on which the Swedish strategy is built upon is universal welfare. The Swedish welfare system comprises: general health care and social care, social insurance that provides financial security in illness, disability, old age and for families with young children, and basic supplementary protection in the form of financial assistance.[25] This protects the entire population and is financed through compulsory charges and taxation. This means that everyone pays towards welfare and everyone benefits from it; particularly the more vulnerable groups. Universal social welfare is intended to create equal opportunities for all and equality between men and women.[25] Similarly, the general pension system, like health care and long-term care, covers the whole population on equal terms.[25]

Two unique aspects of Sweden's strategy are the universal leave policies for parents and the child care reform initiated in 2002/03. Under the universal leave policy, parents are entitled to thirteen months of parental leave at a replacement rate of 80%.[26] To be entitled to the earnings-related parental insurance one has to work for a minimum of 240 days before the birth of the child. Those who are not eligible receive a reduced amount. This policy encourages participation in the labour force, particularly for women. On top of parental leave, parents also receive child allowances at a flat rate per month and child.[26]

The structure of the parental leave policy is often seen as a main explanation why Sweden has been able to combine high female labour force participation rates and low levels of poverty. For instance, research has found that first-time mothers entitled to parental insurance benefits re-enter the workforce faster than non-eligible mothers and cross-national studies have found a close relationship between family policy and poverty outcomes.[26]

In 2002/03 the Swedish government initiated child care reform. By 2003 all municipalities had imposed a cap on the price of child care. The price of child care is determined as a fixed rate of household income with a cap of 38,000 SEK. The government also implemented an obligatory 525 hours a year of child care for all children aged 4 to 5 without any direct charges. These two changes made the average cost for full-time child care decrease from 6% to 2.5% of household income. In addition, the reform also requires municipalities to supply at least 3 hours a day or 15 hours a week of child care for children whose parents are unemployed or on parental leave.[26]

The parental leave policy and the child care reform have resulted in Sweden becoming the country with the lowest rate of low income prevalence for lone-parent families (6.7% in comparison to Canada at 51.6%).[27] Further, the income of lone parents in Sweden is between 70 and 80 percent of similar two parent families whereas this number is less than half in Canada.[28]

D. The United Kingdom

The United Kingdom is currently a leader in Europe in development and implementation of policies to reduce poverty.[24] The United Kingdom has so far produced three National Action Plans to reduce social exclusion and poverty containing 39 main recommendations.[24] As of 2006, the UK had the highest employment rate of the G8 countries and for the first time in 50 years the UK also had the lowest combination of unemployment and activity rates. As a result of tax credits and the implementation of the National Minimum Wage in previous plans, there were 800,000 fewer children and 1 million fewer pensioners living in low-income in 2004/05 than in 1996/97.[29]

Two key objectives of the plan are:

1. Improving access to quality services and tackling discrimination
2. Eliminating child poverty and increasing labour market participation

In order to eliminate child poverty, the government has created policies that focus on supporting and promoting financial security for poor families in and out of work; and breaking cycles of deprivation through early-years support and education. Specifically, they have set the following targets to be met by 2010: to have 70% of lone parents employed by 2010, to have a childcare

placement for all 3 to 14 year olds between the hours of 8 a.m. and 6 p.m. each weekday and to create 3500 children's centres with high quality early-years services in every community.[29]

The United Kingdom recognizes that all determinants of health are inter-related. Therefore, in order to eliminate child poverty and increase labour market participation they recognize the importance of a safe and affordable home. The homelessness strategy for England aims to halve the number of households living in temporary accommodation by 2010. The supply of new social homes will be increased by 50% by 2008, providing 75,000 new social homes over the next three years. As a result of the initiative, there was a 27% reduction in the number of households becoming homeless in 2005 in comparison to the previous year.[29]

E. Scotland

The individual countries of the United Kingdom have all come up with their own action plans to reduce health inequality and poverty. Since 1999 Scotland has been committed to tackling poverty and disadvantage through their *Social Justice Strategy: a Scotland where Everyone Matters*. Beginning in 2003, this title was changed to "*Closing the Opportunity Gap*" with six specific objectives and ten targets announced in 2004. The six objectives of the plan are:[30]

