FACTORS ASSOCIATED WITH CHILDHOOD DEPRESSION IN SASKATOON STUDENTS: A MULTILEVEL ANALYSIS

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ABSTRACT

Depression is a multi-factorial mental health problem that deeply impacts individuals' emotions, behaviours and productivity. This study investigated links between depression and its determinants among children recruited from Saskatoon elementary schools. The overall goal of the study is to (i) determine the extent of mental health disparity and identify multilevel factors that are associated with depression (individual-level), and (ii) examine whether there is a depression discrepancy among Saskatoon elementary schools (school-level). Our study could provide theoretical bases for future interventions which reducing mental health disparities in Saskatoon school children.

This is a cross-sectional study based on the Saskatoon Student Health Survey administered by Saskatoon Health Region in 2008/2009. It included 4200 students from 76 elementary schools. Data on self-reported mental health, physical activity, bullying experiences, and school refusal behaviours was collected. School-level material and social deprivation were also measured. A multilevel logistic model was used to analyze the data.

A total of 3648 (86.9%) students responded to the questions on depression. Among them, 813 (22.3%) reported suffering from symptoms of depression. Most of the responders were between the ages of 11 and 13, 80% had a normal Body Mass Index

(BMI), and a majority (78.2%) were Caucasian. Factors associated with depression were: female, student from single parent family, reporting a ‘good relationship’ with parents, over weight/obese, having experienced social or electronic bullying, having few friends, feeling like an outsider, skipped school, and being treated badly at school. In addition, students in schools deemed as representing moderate material deprivation were 2.04 times more likely to be depressed compared to schools deemed to represent low material deprivation (OR=2.04, 95% CI: 1.53-2.72, p<.0001). Our study revealed that disparities in depression exist between schools, and students’ school refusal behaviour was the main factors contributing to the disparity between schools.

The study will increase awareness in Saskatoon Health Region and among stakeholders about mental health disparity and its complex determinants among children in Saskatoon.

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Dedicated to my dearest mother:

Yuwei Sun

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LIST OF ABBREVIATIONS

WHO- World Health Organization

CHEO- Children's Hospital of Eastern Ontario

NLSCY- Canada's National Longitudinal Study of Children and Youth

SES- Socioeconomic status

CES-D- Center for Epidemiologic Studies-Depression

KKD- Kilocalories per kilogram per day

BMI- Body Mass Index

DA- Dissemination areas

SHAPES- School Health Action Planning and Evaluation System

PASCQ- Physical Activity Stages Questionnaires

HBSC- Health Behavior in School-Age Children

SRB- School refusal behaviour

OR- Odds ratio

VAR-Variance

CI- Confidence interval

CHAPTER 1: INTRODUCTION

1.1 Objective

Depression is a common mental disorder that presents with depressed mood, loss of interest or pleasure, feelings of guilt or low self-esteem, disturbed sleep or appetite, low energy, and poor concentration (World Health Organization, 2003). Around five percent of children and adolescents suffer from depression in the general population worldwide (Cohen, 2007). The main purpose of this study is to: (i) determine the extent of mental health disparity and identify multilevel factors that are associated with depression among children in grades 5 through 8 in the city of Saskatoon in 2008/2009, and (ii) examine whether there is a variation of depression among Saskatoon elementary schools. By conducting multilevel analysis, we are able to address the underlying individual-level and school-level factors of childhood depression, and how much of the school-level differences in depression may be explained by these factors.

In this study depression serves as the primary outcome to represent mental health status. The associated factors being considered in this study were: demographic indicators such as age, gender, and parents' employment; social indicators (i.e. friend support or being bullied); health indicators; and self-reported behaviour indicators (i.e. withdrawal from school). School-level factors being considered were material and

social deprivation index scores of the neighbourhoods in which schools were located, which were extrapolated to represent a school-level factor.

1.2 Rationale

Studies have reported that significant disparities exist between socioeconomic groups for many health issues, such as mental health disorders, suicide attempts, low birth weight, infant mortality, diabetes, heart disease, and so on, in Saskatoon (Lemstra et al., 2006; Muhajarine & Vu, 2009). Authors of these studies have also suggested that there should be a strong connection between community residents of younger age and schools, so the interventions to address health disparity should take place in the schools (Lemstra et al., 2006). Therefore, the Student Health Survey chose to include students who were in the middle years of school, which are from grade 5 to grade 8. That decision is based on previous studies which suggested that children in these grades have the best opportunity for a positive response to interventions, and the majority of children are still in school at this age (Rohrbach et al., 2005). The Saskatoon Student Health Survey was conducted in 2006-2007 and 2008-2009, which aimed to: collect information about children's health status in Saskatoon, exploring indicators that could influence health; and support the identification, implementation, and evaluation of new interventions, with the goal of addressing specific health disparities among children in Saskatoon.

My study, based on the Student Health Survey study, provided an opportunity to

perform a more detailed evaluation of students' health status. It chose depression as the outcome variable, considering that children's mental health problems are of great concern. This study revealed factors that influence students' mental health status, which provides further information for Saskatoon Health Region to implement future programs. This study also revealed the role of schools in students' mental health status by taking school differences into consideration, which provides information for Saskatoon's elementary schools to enhance students' health.

1.3 Study hypotheses

Primary hypotheses:

1. Depression will be significantly associated with physical activity such that children with lower levels of physical activity are more likely to have depression, after controlling for their demographic and family characteristics.
2. Depression will be significantly associated with bullying such that children who have experienced bullying are more likely to have depression, after controlling for their demographic and family characteristics.
3. Depression will be significantly associated with school performance such that children who have worse school performance are more likely to have depression, after controlling for their demographic and family characteristics.

Secondary hypotheses:

1. The prevalence of depression will vary significantly across schools.
2. Physical activity, bullying and school performance will contribute to explanation

of depression disparity across the schools.

3. School-level material and social deprivation will contribute to the explanation of the variation of depression across the schools.

CHAPTER 2: LITERATURE REVIEW

2.1 Mental health problems

According to the World Health Organization, mental health is a state of well-being of mental function (WHO, 2003). Although mental health problems affect various groups of people, they are more likely to occur among certain groups, such as people with lower incomes, people who are unemployed, people with lower education levels, victims of violence or people who are being abused or neglected, as well as youth (WHO, 2003).

Mental health is an essential component in children's development, and yet it is one of the most under-evaluated and under-appreciated developmental domains in children's health (Stagman & Cooper, 2010). It is widely and readily accepted that robust and stable mental health is essential for children's health and well-being at present and in the future. Thus, the lack of research on children's mental health is of great concern.

Waddel et al. (2005), one of those who studied the prevalence of mental health problems among children, suggested that among those national studies revealing the prevalence of mental health problems among children, 14% of Canadian children aged 4 to 17 experienced mental disorders, which resulted in severe distress and

impairment at home, school, as well as in the community. However, less than 25% of these children received treatment services. Without treatment, problems originated in childhood will lead to distress and impairment throughout adulthood. Waddel et al. (2005) also pointed out that children's mental health problems have not drawn the attention of the public policy warranted by recent epidemiologic data. Another study indicated that according to 1994 National Longitudinal Survey of Children and Youth (NLSCY), 1.4% of Canadian children reported receiving drug treatment for depression, and the overall treatment rate for depression was 4.7% (Currie & Stabile, 2004).

A national survey of school-aged children in the United States revealed that many mild and moderate forms of mental disorders exist in children, indicating that at least 12% of children who are under 18 suffered from mental disorder (National Institute of Mental Health, 1990; Tuma, 1989). In addition, another national survey of school-aged children in the United States indicated that although "normal" school children might not meet the diagnostic criteria because the standardized instrument did not cover their difficulties, they still had many behavioral problems that required clinical attention (Silk et al., 2000). Those "normal" children with behaviour problems often exhibited behavioral characteristics that rebel authority, such as school authorities or parents. (Jones, 1999). In the U.K, nearly 10% of children from age 5 to 16 years old have a clinically diagnosable mental health problem (Green et al., 2005).

2.1.1 Depression

One of the mental health problems with the highest prevalence is depression, which is a multi-factorial disorder that could deeply influence individuals' emotions, thoughts, behaviours, self-esteem, interpersonal relations, physical functions, work/school productivity and biological processes (Hankin, 2006). It has been ranked as the fourth leading cause of disability and premature death in the world (Murray & Lopez, 1996).

Depression can be categorized into three levels by its order of severity. First, as a symptom, it refers to "blue mood" which often is a response to a loss or disappointment, a common experience in everyday life. Second, as a syndrome, depression refers to a number of symptoms combined together, including: depressed mood most of the day, reduced interest or bored in almost all things and activities, abnormal weight loss or weight gain, feeling fatigued, general malaise, or a loss of energy even when no work has been performed and no effort has been made, feeling unhappy or worthless without a reason, unable to think or concentrate, and recurrent thoughts of suicide. Depressive disorder is more severe than depressive syndrome. It implies that the depressive syndrome leads to some degree of incapacity (Kazdin, 1990; Tomson et al., 2003). My study was assessing depressive syndrome in children.

2.1.1.1 Childhood depression

According to Cantwell and Carlson (1979), there were four different schools of thought about the clinical picture of childhood depression. The first assertion suggests

that depression as a syndrome does not occur in childhood. The second states that depression in childhood does exist, but it demonstrates characteristics that are unique from that in adulthood. The third also accepts the existence of depression in childhood, yet it suggests that childhood depression does not consist of the same symptoms as that in adulthood, but rather includes other symptoms. The last assertion is that the clinical picture of depression in childhood is similar to that in adulthood.

Although the previous four schools of thought still coexist, several studies have imply that depression does not merely occur in adulthood, but children and teenagers are also vulnerable to it (American Academy of Child & Adolescent Psychiatry, 2008). About one out of five children and adolescents suffer from depression by the age of 18 in the general population in Canada (Children's Hospital of Eastern Ontario, 2009). The following situations tend to cause depression among children: conflicts between parents and siblings, parents' separation or divorce, bullying, conflicts or stress with friends, and finally, not doing well in school or feeling too much pressure to do well in school (CHEO, 2009). In addition, the severity of depression might be altered by age and development due to social, emotional, and biological changes throughout childhood (Weiss & Garber, 2003).

Adult depression was usually preceded by youth depression (kim-Cohen et al., 2004). In Kim-Cohen et al. (2004)'s study, an entire newborn cohort of subjects was studied for 26 years, and 75% of those depressed had already had a depressed mood in

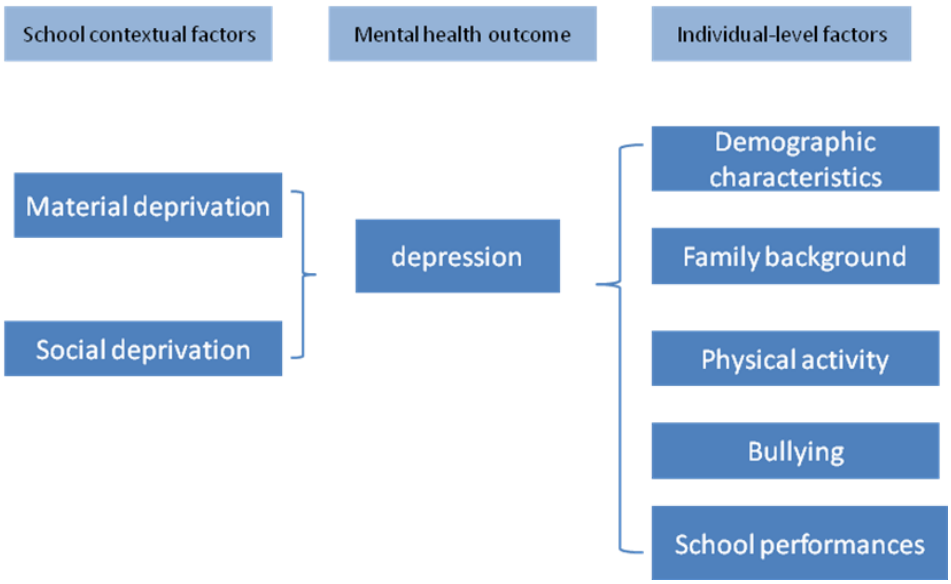
childhood or adolescence, and merely 25% had had the onset of depressed mood during their adulthood. Several longitudinal studies of self-reported depression indicated that the level of depression increases from a relatively low level in childhood to a higher level at early adolescent (Cole et al., 1999; Ge et al., 1994; Wade et al., 2002; Wichstrom, 1999). Cross-sectional studies of clinical depression have reported that the prevalence of depression has been generally low among pre-adolescent school-aged children, but has started to be popular in adolescence (Costello et al., 1996). When a child becomes depressed, things that were once intriguing to him/her turn to be boring. The depressed child might think of death or suicide and is more at risk of committing suicide (American Academy of Child & Adolescent Psychiatry, 2008). For all these reasons, an examination of childhood depression is not only warranted but is urgent for a more well-rounded understanding of population health in Canada.

2.2 Conceptual model

Figures 2-1 and 2-2 are the conceptual models of my study. As shown in figure 2-1, the associated factors of depression were of multi-levels (individual-level and school contextual level). Factors in the individual-level included demographic characteristics, family background, physical activity, bullying, and social performance. These individual-level factors reflect the status of each individual within schools (also referred to as compositional factors), while factors in the school-level reflect school attributes (also refered to as contextual factors). Demographic characteristics and

family structures were individual factors that reflected the students' personal information and family information, while the other three factors at the individual-level were associated with behaviour, school performance, environmental and social support. My study aimed at determining how students' engagement in school affects depression. Thus, physical activity, bullying and school performance were factors of special concern in this study, as they are related to well-being and school engagement across different domains (Figure 2-2). However, demographic characteristics and family background variables were still kept in the analysis process as adjusted variables, accounting for their well-known effects on depression. Material and social deprivation were school contextual factors, which represent indicators of social context, especially socioeconomic, of each school by aggregating the deprivation status of each individual within a school.

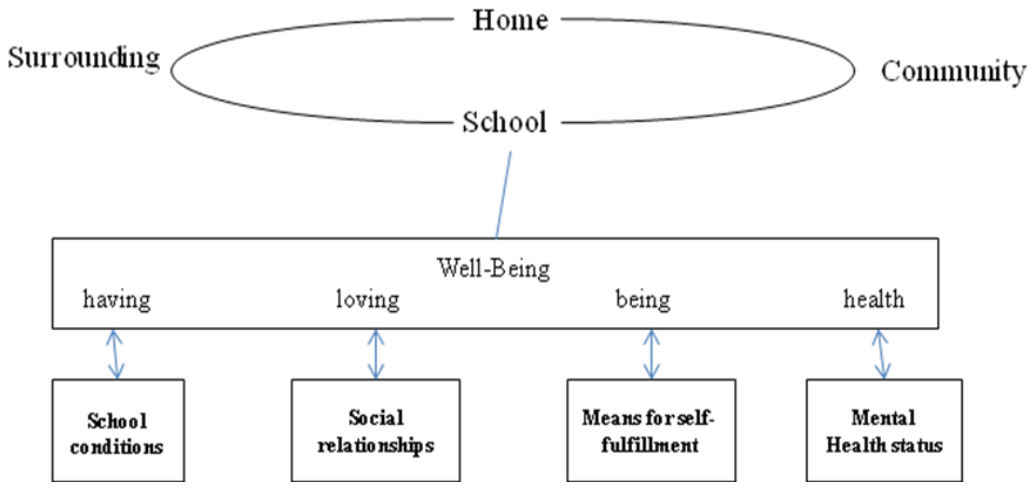
Figure 2-1: Conceptual model of depression



The model in Figure 2-2 is a school well-being model established by Allardt (1989). It

describes how well-being in school functions in students' mental health status. Allardt's model was built to fit the school setting from the students' viewpoint based on studies of school health and evaluation. Students' home life was considered to have an impact on school, because the initial education children received was at home, and the society in which individuals function in play a role in children's initial learning as well.

Figure 2-2: Conceptual model of school functioning



In Allardt's model, students' well-being has been divided into four groups: school conditions (having), social relationships (loving), means for self-fulfillment (being), and health status (health). School conditions (having) refer to the physical environment of the school, including school conditions and learning environment. In my study, the frequency that students have physical activity class was related to this domain. Social relationships (loving) refer to social functioning, student-teacher relationships, peer relationships, bullying, decision-making in school, and so on. In my study, both school performances and bullying belonged to social relationships. "Being" refers to each person being respected as a valuable part of the society (Allardt,

1989), and it can be seen as the way in which school provides approaches for students' self-fulfillment. School performances and social deprivation in my study belong to this domain. The last domain is students' health status, depression belongs to this domain as a component of mental health.

2.3 Physical activity

Physical activity has been defined as the "training of the body to improve its function and enhance its fitness" (Encyclopeadia Britannica Online, 2000). By exploring the associations between physical activity and mental health, researchers have become convinced of the fact that physical activity is linked to the improvement of good mental health status (Paluska & Schwenk, 2000).

2.3.1 Physical activity and depression

Individuals with depressive symptoms tended to be less physically active and thus more sedentary than their non-depressed counterparts (Martinsen, 1990). Meanwhile, increased exercise has been shown to reduce or diminish depression and other kinds of mental health problems (Sallis, 1996). In addition, weight, which was measured by body mass index (BMI), was significantly correlated with depression, which could be one of the ways in which physical activity affects mental health status (Epstein et al., 1994).

2.3.1.1 Clinical and non-clinical studies

Martinsen et al. (1985) studied the effect of exercise on depressed mood with 43 individuals that had been clinically diagnosed as depressed. After participating in vigorous activity for nine weeks, the subjects showed a significant reduction in their depressive scores. Another study had 15 moderately depressed individuals whose depressive scores had remained the same in a period of exercise placebo, which means no exercise at all during this period, but had significantly decreased after participating in vigorous physical activity for 10 weeks (Sime, 1987). In addition, those who were diagnosed as severely depressed achieved the most apparent mental health improvements by doing more exercise (Paluska & Schwenk, 2000).

The reason for conducting a non-clinical study was that the participants were from a general population who had not been previously diagnosed with depression, making the findings of the study more applicable to general population. However so far, there is less clear information for this kind of study. Among non-clinical studies about depression and physical activity, one study randomly assigned 120 subjects to either one month of an aerobic training program or an assessment program, the results indicated that although exercise produced an obvious change in satisfaction with physical appearance, it resulted in no change in depressed mood (King et al., 1989). Another study randomly divided 109 participants into 4 groups: high intensity exercise, moderate intensity exercise, attention-placebo, which means no exercise at all, and waiting list. After 10 weeks, it was found that only the moderate intensity exercise group had a significant improvement in mental response (Paluska &

Schwenk, 2000).

2.3.2 Physical activity among children

Physical activity was positively associated with children's well-being, regardless of cultural status, gender, etc. (Steptoe & Butler, 1996). Daily physical activity has been strongly recommended by researchers, and young people were encouraged to accumulate 30 to 60 minutes of exercise per day (Aaron et al., 1993; Butcher, 1983), since childhood and adolescence are essential periods for promoting an increase of physical activity levels (Paluska & Schwenk, 2000). However, school children were still lack of enough exercises. In the United States, for example, merely 36% of school children and adolescents meet the recommended levels of physical activity (Centers for Disease Control and Prevention, 2005), and only 3.8 % of elementary schools provide daily physical education (Active Living Research, 2007). Since physical activity has essential benefits for health in young people and many were not meeting the established guidelines, improving the physical activity level of youth has become an important task in the public health field (Sallis et al., 2001).

Children's physical activity was a complex behavior influenced by many other factors, such as family and social support (Sallis et al., 2001). Social support for physical activity includes: direct support, such as transportation to an exercise class; emotional and motivational support, such as praise or encouragement; and observational support, which refers to the construction of healthy behaviors (Springer et al., 2006). Family

support has long been correlated with physical activity in children (Sallis et al., 2001). Parents and siblings can support children's physical activity by providing transportation and encouragement, as well as by participating in physical activity (Felton et al., 2002).

2.4 Bullying

2.4.1 Definition and characters of bullying

Bullying has been defined as a repeated aggression happening among peers during which one or more persons intends to harm another person physically, verbally, or psychologically (Boulton & Underwood, 1992; Nansel et al., 2001; Olweus, 1978; Wolke et al., 2001). It has been identified as a risk factor in the development of depression in youth, with the greatest incidence of depression occurring as a result of social isolation (Van der Wal et al, 2003).

The form of bullying could be: verbal; physical, such as pushing and kicking; social, such as name-calling, threatening, mocking; and isolating (Nansel et al., 2001). Bullying behaviors can also be divided into two groups: direct and indirect bullying. The former refers to physical or verbal bullying by face-to-face interactions, such as threatening or kicking, while the latter refers to actions that the bullies or the victims can do when either is absent. Girls were more exposed to indirect bullying while boys tended to be involved more in direct bullying (Craig, 1998; Crick & Bigbee, 1998).

Being bullied used to be regarded as merely an unhappy, yet normal, experience which frequently happened to school children, and was not considered as a risk factor for mental health problems. However, cross-sectional studies have indicated that children who had bullying experiences were more likely to have distressed symptoms such as depression and anxiety (Hawker & Boulton, 2000). Investigating deeper into bullying and its impact on school children's well-being became necessary for conducting interventions targeted at preventing and reducing bullying behaviors at school, and thus reducing the harm to school children (Arseneault et al., 2010).

2.4.2 Bullying victimization and mental health problems

Individuals who took part in bullying can be categorized into three roles: bully, victims and bully-victims. Bully-victims refer to those who are both a bully and a victim. A study of bullying among children across 25 countries reported that an average of 10% of children admitted bullying others recently, 11% reported being a victim of bullying, and 6% admitted being both bullies and victims (Nansel et al., 2004). All three roles pertained to mental health problems. Bullies often have more behavioral problems; victims presented symptoms of anxiety and depression, low self-esteem and poor social skills; and bully-victims tend to have the highest level of problems (Nansel et al., 2004). My study only explored depression among bullying victims because the Student Health Survey did not include the other two roles.

Researchers showed that victims of bullying were prone to have many kinds of mental

health problems. Being a victim of bullying not only increased depression and anxiety, but also resulted in suicidal ideations (Arseneault et al., 2010).

Depression can be a consequence of bullying experiences, but it was also a factor that could increase the risk of being bullied. One study indicated that young children with internal problems such as anxiety, depression and low self-esteem have a higher risk of being bullied by their peers (Hodges & Perry, 1999; Arseneault et al., 2006). Other factors that accounted for children's bullying were genetic influences, home environment, and school characteristics (Arseneault et al., 2010).

2.5 School performance

2.5.1 School refusal behavior and school absenteeism

Some school aged children were prone to exhibit behavior problems, such as problems in school performance, and were easily being provoked, disrespectful of teachers, and show symptoms of depression (Huebner & Mancini, 2005). School refusal behavior refers to a child's refusal to attend school or having difficulty in attending school for the whole day (Kearney et al., 1989). Around 4% of all school aged children in the United States were reported to have school refusal behavior (Granell et al., 1984). According to the National Center for Education Statistics in the United States for 2005, 19% of grade 4 students and 20% of grade 8 students were reported as having skipped at least 3 days of school in the past month (Kearney, 2007).

2.5.2 School refusal behavior and mental health

Children in elementary school with mental health problems had a higher risk of having problems at school, skipping, being expelled, or being suspended than their counterparts (Kearney, 1993). One study showed that school-aged children with mental health problems may be absent from school as many as 18 to 22 days per month, and their rates of being suspended or expelled from school were three times higher than that of their peers (Kearney, 1993). Another American study showed the relationship between mental health and school refusal. First, around 14% of children with mental health problems get mostly grade Ds and Fs. Second, up to 44% of these children dropped out of high school. Lastly, there were more than 10% of high school students whose dropouts resulted from mental health problems (Kearney, 1993).