1. To increase the chances of sustained employment for vulnerable and disadvantaged groups - in order to lift them permanently out of poverty;
2. To improve the confidence and skills of the most disadvantaged children and young people - in order to provide them with the greatest chance of avoiding poverty when they leave school;
3. To reduce the vulnerability of low income families to financial exclusion and multiple debts - in order to prevent them becoming over-indebted and/or to lift them out of poverty;
4. To regenerate the most disadvantaged neighbourhoods - in order that people living there can take advantage of job opportunities and improve their quality of life;
5. To increase the rate of improvement of the health status of people living in the most deprived communities - in order to improve their quality of life, including their employability prospects and
6. To improve access to high quality services for the most disadvantaged groups and individuals in rural communities - in order to improve their quality of life and enhance their access to opportunity.

One initiative that has been introduced in order to meet the first objective to increase employment opportunities is Working for Families (WFF) which aims to ensure that access to affordable, flexible childcare is not an obstacle in preventing parents from accessing education, training or employment.[29] The data shows that of the 6000 parents had engaged WFF, 2600 had either returned to work or entered into a skills training program.

<u>Poverty Reduction Plans in Canada</u>

Regrettably, Canada does not have a national anti-poverty or health disparity reduction plan. Only two provinces in Canada have developed provincial anti-poverty strategies: Québec and Newfoundland and Labrador.[31] Poverty in these provinces is concentrated in specific regions/neighbourhoods and is particularly evident for lone-parent families, recent immigrants, persons with disabilities and Aboriginal people.[32,33] Québec in particular has a comprehensive action plan and will therefore be discussed in more detail.

A. Québec

On December 13, 2002 the National Assembly in Québec unanimously adopted Bill 112: a law to combat poverty and social exclusion. The law itself is the most important and unique part of the

bill as it takes the problem of poverty and changes it into a legislative commitment.[32] Following the passing of Bill 112, the Government of Québec released its Government Action Plan to Combat Poverty and Social Exclusion in April, 2004. The action plan consists of a set of five-year measures for achieving the goals set in the act to combat poverty and social exclusion. The action plan "*Reconciling Freedom and Social Justice: a Challenge for the Future*" reflects a long-term vision, but includes short-term and medium-term commitments.[34]

The action plan is based on two principles:[35]

1. Employment is the leading solution in ensuring economic security and social inclusion for people able to work
2. A higher level of protection must be granted to people with a severely limited capacity for employment

The plan focuses on four major areas:

1. Improving the lives of people living in poverty. The six goals to accomplish this plan are listed below.

The first goal is to increase minimum wage. As a first step to improving the lives of low-income earners, measures must be implemented to ensure that work is more attractive than employment assistance.[34,35]. The second goal is to provide better support for low-income earners through the Work Premium. Prior to the introduction of the Work Premium, there was no advantage for those on employment assistance to work since after a certain amount earned, each dollar was deducted from the financial assistance they received.[24,35] The third goal is to provide more flexibility for assets under the Employment Assistance Program. The government intends to encourage those living in poverty to save to buy a home, go to school, or become self-employed.[34] The fourth goal is to provide funding to the Réseau Québécois de Crédit Communautaire which is made up of 17 organizations that grant credit to people with low income who want to start their own businesses.[34] The fifth goal is to build more decent and affordable housing.[36] The sixth goals is to ensure everyone has access to adequate amounts of nutritious food.[35]

2. Preventing poverty and social exclusion by fostering development of personal potential

The first action plan is to make children, low-income families and young people a priority.[34]
The second action plan is the creation of a child assistance initiative that covers the basic needs of dependent children under 18 years old.[36] The third action plan is active assistance for young adults who are on government assistance in order to help them enter the work force.[34]

3. Involving society as a whole

The first requirement is that all regions and municipalities combine their strategies and agree on priority actions and disadvantaged areas.[34] The second requirement is to encourage and enable new partnerships among the various private, public and community players.[35]

4. Ensuring consistent, coherent action

The recommendation is for the government to form an interdepartmental committee to ensure the participation of all partners across Québec which is needed in order to coordinate and implement the Action Plan.[34] There is also the need to conduct research in partnership with the relevant Quebec networks, the Institut de la Statistque du Québec, and the main government departments involved in combating poverty and social exclusion.[36] Finally, the government should will provide regular updates to the public to encourage active participation in the fight against poverty and social exclusion.[34]

B. Newfoundland and Labrador

Newfoundland and Labrador initiated a government-wide integrated approach based on the principles of social inclusion and collaboration in 2006. The government has committed to transform Newfoundland and Labrador over a ten-year-period from a province with the most poverty to a province with the least poverty.

The goals and objectives of the strategy are: [33]

1. Improved access and coordination of services for those with low incomes
2. A stronger social safety net
3. Improved earned incomes
4. Increased emphasis on early childhood development
5. A better educated population

Recommendations:

The countries and provinces discussed in this section vary in many ways but they all face the same problem of poverty, health inequality and social exclusion. Although each jurisdiction has adapted their own plans to alleviate poverty, commonalities regarding the construction of a plan emerge.

1. An effective plan to reduce poverty and health inequality needs to meet the following three requirements:

A multi-year plan is needed which should be made up of interventions that have been shown to be effective while continuing to conduct research directed at the development of new interventions.[22,33] Second, Concrete targets should be formulated for each of the strategy areas decided upon in order to determine if the interventions are effective, and to what extent. Both short and long term targets should be developed.[22] Third, the plan must receive broad support across many sectors (both public and private) in order to be effective.[22,29,33,34]

2. Evaluation of interventions and policies needs to be a priority.

A common problem that emerges in the national and provincial reports on reducing poverty is the lack of evaluation. In a report written by Mackenbach and Bakker on health disparity plans in Europe, the authors conclude that:

> The available evidence on the effectiveness of policies and interventions to reduce socioeconomic inequalities in health is very limited…there seem to be many entry points, but for only some of these have policies and interventions been devised, only some of them have been evaluated, and not all of the results have been made available to policy-makers around Europe."[24]

In a recent report evaluating plans to reduce health inequalities in Europe, the authors found that "aside from [a] few examples, there appears to be insufficient recognition that evaluation is a prerequisite for decisions as to whether a policy should be continued, expanded, adapted or curtailed."[37]

Although these reports on evaluation focus on European countries, Canada's two provinces with comprehensive plans are no different. Even though Québec has released two follow up reports to their plan, there is little mention of any evaluation. Instead it seems to be the norm to present general statistics as opposed to any actual evaluation.

In order to determine if interventions are effective, strategies to evaluate interventions need to be put in place at the same time a plan is developed.

3.5. Initial Progress in Saskatoon towards Health Disparity Intervention

Upon publication of the health disparity study (section 2.3), Mark Lemstra and Gary Beaudin of the Saskatoon Health Region initiated over 200 community consultations with 60 government and non-government organizations. The purpose of the community consultations was to transfer knowledge of the results of the study and build consensus on health disparity intervention.

As a result of the initial health disparity by neighbourhood income report and the community consultations, the Saskatoon Health Region (SHR) initiated some policy changes. SHR transferred 1.2 million dollars of health resources to Saskatoon's six low income neighbourhoods with a primary focus on six elementary schools within those neighbourhoods. Within this initiative, the Department of Paediatrics started two Paediatric clinics in St Mary's school and W.P. Bate school. SHR also incorporated "Partnering to Improve Aboriginal Health" as one of its five strategic visions to accomplish within the next three years. An Elders Advisory Council was created to consult with the Senior Leadership Team and Population Health Research of SHR. A Memorandum of Understanding has been prepared between Public Health of SHR and the Saskatoon Tribal Council (STC) to work together to alleviate health disparities. Lastly, a Memorandum of Understanding was signed between Population Health Research of SHR and STC to formally study health disparities and Aboriginal health in true partnership.

Agencies other than SHR also transferred resources to Saskatoon's low income neighbourhoods as a result of the health disparity study. The United Way allocated $50,000 for after school programs and will focus their 2007/2008 fundraising campaign on health disparity alleviation in youth within Saskatoon's six low income neighbourhoods. The Saskatoon Health Region added $30,000 to the after school program initiated by the United Way. The Catholic and Public School Boards granted access to their schools for school health services and school health research. The seven Chiefs of the Saskatoon Tribal Council published a declaration acknowledging health disparity in Saskatoon and the willingness to partner on research and intervention. The Saskatoon Tribal Council and the Saskatoon Health Region raised $300,000 for a child immunization clinic in the middle of the low income neighbourhoods. The City of Saskatoon doubled its annual financial allocation for affordable housing. Perhaps most importantly, the Government of Saskatchewan allocated $40 million dollars for low income subsidized housing and $9.5 million for a new primary care center.