Hersov (1960) was the earliest one to investigate diagnosed depression and school refusal behavior. He compared three sets of children: one group of children wished to stay home from school; another group of children missed school with no attempt to remain home, which was also called “truancy”; and the third group of students did not have school refusal behavior. The results showed that children who preferred to stay at home from school displayed depressive symptoms in 20% of cases, while there were depressive symptoms in 6% of cases for the truant group and 10% of cases in the non-school refusal behavior groups. A recent study focused on a group of children with school refusal behavior through both clinical interviews and self-reported

measures of depression, and found out that 50% of children with school refusal behaviour met the criteria for severe depression (Kearney, 2007).

2.5.3 Peer relationships and mental health

Children began to rely on social support from their peers by the middle childhood years (Bolger et al., 1998). By providing social support, friendship can enhance an individual's self-esteem, which was highly associated with the individual's achievement (Schwartz et al., 2008). Furthermore, being successful in school could also increase a child's personal efficacy, thus alleviating or diminishing the impact of unhappy experiences at school (Bolger et al., 1998). Additionally, group acceptance accounts for children's attitudes towards competition and conformity (Schwartz et al., 2008). Therefore, friendship was investigated by researchers as a source of emotional support and personal validation, and could reduce the risk of depression since children can efficiently alleviate negative emotions through friends' support (Schwartz et al., 2008). Both self-perception of being rejected by peers and disrupted relationships with peers have been implicated in depressed mood and suicidal ideation in childhood (Bagwell et al., 1998).

2.6 Family

2.6.1 Family structure

The family's core job was to provide a nurturing and comfortable home for family members, especially for children. Children who lived in disharmonious families were

more prone to develop mental health problems (Chiariello & Orvaschel, 1995). Family relationship problems that have been examined in the past studies were namely: abuse or neglect, lack of family cohesion, parental disharmony, violence in the family, parental disagreement about discipline, emotional responsiveness of parents, parental rejection, lack of parent-child affection, parent-child discord, affectionless control, harsh discipline, perceived negative role in the family, and poor care and mothering (Weich et al., 2009). Some studies have illustrated a significant association between higher risk of depression and children living in a broken family. Others have noted that maltreatment such as abuse and neglect were associated with depression in childhood (Weich et al., 2009). Jaffee et al. (2002) found a significant association between depression and parental disagreement about discipline. They estimated that being abused or neglected in childhood may result in the onset of depression in children. Weich et al. (2009) demonstrated the association between parent-child relations and depression in gender interactions. In his study, significant associations between depression and poor parental care, parental rejection, or punishment were reported only in females, while the association between harsh discipline and depression was only found in males (Weich et al., 2009).

2.6.2 Relationship with parents

Children's relationships with parents were shown to be impaired in families with depressed children, since children received less maternal positive reinforcement and more maternal aversive social attention than their peers. Additionally, depressed

children were prone to be more sensitive regarding to their parents' emotions, perceiving their parents to be more critical, sad or angry than they really were (Chiariello & Orvaschel, 1995). Meanwhile, parents of depressed children often displayed more detached, angry, rejecting behaviors; less parental involvement; and less communication (Burbach & Borduin, 1986).

2.7 Cultural status and Depressed Mood among Children

Cultural status has been broadly defined as a common heritage or a set of beliefs, norms and values. It refers to the shared attributes of a group of people (US Department of Health and Human Services, 1999). Aboriginal people is the collective name for the original peoples of North America and their descendants, who have unique heritages, languages, cultural practices and spiritual beliefs (Communication Branch Indian and Northern Affairs Canada, 2004).

Health Canada (2003) reported that Aboriginal were more likely to experience poor health outcomes in basically every indicator. In regards to depression, however, cultural status was usually being adjusted by other indicators. The 2006/2007 Saskatoon Student Health Survey found that Aboriginal children between the ages of 10-15 were 181% more likely to become depressed than Caucasian children. However, after adjusting for other variables such as SES, Aboriginal children were shown to be only 13% more likely to report depressed symptoms (Lemstra & Neudorf, 2008). Another study in Canada revealed that Aboriginal Canadians experience more

depression than their peers, but increases in family income reduced the severity of depression (Wu et al., 2003).

Studies have found that the associations between cultural status and depression changed after controlling for SES (Samann, 2000; Ralph-Campbell et al., 2006). One study conducted by Samann (2000) explored the impact of cultural status and poverty on children's mental health status. The results showed that children whose parents live in poverty or who have experienced severe economic losses were more prone to report suffering from depression and anxiety. However, after controlling the socioeconomic status, they are less likely to report mental health problems. Another Canadian study found that Aboriginals no longer have lower self-reported health and diabetes prevalence after controlling the socioeconomic confounders (Ralph-Campbell et al., 2006). The study of depression from the National Population Health Survey revealed that Aboriginal Canadians suffered significantly more severe depressed mood than non-Aboriginal Canadians, but an increase in family income could decrease the level of depressed mood. After controlling the socioeconomic status, Aboriginal Canadians no longer differed from non-Aboriginal Canadians in depression (Dalstra et al., 2005). The studies above have indicated that socioeconomic status was responsible for mental health disadvantages between the groups.

2.8 Gender differences

Gender differences in depressed mood have generally been accepted over the past few

decades (Simonds & Whiffen, 2003). Women are considered to be twice likely to experience depression than men (Sprock & Yoder, 1997). For example, the National Comorbidity Survey in the United States indicated that the prevalence rates of major depression among women was 21%, and the rates among men was merely 13% (Kessler et al., 1993). Another study demonstrated that depressive symptoms had a higher prevalence among boys than girls until adolescence, from which time on the rates for girls started to increase, whereas the rates for boys remained the same (Hankin & Abramson, 1999). One of the possible explanations for this difference was that women report more severe distress symptoms than men do (Young et al., 1990). A variety of biological, social, and psychological explanations for the greater vulnerability to depression among girls have been evaluated. Studies have listed out factors of depression, such as social roles, discrimination, power imbalances, childhood adversity, and violent assault (Bebbington et al., 1998; Silverstein and Lynch, 1998; Veijola et al., 1998), and indicated that girls were more disadvantaged relative to boys on all of the factors above.

2.9 Genetic determinants

Researchers have pointed out that depression is moderately heritable (Rice et al., 2002; Sullivan et al., 2000). Having a parent with a history of major depression is one of the strongest predictors of depression in youth (Beardslee et al., 1998). On account of the absence of genetic information in the Student Health Survey, this factor was not included in my study.

2.10 School effects

2.10.1 Neighbourhood effects

Recent researchers tended to focus on both individual and the environmental factors, and attempted to reduce ecological fallacy, which refers to the bias when one infers individual-level relationships from clustered groups (Schwartz, 1994). Researchers suggested that social contexts might impact health status as much as individual factors (Susser, 1996; Pearce, 1996). As a result, the new public health has been developed to look both upstream (environmental influences) and downstream (individual behaviour) at the causes of poor health status (Susser, 1996). Sociologists have always considered neighborhood environments to be the essential factors that form an individual's lifestyle (Massey et al., 1991). Previous studies have shown that the physical as well as social environment of neighborhoods impact health outcomes (Macintyre et al., 1993; Schwartz, 1994).

2.10.2 Does school matter?

School is one of the most essential sources of social support at the community-level for students. Children spent over one third of their time in school, and engaged in numerous social interactions at school (Ellonen et al., 2008). School-related variables, such as children's school refusal behaviour, can be affected by characteristics of the school, including: school policies, composition, and location (Anderman, 2002; Opdenakker & Van Damme, 2001; Trautwein et al., 2002). School policy makers

recognized that physical, emotional and social health problems, serves as barriers to learning, need more concern, in order to improve school function as well as the effectiveness of students' learning and performing (Flaherty et al., 1996). Most studies have concentrated on school-related outcomes rather than school contextual and compositional effects; hence, there have been few studies focused on depressive symptoms in children in relation to school contextual effects (Ellonen et al., 2008). The difference between contextual effects and compositional effects in multilevel analysis is that: when inter-group differences in an outcome resulted from differences in the characteristics of the individuals included within the groups, then it is attributed to compositional effects. When group differences resulted from the effect of group-level variables, then the appropriate attribution could be made to contextual effects on the outcomes (Roux, 2002).

2.10.3 School-level deprivation

Area-level deprivation is a school contextual effect that has not been extensively explored. The concept of deprivation, as used in many studies, is related to poverty, but it is not necessarily synonymous with poverty since poverty is often measured only in terms of income. Theoretically, it has been suggested that the distressing effects of neighbourhood poverty and deprivation on individuals works through the invocation and internalization of neighbourhood physical and social problems (Ross, 2000). In my study, two aspects of deprivation were considered: material deprivation and social deprivation. Six indicators have been selected to construct index:

educational level, employment, average income, the proportion of people who live along, marriage status, and the proportion of single-parent families (Pampalon & Raymond, 2000).

CHAPTER 3: METHODS

3.1 Study objective

The objective of my study is to investigate the pattern of depression in Saskatoon children. The more specific aims are to: (i) determine the extent of depression disparity among Saskatoon elementary schools; and (ii) evaluate the relationship between depression and its covariates, including physical activity, bullying, school refusal behavior, and school-level deprivation, at both the individual-level and school-level.

3.2 Data collection

This is a cross-sectional study based on the Saskatoon Student Health Survey, which was conducted by the Saskatoon Health Region during the fall/winter of the 2008-2009 school year. A total of 76 Saskatoon elementary schools, including both public schools (N=42) and Catholic schools (N=34) involved in the study. A total of 4200 students from grades 5 to 8 participated in the survey by filling out a questionnaire.

The 2008/2009 survey contained 114 questions, the information gathered included students' mental health status, physical activity level, bullying experiences and school performances, as well as demographics, socioeconomic status (SES), and family

structures. The Center for Epidemiologic Studies-Depression Scale with 12 items (CES-D-12) was used to assess self-reported depression of participants. KKD (kilocalories per kilogram per day) has been calculated to measure the participants' physical activity level. Other information, such as bullying, family structure, social behavior, and health status, were based on self-reported questions. The school-level information, which included both material deprivation and social deprivation information, was also obtained from Census Canada data via the Saskatoon Health Region.

3.3 Framework of variables

There were 149 variables in the dataset regarding the 2008/2009 Student Health Survey, some of which were taken into account in my study according to the study hypothesis. The outcome variable in this study is depressed mood. The explanatory variables are demographic factors, family structure, physical activity, bullying, school performances and deprivation. Table 3.1 presents the variables and the questions in the questionnaire related to each variable.

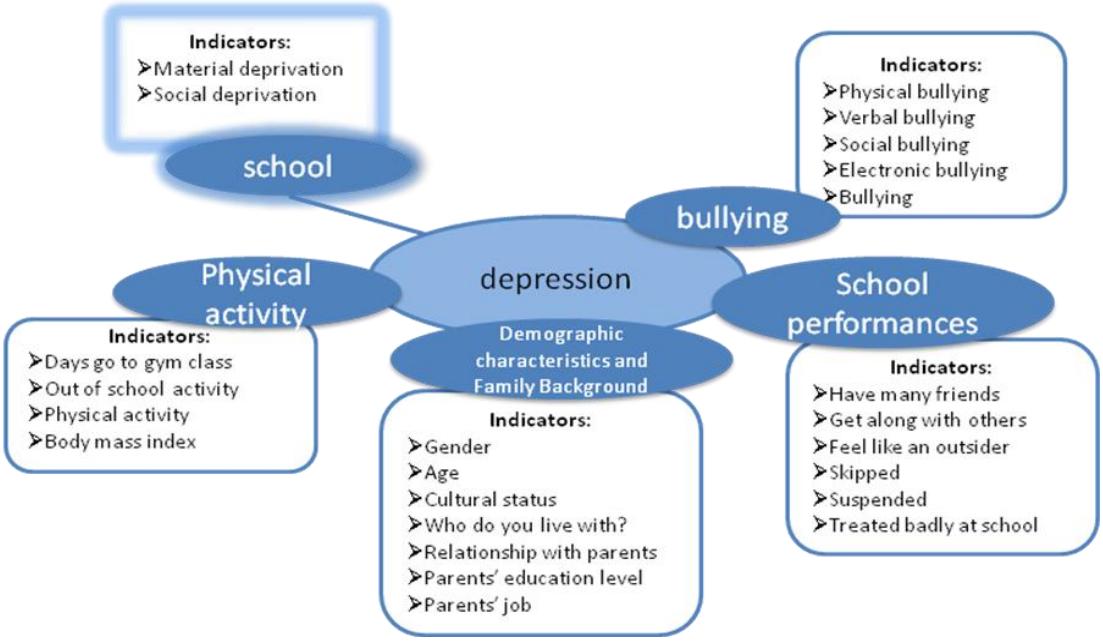
Table 3.1: List of variables

V**ariable**	**Question on Survey**
Gender	What is your gender?
Age	How old are you?
Cultural status	White, aboriginal or other?
Live with	Who do you live with?
Parents' job	Do your parents have job?
Parents education	What is your parents' educational level?
Parent relation	What is your relationship with parents?
Physical education	How many days do you go to gym class per week?
Friends' physical education	How many of your closet friends exercise regularly?
BMI	What is your height and weight?
Sibling support	Do your siblings encourage you to do sports or physical activities?
Out of school activity	How often do you do physical activities outside school per week?
Friends support	Getting support to do physical activity from friends.
Family support	Getting support to do physical activity from friends.
Physical activity	Physical activity level
Physical bullying	How often have you been bullied physically at school?
Verbal bullying	How often have you been bullied verbally at school?
Social bullying	How often have you been bullied socially at school?
Electronic bullying	How often have you been bullied electronically at school?
Bullying	How often have you been bullied at school?
Friend	Do you have many friends?
Get along with others	Do you get along with others easily?
Feel like an outsider	How often do you feel like an outsider?
Skip	How many times have you skipped a day of school?
Suspend	How many times have you been suspended from school?
Treated badly at school	How often have you been left out or treated badly?
School name	What is the name of your school?
Depression	Depressed mood

Figure 3-1 presents variables, as they were operationalized in the survey, representing each factor. The demographic factor included variables of students' personal information; family structure factor included variables of the students' family structure, parents' educational level and parent's employment. The physical activity factor included variables reflecting students' frequency of participating in exercises in and out of school, as well as body mass index (BMI), which is calculated from

self-reported height and weight measures. The bullying factor included information on students' bullying experiences, specifically in relation to four different kinds of bullying. The school performances factor included variables related to students' school life and feelings at school.

Figure 3-1: Indicators of each interested factor



3.4 Measurements

3.4.1 Depression

CES-D scale, as a self-reported scale usually contains 20 items, is used to measure the risk of clinical depression rather than provide a clinical diagnosis of depression (Fechner-Bates et al., 1994). Student Health Survey participants were instructed to circle the number for each statement that best described how often they felt or behaved amongst the choices given during the past week. The following cut-off points were considered to be best evaluate the categories of depression: 0-9=none or minimal,

10-16=mild, 17-24=moderate, and>24=severe. According to Radloff (1977), clinical populations have been shown to have a significantly higher score on the scale than community populations. In addition, the CES-D scores have been shown to be relative to other measures of depression (Roberts et al., 1991).

The Saskatoon Student Health Survey used a shorter version named "12-item CES-D measuring scale" to assess the prevalence of depression in participants. According to Statistics Canada (2001), the length of the 20-item CES-D scale might pose a challenge when it is used in large population based surveys such as the Canadian National Longitudinal Study of Children and Youth (NLSCY). Thus, the scale was reduced from 20 to 12 items in the NLSCY survey in 1996. The shorter version is called the CES-D-12 scale. The sum of the score for the shorter scale is 36, with each item ranging from 0-3. A score of 0-11=minimal, 12-20=moderate, and 21-36=severe. According to the cut-off points in the standard 20-item measuring scale, if the score corresponds to greater than the 'minimal or moderate' score range, then the respondent may be considered risk for depression. Thus, in a score of 12 or higher in the shorter CES-D scale was defined as participants 'at-risk' for depression, because "12" is the cut-off point for minimal and moderate depression.

Poulin et al. (2005) conducted a validation study to assess the degree of confidence of depression measured by the 12-item version CES-D. In their study, 12,990 Canadian students were involved. And the 12 item CES-D was found to have acceptable internal

reliability. Only one of the CES-D-12 NLSCY were found to have acceptable discrimination ability. The major disadvantage of the CES-D-12 scale is that it lack of inquiry about irritability, which serves as an essential symptom of depressed mood among youth.

3.4.2 Deprivation

A deprivation index has been developed by the Institute National de Santé Publique du Quebec (INSPQ) to measure the level of deprivation across Canada at an area-level. The deprivation index measures deprivation at the dissemination area-level (DA-level), with a population of 400 to 700 persons in each DA. This index includes approximately 98% of the population in Canada. The DAs have been ranked from the most to the least deprived, then broken down into quintiles, each of which contains 20% of the total population. Quintile 1 represents the least deprived population, while quintile 5 represents the most deprived (Pampalon, Hamel, Gamache, & Raymond, 2009). In the Student Health Survey, each school reported the number of students that resided in certain postal codes. Using this postal code information, the Public Health Observatory, Saskatoon Health Region assigned students in each school to one of the five deprivation quintiles for both material and social deprivation. For my study, deprivation levels for each school were calculated by dividing the number of students in quintiles 4 and 5 into the total number of students. The schools were then further classified into 3 categories as follows: <20% that fell into quintiles 4 and 5 as minimum deprivation (least deprived); 20% - 80% as moderate level of deprivation,

and >80% as the most deprived. Tables 3.2 and 3.3 provide the percentage of students in quintiles 4 and 5, and the number of schools in each percentage range.

Table 3.2: Material deprivation percentage of students in quintile 4 and 5

Percentage of Material Deprivation	Number of Schools	Percent
Minimum deprivation		
<10%	31	41.9%
10%-20%	8	10.8%
Moderate deprivation		
20%-30%	6	8.1%
30%-40%	5	6.8%
40%-50%	3	4.1%
50%-60%	4	5.4%
60%-70%	3	4.1%
70%-80%	2	2.7%
Most deprivation		
80%-90%	7	9.5%
>=90%	5	6.8%

Table 3.3: Social deprivation percentage of students in quintile 4 and 5

Percentage of Social Deprivation	Number of Schools	Percent
Minimum		
<10%	6	8.1%
10%-20%	9	12.2%
Moderate deprivation		
20%-30%	3	4.1%
30%-40%	11	14.9%
40%-50%	14	18.9%
50%-60%	4	5.4%
60%-70%	7	9.5%
70%-80%	1	1.4%
Most deprivation		
80%-90%	8	10.8%
>=90%	11	14.9%

In order to examine the validity of the Deprivation Index, researchers conducted a study focusing on deprivation and premature mortality in Canada (Pampalon et al., 2009). The results showed that variations in the deprivation index were highly correlated to variations in mortality. Both material and social deprivation contributed to mortality independently, and the contribution increased gradually with the severity of deprivation. This correlation was observed everywhere in Canada and affected the entire population. The deprivation index still has limitations. It is a measurement for DA-level SES conditions, rather than an individual measure. In that case, although the index could be used in etiological studies, it still cannot substitute measurement for individual-level, which was considered to be the only approach to explore individual status. Researchers suggested that measurements for two different levels should be considered simultaneously through multilevel modeling approach (Subramanian et al., 2003).

3.4.3 Physical activity level

Physical activity measures were from the School Health Action Planning and Evaluation System (SHAPES) Physical Activity Questionnaires and the Physical Activity Stages Questionnaires (PASCQ). The SHAPES is a modular local data collection and feedback system designed for schools, with the aim of providing the evidence that school-based physical activity interventions need to be evaluated (Wong, Leatherdale, & Manske, 2006). The questionnaire were required to recall vigorous and moderate physical activity, respectively, as well as recall the number of hours of

physical activity was performed for each day of the previous week (Wong et al., 2006). PASCQ is a binary type questionnaire designed to estimate the subjects' stages of change related to physical activity (Marcus et al., 1992; Marcus and Lewis, 2003). Participants were asked to provide an answer of "yes" or "no" based on their physical activity participation. According to their answers, they will be classified into five stages based on a scoring algorithm.

Students were asked to report how many minutes of hard and moderate physical activity they did on the past seven days. A total amount of time was calculated by adding up the amount of time in each day per week. The amount of kilocalories expended per kilogram of body weight per day (KKD) has been calculated to determine the level of participants' physical activity. Physical activity level was calculated by the sum of KKD of both hard and moderate physical activity divided by the number of days. The total KKD was divided into 3 categories: KKD<3 for inactive, 3≤KKD<8 for moderate active, KKD≥8 for very active (SHAPES).

School Health Action, Planning and Evaluation System (SHAPES) has been designed for large-scale, school-based data collection. It has been used to argue that it is necessary to evaluate school-based physical activity interventions (Wong et al., 2006). Wong et al. (2006) conducted a series of studies to examine the validity and reliability of SHAPES. The results showed that the majority of items in the SHAPES questionnaire had acceptable reliability. It indicated that the test-retest reliability of

physical activity level and BMI from SHAPES were similar to other questionnaires. The results also indicated that there was a moderate correlation between SHAPES measurements and other measuring approaches. Thus, SHAPES physical activity questionnaires had acceptable test-retest reliability for children and adolescents.

3.4.4 Other measurements

Bullying questions were extracted from the Safe School Survey. The eight-question parenting relationship scale, which came from the Health Behaviour in School-Age Children (HBSC), attempts to estimate the relationship between children and their parents. School refusal behaviour was measured by asking students' experience at school. For instance, students were asked whether they had ever skipped, been suspended, and been treated badly at school. The negative responses to these questions indicated having experienced a school refusal behaviour by the respondent. Other information such as family background including family structure, social behaviour including friendship and relations with peers, and health status were based on self-reported questions.

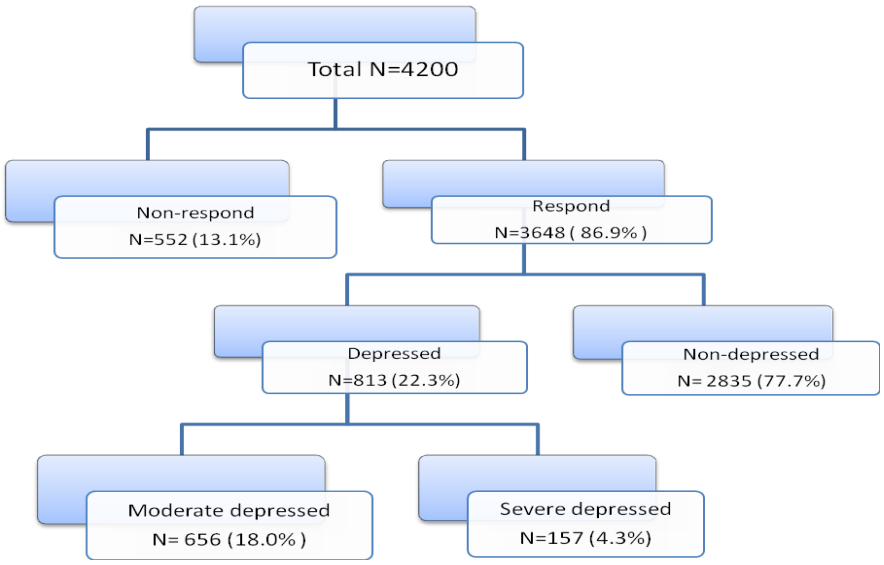
3.5 Study profile

3.5.1 Depression disparity among students

Figure 3-2 provides the study profile of the Student Health Survey data. There were a total of 4200 elementary school students that completed the survey. A total of 3648 students responded to all of the 12 questions in terms of depressed mood, while the

rest 13% students did not give response and thus were excluded from the study. Among the responders, 813 (22.3%) were found to be depressed. Specifically, 18.0% were found to be moderate depressed and 4.3% were found to be severe depressed. The depression rate of our participants were very close to the depression rate in Canada (20%), which proved the external validity of the measurement of depression in my study.