3.6. Plans for Future Research

One of the problems facing health disparity researchers is the confounding relationship between cultural status and socioeconomic status (SES). The distinction is important because SES is preventable and modifiable whereas cultural status is not. Regrettably, there are too many examples of research papers that list cultural status or race as a major risk indicator for poor health outcomes and risk behaviours. An equal amount of prioritization should be expended on research initiatives that examine the independent effect of cultural status after controlling for other covariates like SES. While Aboriginal cultural status is not the main risk indicator for poor health once other covariates have been statistically controlled for, the reality is that Aboriginal cultural status is currently associated with poverty and impoverished social conditions and therefore is also associated with poor health. In order to resolve these difficult questions, more focus needs to be spent on prospective and longitudinal research that can determine causes or determinants of health while accounting for pathways and intermediaries.

Second, there is also an absence of prospective evaluation of interventions to reduce or alleviate health disparity. In the world of limited human and financial resources, it is necessary to determine which interventions are effective in which populations under what circumstances. The re-prioritization of current resources, or the allocation of new resources towards low SES residents, has a political element and, as such, there needs to be a strong evaluation component in order for decision makers to make evidence-based decisions.

The following research initiatives are underway in Saskatoon.

1. We need to determine the broad based social policies that lead to poverty and impoverished social conditions in Aboriginal people and describe how they act as pathways to poor health. This will be accomplished with two main research projects.

The first research project is a five year prospective longitudinal study of 6,000 Saskatoon First Nation adults and children. The survey to be used will be the comprehensive First Nations Regional Longitudinal Health Survey. The self-report information will be linked to health records. The purpose is to determine which factors are impacting on health and to what extent. We will need to determine the independent effect of variables like socioeconomic status (i.e., income, education, employment and housing), behaviours (i.e., smoking, alcohol usage) and societal factors that impact on socioeconomic status and behaviours (i.e., racism, prejudice, residential schools, social policies).

The second research project will be a five year prospective longitudinal study of 30,000 youth in Saskatoon. The purpose of the study will be to prospectively ascertain the determinants of health in Saskatoon youth with a longitudinal study design. The survey to be used is the National Longitudinal Survey of Children and Youth (NLSCY). The primary objective of the NLSCY is to monitor the development and well-being of children and youth in Canada from childhood to adulthood. The NLSCY collects longitudinal information on child development and determines the biological, social, economical, and environmental conditions of child development in order to develop and deliver effective policies and programs.

2. We will prospectively evaluate the effectiveness of a school based intervention to alleviate health disparity in Saskatoon youth. Not only will the NLSCY be used to determine which factors are impacting health in Saskatoon youth, the NLSCY will also be used as the evaluation tool to prospectively determine the effectiveness of interventions that have been started in low income schools to impact health, mental health and behaviours. The school based resources include two paediatric clinics, six public health nurses, two mental health therapists, preferred access to a number of specialists (i.e., youth psychiatrist), after school recreation and literacy programs, peer education and mentoring programs and so on.

3.7. Conclusions

This thesis is a broad study about socioeconomic status and health status. The main research questions of the thesis are:

1. Is socioeconomic status associated with poor health status in Saskatoon residents?
2. Is Aboriginal cultural status independently associated with poor health status after controlling for other covariates, namely socioeconomic status?

A finding of this report is that Aboriginal cultural status has a much more limited association with lower health status after controlling for socioeconomic status and other covariates. This is an important finding that needs further discussion because there is not an ample amount of research

that has specifically addressed this topic previously. A Canadian study found that lower self report health and diabetes prevalence were not associated with Aboriginal cultural status after controlling for socioeconomic confounders.[11] Analysis from the Canadian National Population Health Survey revealed that after controlling for socioeconomic status, Aboriginal Canadians no longer differed from other Canadians in levels of depression or risk of a major depressive episode. The authors found that an increase in family income reduces the level of depression and the risk of a major depressive episode.[16]

In his Pulitzer Prize winning book, Jared Diamond discusses that the biological explanation for inequalities between cultural groups is wrong but, unfortunately, we're not told what the correct explanation is.[38] Economic and political interests have always affected both the explanation of health disparities and responses to them.[39]

There is a need to transfer the results of this research to the Saskatoon community for two main reasons:

1. It prevents the negative stereotype and shame felt by Aboriginal people who are told that the primary cause of their health disparity is a result of their cultural status and

2. It allows policy makers and the public at large to acknowledge that health disparity reduction is possible because the main determinants of health (i.e., income, education) are modifiable (in comparison to Aboriginal cultural status).

In summary, all of society feels the impact of health disparities – directly and indirectly. Health disparities are inconsistent with Canadian values. In addition to the excess burden of illness on those who are already disadvantaged, health disparities threaten the cohesiveness of community and society, challenge the sustainability of the health system and have an impact on the economy. These consequences are avoidable and can be successfully addressed.[17]

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3.9. Summary

The primary purpose of the thesis was to determine if socioeconomic status is associated with poor health status in Saskatoon residents. The second purpose of the collection of papers was to determine if Aboriginal cultural status is independently associated with poor health outcomes after multivariate adjustment for other factors like socioeconomic status.

The first and second papers discuss the analysis of the literature prior to school based health disparity intervention. The third, fourth, fifth and sixth research papers provide analysis on population health and quantify the level of health disparity in the Saskatoon population by socioeconomic status. The fourth and sixth papers review the influence of behaviours on health outcomes. The fourth, fifth and sixth papers discuss the association between Aboriginal cultural status and poor health outcome after multivariate adjustment. The seventh paper discusses community consultation prior to community based intervention.

In total, there are seven research papers that form the body of the thesis:

A. The first paper was a systematic literature review to identify published or unpublished papers between January 1, 1980 and October 31, 2006 that reviewed depressed mood or anxiety by SES in youth aged 10-15 years old. We found nine studies that fulfilled our inclusion criteria and passed the methodological quality review. The prevalence of depressed mood or anxiety was 2.49 times higher (95% CI- 2.33-2.67) in youth with low SES in comparison to youth with higher SES.

B. The second paper was a systematic literature review to identify published or unpublished papers between January 01, 1980 and February 09, 2007 that reviewed marijuana and alcohol risk behaviour by SES in adolescents aged 10-15 years. We found nine studies that fulfilled our inclusion criteria and passed the methodological quality review. The prevalence of marijuana and alcohol risk behaviour was 22% higher, (RR = 1.22; 95% CI- 1.14, 1.31) in adolescents with low SES in comparison to adolescents with higher SES. Stratification by country of origin revealed that American and New Zealand studies had statistically significant variability in the reported effects as compared to European and UK studies.

C. The third paper was a cross sectional ecological study to review all hospital discharges, physician visits, medication utilisation, public health information and vital statistics for Saskatoon by neighbourhood income status. Statistically significant differences in healthcare utilization by neighbourhood income status were observed for suicide attempts, mental disorders, injuries and poisonings, diabetes, chronic obstructive pulmonary disease, coronary heart disease and in the incidence of Chlamydia, gonorrhea, hepatitis C, teen birth, low birth weight, infant mortality and all-cause mortality. The rate ratios increased in size when comparing low income neighbourhoods to high income neighbourhoods. No clear trend was observed for stroke or cancer.

D. The fourth paper used data from three cycles of the Canadian Community Health Survey merged with identical data collected by the Saskatoon Health Region. The four health outcomes included self report health, heart disease prevalence, diabetes prevalence and lifetime suicide ideation. The risk indicators included disease intermediaries, behaviours, life stress, healthcare utilization, socioeconomic status and cultural status. After cross tabulation, Aboriginal cultural status and income were strongly associated with almost all health outcomes, disease intermediaries, behaviours, life stress and healthcare utilization variables. After full multivariate adjustment, age and income had the strongest associations with the outcomes of lower self report health, diabetes prevalence, heart disease prevalence and suicide ideation. Aboriginal cultural

status had a more limited association with poor health outcome after full multivariate adjustment for other covariates.