Figure 3-2: Study profile of survey data 2008/2009



3.5.2 Depression and bullying disparity between schools

The total percentage of depression in Saskatoon elementary schools were 22.2%, and the percentage in each school varies across this total percentage. The lowest percentage was 0%, which was found in two schools. One of them was public school and the other was Catholic school. However, there were only 16 participants and 4 participants, respectively, involved in the study for each of the two schools, and thus

the validity was not guaranteed. Except these two schools with extremely lower percentage, the second lowest we found was 6.9% in another public school. There were 116 students participated in the study and merely 8 were found to be depressed. Besides, there were five other schools having a depression percentage which is lower than 10%, and three of the five were public schools. The highest depression rate was 50%, which exist in two schools. However, merely 4 participants were involved in the study for both the two schools. Except these two schools, the second highest we found was 42.8% in a public school.

Among a total of 3648 participants after excluded the non-responders, 3588 responded to the question of bullying. Among them, 55.9% reported had been bullied. The percentage of bullying in most of the schools were ranging from 50%-65%. The highest two percentages were found was in a public school (84.6%) and a Catholic school (81.8%). Other schools all have a percentage that is lower than 80%. The lowest bullying percentage is 28.6%, which was found in a Catholic school, and the rest of the schools were having a bullying rate greater than 40%.

3.6 Statistical analysis

3.6.1 Analysis process

Descriptive statistics were used to summarize the data. Participants were classified as depressed and non-depressed based on the CES-D-12 measuring scale. Univariate, multivariate, and multilevel logistic regression models were built. First, univariate

analysis was conducted by Chi-square test for comparing categorical variables. Subsequently, potential risk factors significantly associated with depression in the univariate analysis were included in the initial iterations of the multivariate logistic regression model. Finally, a multilevel logistic regression model was built. This model was used to examine the effects of independent variables measured at two levels (individual-level and school-level) on the dependent variable, so that the contribution of individual-level and school-level characteristics could be examined on the outcome.

3.6.2 Multivariable analysis

In the first step, demographic characteristics and family structure variables were added to the model to see whether they were significantly associated with depression. The variables of students' physical activity level, bullying experience and school performances were added to the model, respectively, after adjusting for demographic and family factors; this was done in order to determine whether and to what extent these variables would affect the outcome. Finally, these three models were combined into one final model, with the demographic variables, family structure variables, physical activity variables, bullying variables, as well as school performances variables all included, as well as school-level deprivation variables.

3.6.3 Multilevel analysis

3.6.3.1 Literature review

Multilevel analysis is a statistical approach that can be used for clustered sources of variability in multilevel data, which involves units at a higher level. It can take into account the variability associated with each level of the hierarchy (Dai et al., 2010). In data which has a hierarchical structure, individuals are not treated as independent, they are considered nested in a larger unit. Thus, multilevel analysis provides an approach to examining the effects of individual-level and group-level variables simultaneously (Duncan et al., 1995). It can also estimate both between group and within group variations, and help to figure out how those levels interact with each other (Duncan et al., 1995). Thus, multilevel models were used in order to draw insights regarding the causes of both the inter-individual and the inter-group variations (Duncan et al., 1995).

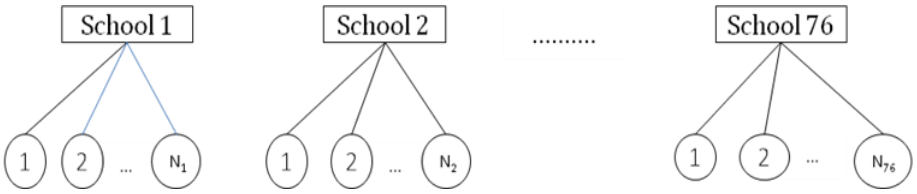
In general, multilevel analysis is a combination of contextual analysis and random effects models. Contextual analysis usually focuses on how social context affects individual behaviour (Boyce et al., 1998). In contextual analysis, group-level factors, which aggregate the characteristics of individuals within groups, are included together with individual-level factors in multilevel models. Thus, it allows for the examination of how individual-level and group-level factors are related to outcomes (Blalock, 1984).

3.6.3.2 Multilevel logistic regression model

A multilevel modeling approach was considered appropriate for this study since

groups of students that come from the same elementary school were considered clustered, rather than independent from one another. Although in most cases it is assumed subjects are independent from each other, the students in our study were clustered by some feature, such as attending the same elementary school; thus, students were clustered by school rather than being considered independent from each other. A multilevel model is appropriate to take into account the variability at each level of hierarchy and therefore allow the contextual effects to be analyzed within the models, as well as account for students clustered within schools.

Figure 3-3: Data Structure for a two-level hierarchical model



In this data structure in Figure 3-3, level one is the student level and level two is the school-level. Within each level two, there are N_j students in the jth school.

Ordinary logistic regression model

The ordinary logistic regression model can be written as this:

$$y_{ij} = \pi_{ij} + e_{ij}, \qquad (3.1)$$

$$\text{Logit}(\pi_{ij}) = \log\left(\frac{\pi ij}{1-\pi ij}\right) = \alpha + \beta x_{ij}$$

Y represents a binary outcome variable (depressed or non-depressed) and x is an individual-level explanatory variable. Where i = 1, …, I_j is individual-level indicator, j = 1, …, J is the school-level indictor. π_{ij} is the probability of depressed mood of

student i in school j, conditional on the risk factor x. This logit model has a linear function at the log odds scale. The probability function is

$$\pi i\ j = \frac{\exp(\alpha+\beta xij)}{1+\exp(\alpha+\beta xij)} \quad (3.2)$$

This model is a one-level model without school-level effects. It does not account for the variation between schools and the nesting of students within schools.

Multilevel logistic regression model

One approach to take school-level effects into account is to treat the school intercepts, α_j (j=1,..,J), as a random variable with a specific probability distribution, which results in a random intercept model:

$$\text{logit}(\pi_{ij}) = \alpha_j + \beta x_{ij} \quad (3.3)$$

$$\alpha_j = \alpha + u_j$$

In this model, the school effects were estimated by the random intercepts α_j (j=1,…J). This was a linear combination of a grand mean (α) and a deviation (u_j) from that mean. u_j is independent from the student level random error (e_{ij}). The school intercepts measured the differences between the schools, adjusting for other predictors in the model. Equation 3.3 is a multilevel model with two levels. The first level expressed the outcome as the sum of an intercept for the school to which the student belongs and the student's associated factors; the second level specified the school-level intercepts as the sum of an overall mean and the random deviation from that mean. Equation 3.3 can be combined into one equation:

$$\text{logit}(\pi_{ij}) = \alpha + u_j + \beta x_{ij} \quad (3.4)$$

Including school fixed effects

The random intercept model above treats the school effects as random effects only. It does not contain school-level (level-2) predictors. Also of interest was the contribution of material and social deprivation at each school to disparity in depression. These school contextual variables can be readily included in the model. It was assumed z is a dummy variable indicating the deprivation level of jth school. Of interest is finding out if z has a significant impact on depression. For this purpose, we add a fixed effect of the higher level to Equations 3.4,

$$\text{logit}(\pi_{ij}) = \alpha_j + \beta x_{ij} \qquad (3.5)$$

$$\alpha_j = \alpha + \gamma z_j + u_j$$

In equation (3.5) the school intercept α_j becomes a linear combination of three terms: a grand mean (α), a school fixed effect (γ) and school random effects (u_j). The differences between the schools are now explained by the observed school attribute, z, in addition to the random effects. These two equations (equation 3.5) can be written in one equation as

$$\text{logit}(\pi_{ij}) = \alpha + \gamma z_j + u_j + \beta x_{ij} \qquad (3.6)$$

Including cross-level interaction

Also of interest were possible interactions between the associated factors. An interaction is the incidence rate of an event in the presence of two or more risk factors, differing from the incidence rate expected to result from their individual effects. In

multilevel models, we can explore the potential interactions among variables across the levels. For instance, if we are interested in the effect of interaction between school-level deprivation and cultural status of the students, we can use the multilevel model to estimate the interaction between them. We specify the multilevel model as follows,

$$\text{logit}(\pi_{ij}) = \alpha_j + \beta_j x_{ij} \quad (3.7)$$

$$\alpha_j = \alpha + \gamma z_j + u_j$$

$$\beta_j = \beta + \theta z_j$$

The slope in equation 3.7 can vary across schools. $\beta_j = \beta + \theta z_j$ indicates that the slope coefficient is a linear combination of the average slope (β) and the school effect (z_j). It generates a cross-level interaction term:

$$\text{logit}(\pi_{ij}) = \alpha + \gamma z_j + u_j + \beta x_{ij} + \theta z_j x_{ij} \quad (3.8)$$

Where θ is the parameter for the interaction term $z_j x_{ij}$. Equation 3.8 is a random intercept model with cross-level interaction. (Dai et al., 2010).

3.6.3.3 Modeling process for multilevel models

As is shown in Figure 3-4, a four-step approach was adopted to build the multilevel model, which presents the information of the *i*th student clustered within the *j*th school.

Step 1: The initial step was to build an empty model, which can also be called a null

model. It is a model that only contains the school as random effect, without any other covariates. This model is used to examine variations in depression among school-level units.

Step 2: The second step was to add adjusted variables into the model. Adjusted variables were individual characteristics including demographic characteristics and family structure, which were thought to be associated with depression. By knowing the extent of change of variation, it was possible to determine whether these adjusted variables explained the differences in depression among schools.

Step 3: For the third step, main factors including physical activity, bullying and social performance were added to the model, respectively. The variation in this model was compared to the previous one in order to know whether these main factors contributed to the differences in depression among schools.

Step 4: Finally, a full model was achieved by adding contextual variables as second level fixed effects. The final model contained explanatory variables at both levels. This model provided information about the contextual effect of schools.

Figure 3-4: Multilevel modelling process

	Step 1		Step 2		Step 3		Step 4	
Variable name	**OR**	**COV**	**OR**	**COV**	**OR**	**COV**	**OR**	**COV**
Empty model		×						
Individual-level				×		×		
Adjusted factors			×		×		×	
Physical activity					×		×	
bullying					×		×	
School performance					×		×	
School-level								×
deprivation							×	

Note: OR = Odds Ratio; COV = covariance

3.7 Ethics approval

The original study was conducted by the Saskatoon Health Region and had been approved by U of S Ethics (Beh # 06-237). The ethics approval for this research was also approved by U of S Ethics (Beh # 11-66).

3.8 Software

In this study, α=0.15 was used as the significance level for univariate statistical analysis, and α=0.05 was used as the significance level for multivariate statistical analysis. Excel was used to input data, and SAS version 9.2 was used for data analysis.

CHAPTER 4: RESULTS

4.1 Descriptive analysis

According to the descriptive analysis results, the percentage of boys and girls in the study sample were almost equal (male: 48.8%; female: 51.2%). Most of the students were of age 11 - 13 year old (n=3149, 75.5%), and only a few were adolescents, who were at the age of 14 or above (n=118, 2.8%). A majority of the participants were Caucasian (n=3223, 78.2%); of the remainder, half were Aboriginal (n=424, 10.3%) and half reported as 'other minorities' (n=414, 11.9%). Most of the students lived with both parents (n=3056, 73.2%), but 22.6% were from single parent families. A total of 3627 (95.0%) students reported having moderate relationships with their parents. Students who had a moderate physical activity level (n=3066, 74.3%) and had a normal BMI (n=2933, 79.3%) made up a large part of the sample. For students' bullying experiences, 44.7% reported never having experienced any kind of bullying (n=1793). A large portion of students had relatively good performance at school and no school refusal behaviours, although there were 1577 (40.3%) students who still reported being treated badly at school.

4.2 Univariate analysis

The association between depression and the covariates are presented in Table 4.1. Of the 4200 participants, there were 3648 students who responded to the questions on

depression. Among them, 813 (22.3%) were considered to be suffering from a depressed mood. Among twenty-two factors, twenty of them were significantly associated with depressed mood independently. There were two factors that did not have a significant association with depression: participants' parents' employment status (X^2=1.5, P-value=0.22), and the frequency of the participants going to gym class (X^2=3.5, P-value=0.18).

Table 4.1: Associations between each covariate and depression

Variable	Depression		X^2-value	p-value
	No (N=2835)	Yes (N=813)		
Demographic characteristics				
Gender			6.3	<.0001
Female	1370(48.5%)	479(59.1%)		
Male	1455(51.5%)	331(40.9%)		
Age			28.5	0.04
10 or younger	577(20.5%)	173(21.5%)		
11-13	2169(76.9%)	597(74.3%)		
14 or older	74(2.6%)	34(4.2%)		
Cultural status			46.9	<.0001
White	2246(80.2%)	590(73.7%)		
Aboriginal	223(8.0%)	129(36.7%)		
Other	330(11.8%)	82(10.2%)		
Family structure				
Who do you live with			91.5	<.0001
Both mother and father	2154(76.3%)	497(61.3%)		
Single parent	587(20.8%)	245(30.2%)		
Other	82(2.9%)	69(8.5%)		
Parents' employed?			1.5	0.22
No	42(1.5%)	17(2.2%)		
Yes	2684(98.5%)	760(97.8%)		
Parents' education level			30.3	<.0001
At least one is high school or less	802(34.6%)	294(46.5%)		
Both college or university	1517(65.4%)	338(53.5%)		
Relationship with parents			40.7	<.0001
Not very good	2516(96.5%)	682(90.8%)		
Very good	92(3.5%)	69(9.2%)		

Physical activity				
Physical activity level			34.6	<.0001
Low	410(14.7%)	182(22.7%)		
Moderate	2119(75.7%)	569(71.0%)		
High	270(9.7%)	50(6.2%)		
Frequency of going to gym class (per week)			3.5	0.18
1 day or less	38(1.4%)	17(2.2%)		
2 or 3 days	2633(94.8%)	751(94.8%)		
4 days or more	106(3.8%)	24(3.0%)		
Exercise after school			41.7	<.0001
Never	421(3.0%)	193(5.9%)		
1 to 3 times a week	1785(44.6%)	488(56.5%)		
4 or more times a week	576(52.4%)	118(37.6%)		
BMI			28.3	<.0001
Normal (<=25kg/m^2%)	2094(81.5%)	509(72.3%)		
Overweight/obese (>25kg/m^2%)	477(18.5%)	195(27.7%)		
Bullying				
Physical bullying			172.4	<.0001
Never	2260(80.6%)	478(59.5%)		
Once or twice	468(16.7%)	246(30.5%)		
Many times a week	77(2.8%)	80(10.0%)		
Verbal bullying			312.7	<.0001
Never	1728(61.7%)	275(34.3%)		
Once or twice	864(30.9%)	302(37.7%)		
Many times a week	209(7.5%)	225(28.1%)		
Social bullying			404.9	<.0001
Never	2112(75.4%)	361(45.1%)		
Once or twice	576(20.6%)	246(30.8%)		
Many times a week	114(4.1%)	193(24.1%)		
Electronic bullying			217.6	<.0001
Never	2608(93.2%)	604(75.6%)		
Once or twice	154(5.5%)	129(16.2%)		
Many times a week	36(1.3%)	66(8.3%)		
Bullying			209.9	<.0001
Never	1412(50.6%)	172(21.6%)		
Ever	1381(49.4%)	623(78.4%)		
Social performance				
Have many friends			279.9	<.0001
False	57(2.0%)	96(11.9%)		
Sometimes true	146(5.2%)	133(16.5%)		
True	2609(92.8%)	578(71.6%)		
Get along with others easily			347.9	<.0001
False	56(2.0%)	106(13.2%)		

Sometimes true	240(8.6%)	192(23.9%)		
True	2505(89.4%)	507(63.0%)		
Feel like an outsider			600.7	<.0001
All the time	103(3.7%)	202(25.1%)		
Sometime	319(11.4%)	236(29.4%)		
Rarely/never	2388(85.0%)	366(45.5%)		
Skipped school			133.7	<.0001
Never	2665(94.8%)	661(82.2%)		
Reported	147(5.2%)	143(17.8%)		
Suspended from school			23.3	<.0001
Never	2681(95.6%)	733(91.2%)		
Reported	125(4.5%)	71(8.8%)		
Being treated badly at school			251.9	<.0001
Never	1822(66.5%)	259(34.4%)		
Reported	920(33.5%)	494(65.6%)		

Figures 4-1 to 4-4 below show the prevalence of depression according to each category for significantly associated covariates. This provides a basic idea of which groups of students were more likely to have the highest prevalence of depression. A high prevalence of depression was found among those who belong to minority groups, those who had very good relationships with parents, those who experienced social and electronic bullying frequently, and those who failed to get along with others at school.

Specifically, for demographic characteristic variables (Figure 4-1), girls, minorities, students who did not live with both parents, students whose parents' educational level is low, and students who had a very good relationship with their parents were the group of people that were more likely to have a depressed mood.

For physical activity variables (Figure 4-3), students who participated in exercise frequently after school experienced less likelihood of depression than others.

Meanwhile, being overweight or obese was another covariate associated with depression.

For bullying variables, all four specific types of bullying were associated with the risk of prevalence of depression (Figure 4-3). Social and electronic bullying had a stronger association with depression than the other two types of bullying.

For school performance factors, students who had few friends, who felt very hard to get along easily with others, and those who reported feeling like an outsider had a significantly higher prevalence of depression.

Figure 4-1: Prevalence of depressed mood by demographic and family background characteristics