E. The fifth study determined if child immunization coverage rates at age two were lower in low income neighbourhoods of Saskatoon. We contacted parents that were behind and not behind in child immunization coverage to determine differences in knowledge, beliefs and opinions on barriers and solutions. Reviewing the last five years in Saskatoon, the six low income neighbourhoods had complete child immunization coverage rates of 43.7% (95% CI-41.2-45.9) for MMR and 42.6% (95% CI- 40.1-45.1) for DaPTP-Hib while the five affluent neighbourhoods had 90.6% immunization coverage rates for MMR (95% CI-88.9-92.3) and 78.6% for DaPTP-Hib (95% CI- 76.2-81.0). Parents that were behind in immunization coverage with their children were more likely to be single, be of Aboriginal or Other (non-Caucasian or non-Aboriginal) cultural status, have lower family income and have significant differences in reported beliefs, barriers and potential solutions. In the final regression model, Aboriginal cultural status had a more limited association with lower immunization status.

F. The sixth paper was a school health survey with every student in grades 5-8 in the City of Saskatoon. 4093 youth participated in the survey. For Aboriginal youth, the prevalence rate of moderate or severe depressed mood was 21.6% in comparison to 8.9% for Caucasian youth (RR=2.43; 95% CI 1.92-3.08). Aboriginal cultural status was not associated with depressed mood after multivariate adjustment for other covariates in the final multivariate model (OR= 1.132; 95% CI 0.682-1.881). Parental educational status and gender were confounders to the association between Aboriginal cultural status and depressed mood.

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G. The seventh paper was a cross sectional random survey of 5000 Saskatoon residents to determine knowledge about health determinants and health disparity and then determine public support for various interventions to address health disparity. The results demonstrated that Saskatoon residents understand most of the determinants of health except they understate the importance of social class and gender. Saskatoon residents do not have a good understanding of the magnitude of health disparity between income groups. A majority believe risk behaviours are mostly individual choices and are not associated with income status. Most residents believe even small differences in health status between income groups are unacceptable and a majority believe that something can be done to address health disparity by income status. Interventions proposed by residents to alleviate health disparity were evidence based including work earning supplements and strengthening early intervention programs. Logistic regression revealed that greatest support for transferring money from healthcare treatment to health creation services (like affordable housing and education) came from young Aboriginal males with low income.

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Overall, the thesis demonstrated that socioeconomic status is associated with poor health status in Saskatoon residents. As well, the thesis also demonstrated that Aboriginal cultural status had a more limited association with poor health outcomes after multivariate adjustment for other factors like socioeconomic status.

The author has recently completed a comprehensive health disparity reduction plan for the City of Saskatoon with very specific recommendations. The report was written on behalf of the Saskatoon Health Region, the Greater Saskatoon Catholic School Board, The Saskatoon Public School Board, the City of Saskatoon, the Saskatoon Tribal Council, the United Way and the Province of Saskatchewan. The report includes evidence based suggestions on how to reduce disparity in income, education, employment, housing and access to quality health care. It is hoped that these evidence based policy suggestions will be adopted in order to reduce health inequalities in Saskatoon residents.

3.10. Acknowledgements

My greatest thanks is to my wife Nicole and my two beautiful daughters Kelli and Makenna for their love and support.

I am indebted to Professor Mackenbach for allowing me to complete my PhD thesis under his esteemed leadership and guidance. I am also indebted to Dr. Kunst for his support and expert advice.

3.11. Curriculum Vitae

Mark Lemstra grew up in Gravelbourg, Saskatchewan, Canada. At the age of seventeen, Mark moved to the city of Saskatoon to attend university. Mark has three university degrees from the University of Saskatchewan including a Bachelors degree, a Masters in Physical Medicine and Rehabilitation and a PhD in Psychiatry. From the Netherlands Institute of Health Sciences at Erasmus University, Mark has completed a Masters in Epidemiology, a Doctor of Science in Epidemiology, a Masters in Public Health and a Doctor of Science in Public Health.

From 1992 to 1995, Mark worked as an officer in the Canadian Armed Forces. From 1995 to 2004, Mark was the owner of a group of multidisciplinary medical and rehabilitation clinics. From August 2004 to the present, Mark has worked at the Saskatoon Health Region originally as the manager of Population Health and more recently as the Senior Research Epidemiologist.