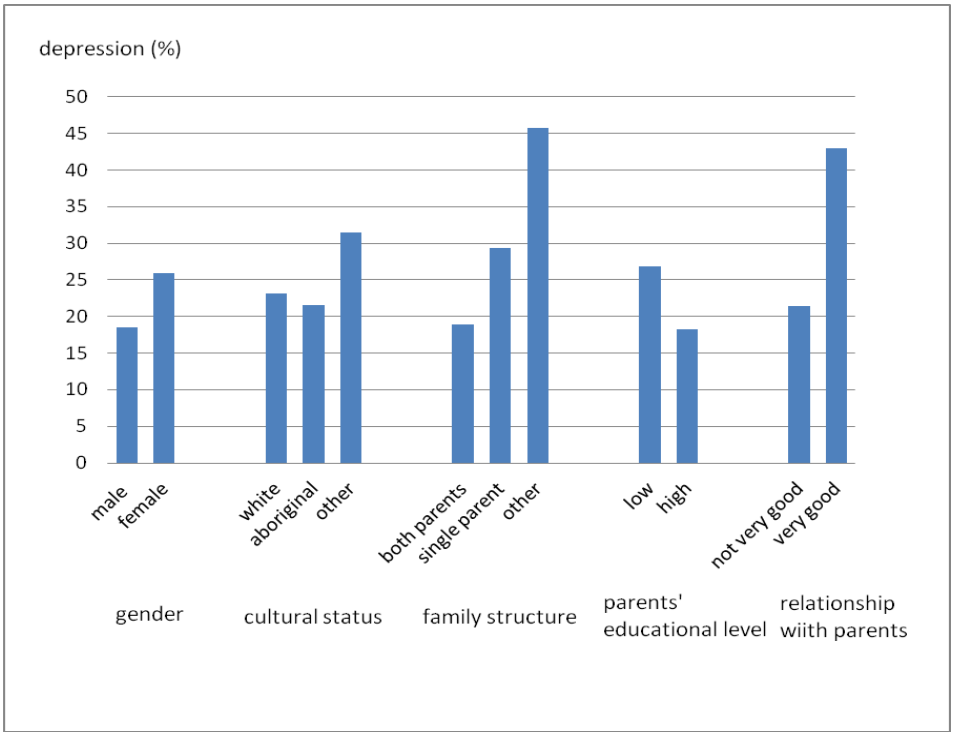


Figure 4-2: Prevalence of depressed mood and physical activity characteristics

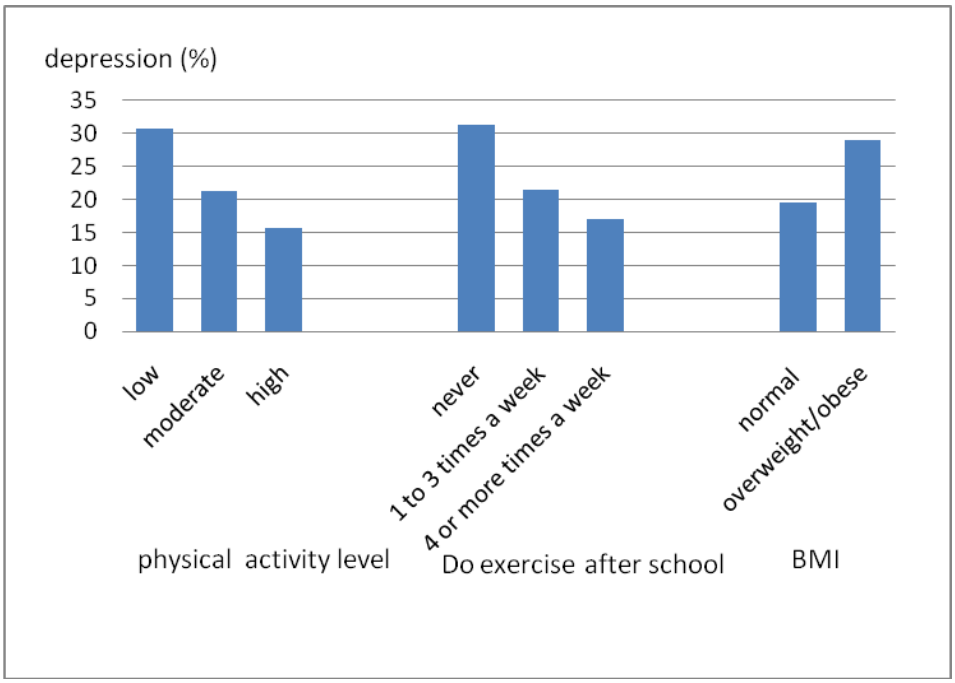


Figure 4-3: Prevalence of depressed mood and bullying characteristics

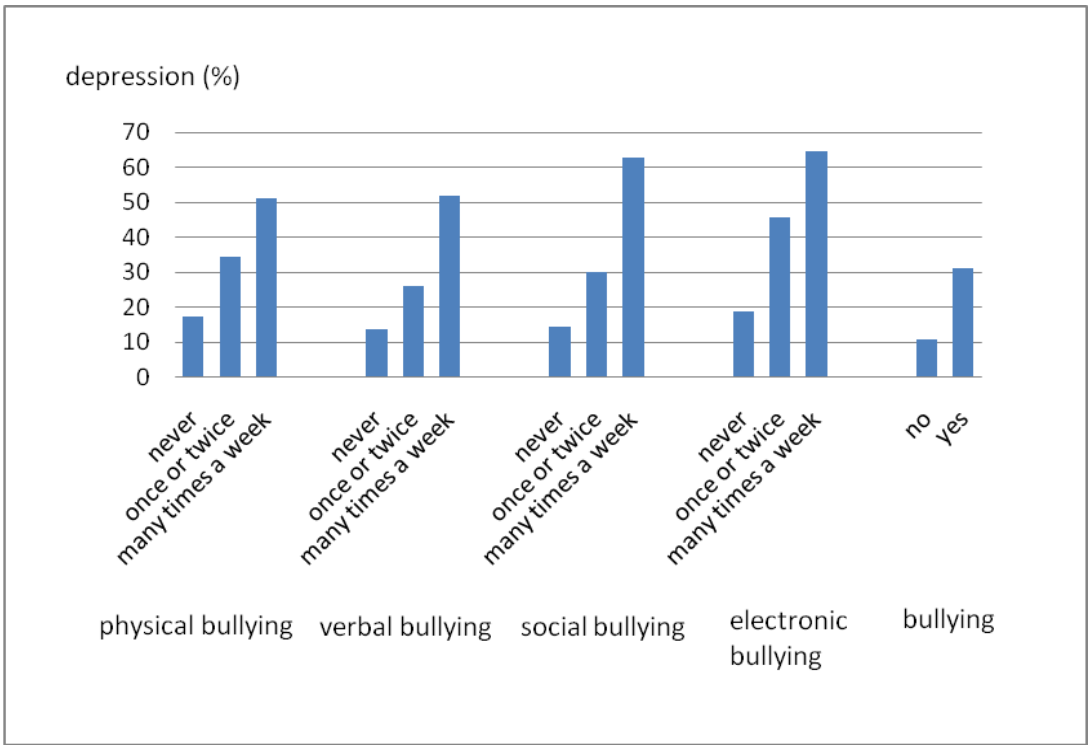
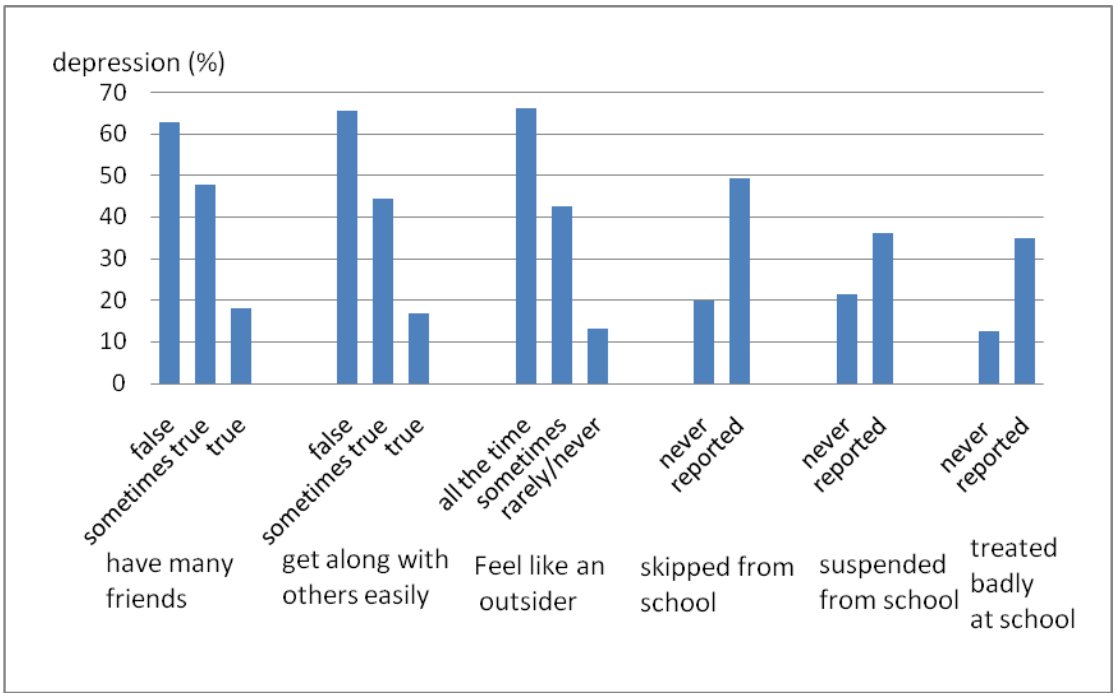


Figure 4-4: Prevalence of depressed mood and school performance characteristics



4.3 Logistic regression analysis

4.3.1 Adjusted factors

Multivariable models including demographic characteristics and family backgrounds are shown in Table 4.2. All factors were significantly associated with depressed mood, except age. Although age was associated with depression independently, the association was no longer significant when adjusted for other variables (p_1=0.44; p_2=0.53).

Odds Ratio and 95% Confidence Interval. The odds ratio (OR) was calculated in the analysis to show how much more likely it is that someone who is exposed to the factor under study will develop the outcome of depression as compared to someone who is not exposed. According to the results, Aboriginal students were 1.63 times

more likely to have a depressed mood compared to Caucasian students (OR=1.63, 95% CI=1.22-2.22), while the risk of depression among students of other ethnicities was not significantly different compared with Caucasian students (OR=0.86, 95% CI=0.63-1.19). A 95% confidence interval (CI) for the odds ratio was also calculated. It indicates that if several independent random samples are drawn from the same population and 95% confidence intervals are calculated for each of them, then on average 19 out of every 20 (95%) such CIs would contain the true population value. In the case above, we may say that approximately 95% of the time the interval would contain the odds ratio of the true population value (that is, it is not very likely—only one in 20 times—that the true odds ratio will not be measured in this instance).

Boys were less likely to have a depressed mood than girls (OR=0.61, 95% CI=0.51-0.74). Children who lived in a single parent family or lived with people other than their parents were found to have a higher percentage of depressed mood than their counterparts (OR_1=1.72, 95% CI_1=1.37-2.16; OR_2=3.26, 95% CI_2=2.06-5.16). Students whose parents had both graduated from college or university were 0.67 times less likely to have a depressed mood than those whose parents had a lower educational level (OR=0.67, 95% CI=0.55-0.82), indicating that higher level of parental education is associated with a lower prevalence of depression among the children. Students who had reported having a very good relationship with their parents were more likely to be depressed than their peers (OR=2.98, 95% CI=2.04-4.34).

Table 4.2: Multivariable logistic regression showing: a) sociodemographic and family characteristics associated with depression, Saskatoon, 2008/2009

Variable	Odds Ratio	95% Confidence Intervals	p-value
Gender			
Female	1	--	--
Male	0.61	0.51, 0.74	<.0001
Age			
10 or less	1		
11-13	0.91	0.71, 1.16	0.44
14 or more	1.18	0.70, 2.03	0.53
Cultural status			
White	1		
Aboriginal	1.63	1.20, 2.22	0.002
Other	0.86	0.63, 1.19	0.36
Family structure			
Both mother and father	1		
Single parent	1.72	1.37, 2.16	<.0001
Other	3.26	2.06, 5.16	<.0001
Parents' education level			
At least one is high school or less	1		
Both college or university	0.67	0.55, 0.82	<.0001
Relationship with Parents			
Not very good	1		
Very good	2.98	2.04, 4.34	<.0001

4.3.2 Main factors

Table 4.3 provides the analysis results of the association between depression and physical activity level. Out-of-school physical activity and BMI had a significant association with depressed mood. Students who do exercise off school sometimes were 0.61 times less likely to be depressed compare to their peers (OR=0.61, 95% CI: 0.44-0.85). And those who often do exercise off school were 0.49 times less likely to be depressed (OR=0.49, 95% CI: 1.35-2.17). Students who were overweight or obese

were 1.7 times more odds to be depressed than those who had a normal weight (OR=1.71, 95% CI=1.35-2.17). Students' physical activity level did not impact depressed mood and thus is not considered as an associated factor.

Table 4.3: Multivariable logistic regression showing: b) sociodemographic, family characteristics and physical activity associated with depression, Saskatoon. 2008/2009

Variable	Odds Ratio	95% Confidence Intervals	p-value
Demographic characteristics			
Gender			
Female	1		
Male	0.57	0.46, 0.70	<.0001
Cultural status			
White	1		
Aboriginal	1.46	1.04, 2.05	0.03
Other	0.85	0.61, 1.20	0.36
Family background			
Family structure			
Both mother and father	1		
Single parent	1.28	0.76, 2.18	0.36
Other	2.03	0.76, 5.42	0.15
Parents' education level			
At least one is high school or less	1		
Both college or university	0.71	0.58, 0.88	0.002
Relationship with Parents			
Not very good	1		
Very good	3.02	2.03, 4.50	<.0001
Physical activity			
Out-of-school physical activity			
Never	1		
1 to 3 times a week	0.61	0.44, 0.85	0.005
4 or more times a week	0.49	0.32, 0.74	0.0007
BMI			
Normal	1		
Overweight/obese	1.71	1.35, 2.17	<.0001

Table 4.4 presents the analysis results of depression and bullying experiences. Students who reported being physically bullied, verbally bullied, socially bullied and electronically bullied had a significantly higher prevalence of depression than those who had never been bullied (physical bullying: OR=1.57, 95% CI=0.96-2.57; verbal bullying: OR=2.06, 95% CI=1.43-2.97; social bullying: OR=4.25, 95% CI=2.93-6.17; electronic bullying: OR=2.77, 95% CI=0.31-5.86).

Table 4.4: Multivariable logistic regression showing: c) socipodemographic, family characteristics, and bullying associated with depression, Saskatoon, 2008/2009

Variable	Odds Ratio	95% Confidence Intervals	p-value
Demographic characteristics			
Gender			
Female	1		
Male	0.70	0.56, 0.88	0.0026
Cultural status			
White	1		
Aboriginal	1.68	1.21, 2.35	0.002
Other	1.04	0.74, 1.47	0.80
Family background			
Family structure			
Both mother and father	1		
Single parent	1.52	1.19, 1.94	0.0008
Other	2.85	1.71, 4.74	<.0001
Parents' education level			
At least one is high school or less	1		
Both college or university	0.71	0.57, 0.87	0.001
Relationship with Parents			
Not very good	1		
Very good	2.78	1.78, 4.36	<.0001
Bullying			
Physical bullying			
Never	1		

Once or twice	1.46	1.12, 1.90	0.005
Many times a week	1.57	0.96, 2.97	0.07
Verbal bullying			
Never	1		
Once or twice	1.31	1.07, 1.69	0.04
Many times a week	2.06	1.43, 2.97	0.0001
Social bullying			
Never	1		
Once or twice	1.53	1.19, 2.97	0.001
Many times a week	4.25	2.93, 6.17	<.0001
Electronic bullying			
Never	1		
Once or twice	2.72	1.78, 4.14	<.0001
Many times a week	2.77	1.31, 5.86	0.008

The analysis results of depression and school performances are provided in Table 4.5. Most of the covariates were significantly associated with depression. Students who reported having many friends were 0.4 times less likely to be depressed than their peers (OR=0.40, 95% CI=0.23-0.69). Students who considered themselves to get along with others easily had a lower prevalence of depression (OR=0.48, 95% CI=0.27-0.84), and those who never felt like an outsider at school also had a significantly lower prevalence of depression (OR=0.25, 95% CI=0.17-0.37). Those who reported having skipped school were three times more likely to be depressed than those who had never skipped school (OR=2.98, 95% CI=2.10-4.25). The prevalence of depression was greater among students who reported being treated badly at school compared with their peers (OR=2.21, 95% CI=1.76-2.78).

Table 4.5: Multivariable logistic regression showing: d) sociodemographic, family characteristics and school performance associated with depression, Saskatoon, 2008/2009

Variable	Odds Ratio	95% Confidence Intervals	p-value
Demographic characteristics			
Gender			
Female	1		
Male	0.62	0.49, 0.78	<.0001
Cultural status			
White	1		
Aboriginal	1.21	0.84, 1.73	0.31
Other	0.75	0.52, 1.09	0.13
Family background			
Family structure			
Both mother and father	1		
Single parent	1.37	1.05, 1.78	0.02
Other	2.56	1.47, 4.46	0.0009
Parents' education level			
At least one is high school or less	1		
Both college or university	0.73	0.58, 0.92	0.008
Relationship with Parents			
Not very good	1		
Very good	2.80	1.79, 4.37	<.0001
School performance			
Have many friends			
False	1		
Sometimes true	0.62	0.34, 1.13	0.12
True	0.40	0.23,0.69	0.001
Get Along with Others Easily			
False	1		
Sometimes true	0.83	0.46, 1.49	0.53
True	0.48	0.27, 0.84	0.01
Feel Like an Outsider			
All the time	1		
Sometime	0.69	0.46, 1.04	0.07
Rarely/never	0.25	0.17, 0.37	<.0001
Skipped school			
Never	1		
Reported	2.98	2.10, 4.25	<.0001
Suspended from School			

Never	1		
Reported	1.06	0.65, 1.73	0.81
Being Treated Badly at School			
Never	1		
Reported	2.21	1.76, 2.78	<.0001

4.3.3 Full model

The statistical analysis results of logistic regression for the full model are presented in Table 4.6. There were 11 covariates included in this final model: gender, family structure, parental educational level, relationship with parents, BMI, social and electronic bullying, having many friends, feeling like an outsider, skipped school and being treated badly at school. Gender was the only one of all the demographic characteristics that was significantly associated with depression in the final model (p-value=0.0004). Being overweight/obese had a significant impact on depression (OR=2.19, 95% CI: 1.45-3.30). There were two kinds of bullying that were found to be associated with depression: social bullying (p=0.005) and electronic bullying (p=0.0008). Whether students get along with others easily or not was not an associated factor (p-value=0.85), but the other school performance variables were significantly associated with depression. Both the association between depression and BMI and the association between depression and getting along with others interacted with students' relationship with parents.

Table 4.6: Final multivariable logistic regression model showing all significant correlates (individual level) associated with depression, Saskatoon, 2008/2009

Variable	Odds Ratio	95% Confidence Intervals	p-value
Demographic characteristics			
Gender			
Female	1		
Male	0.65	0.51, 0.82	0.0004
Family background			
Family structure			
Both mother and father	1		
Single parent	1.57	0.83, 2.95	0.16
Other	2.13	1.15, 3.91	0.02
Parents' education level			
At least one is high school or less	1		
Both college or university	3.12	1.04, 9.37	0.04
Relationship with Parents			
Not very good	1		
Very good	2.60	1.62, 4.19	<.0001
Physical activity			
BMI			
Normal	1		
Overweight/obese	2.19	1.45, 3.30	0.0002
Bullying			
Social bullying			
Never	1		
Once or twice	1.66	1.62, 2.54	0.47
Many times a week	1.84	1.09, 2.82	0.005
Electronic bullying			
Never	1		
Once or twice	1.54	0.25, 3.24	0.0002
Many times a week	3.19	0.74, 6.28	0.0008
Social performance			
Have many friends			
False	1		
Sometimes true	0.66	0.43, 1.00	0.25
True	0.45	0.25, 0.82	0.009
Get Along with Others Easily			
False	1		

Sometimes true	1.40	0.54, 3.65	0.49
True	0.92	0.38, 2.23	0.85
Feel Like an Outsider			
All the time	1		
Sometimes	0.39	0.29, 0.54	0.41
Rarely/never	0.33	0.21, 0.51	<.0001
Skipped school			
Never	1		
Reported	2.54	1.74, 3.70	<.0001
Being Treated Badly at School			
Never	1		
Reported	1.95	1.52, 2.51	<.0001
Interaction			
Relationship with parents*BMI	1		
Very good * overweight	0.50	0.28, 0.87	0.01
Relationship with parents*get along with others			
Very good* Sometimes true	0.32	0.09, 1.10	0.07
Very good* true	0.26	0.08, 0.79	0.02

4.4 Multilevel analysis

4.4.1 School-level variance

Table 4.7 provides the school-level variance in each of the four models: null model; model with demographic characteristics and family structure variables; model with physical activity, bullying, and school performances; and the full model. Model 1 is the null model, which can also be called the empty model. It contained only school random effect in it. The variance between schools in the empty model is 0.16, indicating that the prevalence of depression significantly differed between schools ($p<.0001$). Thus, it is necessary to keep the school random effect in the model.

The variance between schools in the second model, which contained demographic

characteristics and family background variables, changed from 0.16 to 0.10, which had a 37.5% decrease compared to the empty model. This can be explained as gender, cultural status and family structure contributed 37.5% to the total variation in the prevalence of depression between schools. By adding these variables into the model, we achieved a model that has more explanatory power since the variation decreased. But there was still significant variation between schools (Table 4.7).

The third multilevel modelling step included three models: the model including physical activity, the model including bullying, and the model including school performances. In the model focusing on physical activity level, the variance between schools was 0.11, which is a subtle change compared to the variance of the previous model (0.10); this indicates that the addition of physical activity cannot explain much of the variation of depression between schools. In the model including bullying covariates, the variance between schools was 0.10, which was no different than the second model (0.10). We can conclude that bullying did not contribute to the variation between schools either. In the model including school performances covariates, the variance in this model was 0.04, which has a 37.5% decrease compared to the empty model (0.16). It implied that by including school performances covariates, the explanatory power of the model increased, and thus students' school performances were one of the reasons that led to the significant variation; it contributed 37.5% to the variation of depression among schools (Table 4.7).

The fourth model is the final model with both individual-level factors and school-level factors. By adding a school contextual variable into the model, the variance were both around 0.05, and when put them both into the model together, the variance between schools dropped to 0, indicating that deprivation, as a contextual effect, can explain the rest of the variation.

Table 4.7: Variance between schools in 4 hierarchical multilevel models

variance	Model 1	Model 2	Model 3			Model 4
			Physical Activity	Bullying	School Performance	
β(S.E.)	0.16 (0.05)	0.10 (0.05)	0.11 (0.05)	0.10 (0.05)	0.04 (0.04)	0

4.4.2 Multilevel analysis of adjusted factors

Table 4.8 shows the results of the multilevel analysis including demographic characteristics and family background variables. The results show that most of the factors were significantly associated with depression. The prevalence of depression was higher among girls (OR=0.61), Aboriginals (OR=1.52), children who lived in a family other than both parents (single parent: OR=1.65, other: OR=3.22), children whose parents had relatively lower educational levels (OR=1.39), and children who had a very good relationship with their parents (OR=2.82). Only the students' age was not significantly associated (11-13 years old: p=0.48, OR=0.91, 95% CI: 0.71-1.17; 14 or more years old: p=0.40, OR=1.26, 95% CI: 0.73-2.17, compared to 10 or less).

Table 4.8: Multilevel logistic regression showing: a) sociodemographic and family characteristics associated with depression, Saskatoon, 2008/2009

Variable	Odds Ratio	95% Confidence Intervals	p-value
Gender			
Female	1		
Male	0.61	0.50-0.74	<.0001
Age			
10 or less	1		
11-13	0.91	0.71-1.17	0.48
14 or more	1.26	0.73-2.17	0.40
Cultural status			
White	1		
Aboriginal	1.52	1.11-2.09	0.009
Other	0.85	0.61-1.17	0.31
Family structure			
Both mother and father	1		
Single parent	1.65	1.32-2.08	<.0001
Other	3.22	2.02-5.15	<.0001
Parents' education level			
At least one is high school or less	1		
Both college or university	0.72	0.59-0.88	0.001
Relationship with parents			
Not very good	1		
Very good	2.82	1.92-4.13	<.0001

4.4.3 Multilevel analysis of main factors

The analysis results of the third step are presented in Tables 4.9-4.11, which revealed the association between depression and physical activity, bullying, and school refusal behavior, respectively. As is shown in Table 4.9, students participation in physical activity after school was significantly associated with depression (p=0.02). The prevalence of depressed mood was lower among those who had frequently participated in physical activities after school (1 to 3 times a week: OR= 0.73, p=0.03; 4 or more times a week: OR=0.65, p=0.02). Also, the students' BMI was another

variable associated with depression (p<0.0001). Those who were overweight or obese had a higher prevalence of depression. Students' physical activity level and their frequency of taking physical activity classes had no association with depression, and were excluded from the final model.

Table 4.9: Multilevel logistic regression showing: b) sociodemographic, family characteristics and physical activity associated with depression, Saskatoon, 2008/2009

Variable	Odds Ratio	95% Confidence Intervals	p-value
Demographic characteristics			
Gender			
Female	1		
Male	0.58	0.47-0.72	<.0001
Cultural status			
White	1		
Aboriginal	1.42	1.00-2.01	0.05
Other	0.85	0.60-1.21	0.37
Family background			
Family structure			
Both mother and father	1		
Single parent	1.64	1.28-2.10	<.0001
Other	3.27	1.98-5.40	<.0001
Parents' education level			
At least one is high school or less	1		
Both college or university	0.79	0.63-0.98	0.03
Relationship with parents			
Not very good	1		
Very good	2.81	1.88-4.20	<.0001
Physical activity			
Physical activity			
Low	1		
Moderate	0.82	0.61-1.10	0.18
High	0.73	0.46-1.15	0.17
Number of days went to gym class			
1 day or less	1		

2 or 3 days	0.92	0.41-2.05	0.84
4 days or more	0.79	0.31-2.05	0.63
Out-of-school physical activity			
Never	1		
1 to 3 times a week	0.73	0.54-0.98	0.03
4 or more times a week	0.65	0.45-0.94	0.02
BMI			
Normal	1		
Overweight/obese	1.67	1.31-2.13	<.0001

In the model of bullying variables (Table 4.10), all of the four kinds of bullying were significantly associated with depressed mood (physical bullying: p=0.006; verbal bullying: p<0.0001; social bullying: p=0.0002; electronic bullying: p<0.0001), indicating that students who reported having been bullied were more likely to be depressed.

Table 4.10: Multilevel logistic regression showing: c) socipodemographic, family characteristics, and bullying associated with depression, Saskatoon, 2008/2009

Variable	**Odds Ratio**	**95% Confidence Intervals**	**p-value**
Demographic characteristics			
Gender			
Female	1		
Male	0.70	0.55-0.88	0.002
Cultural status			
White	1		
Aboriginal	1.60	1.14-2.25	0.007
Other	1.03	0.73-1.45	0.88
Family background			
Family structure			
Both mother and father	1		
Single parent	1.47	1.15-1.88	0.002
Other	2.86	1.71-4.80	<.0001
Parents' education level			

At least one is high school or less	1		
Both college or university	0.73	0.59-0.91	0.005
Relationship with Parents			
Not very good	1		
Very good	2.69	1.72-4.26	<.0001
Bullying			
Physical bullying	1		
Never	1.45	1.11-1.89	0.006
Once or twice	1.59	0.97-2.61	0.07
Many times a week			
Verbal bullying	1		
Never	1.50	1.16-1.94	0.002
Once or twice	4.25	2.91-6.19	<.0001
Many times a week			
Social bullying	1		
Never	1.32	1.02-1.71	0.03
Once or twice	2.05	1.41-2.97	0.0002
Many times a week			
Electronic bullying			
Never	1		
Once or twice	2.78	1.81-4.26	<.0001
Many times a week	2.67	1.25-5.70	0.01

In the model including school performances variables, whether students had been suspended from school had no relationship with depression (p=0.83). The other factors were found to be associated with depression.

Table 4.11: Multilevel logistic regression showing: d) sociodemographic, family characteristics and school performance associated with depression, Saskatoon, 2008/2009

Variable	Odds Ratio	95% Confidence Intervals	p-value
Demographic characteristics			
Gender			
Female	1		
Male	0.62	0.49-0.78	<.0001
Cultural status			

White	1		
Aboriginal	1.19	0.83-1.72	0.34
Other	0.75	0.51-1.08	0.12
Family background			
Family structure			
Both mother and father	1		
Single parent	1.35	1.03-1.75	0.03
Other	2.56	1.47-4.48	0.001
Parents' education level			
At least one is high school or less	1		
Both college or university	0.74	0.59-0.93	0.01
Relationship with Parents			
Not very good	1		
Very good	2.75	1.75-4.30	<.0001
Social performance			
Have many friends			
False	1		
Sometimes true	0.62	0.35-1.08	0.001
True	0.39	0.22-0.72	0.12
Get Along with Others Easily			
False	1		
Sometimes true	0.83	0.47-1.46	0.01
True	0.48	0.27-0.87	0.53
Feel Like an Outsider			
All the time	1		
Sometimes	0.70	0.47-1.05	<.0001
Rarely/never	0.25	0.17-0.38	0.09
Skipped school			
Never	1		
Reported	2.99	2.10-4.27	<.0001
Been Suspended from School			
Never	1		
Reported	1.05	0.65-1.72	0.83
Been Treated Badly at School			
Never	1		
Reported	2.18	1.74-2.75	<.0001

4.4.4 Multilevel analysis of all factors

The final multilevel model contained 12 individual-level covariates that were

significantly associated with depression: gender, family structure, parents' educational level, relationship with parents, BMI, social bullying, electronic bullying, having many friends, get along with others easily, feeling like an outsider, skipped from school, and being treated badly at school (Table 1). In addition, the following interactions between individual-level variables were observed: family structure by BMI, parental educational level by BMI, bullying by gender, and parents' educational level by getting along with others. Cultural status, physical activity level (KKD), out-of-school exercise, physical bullying, verbal bullying, and suspension from school were significantly associated with depression in univariate analysis, but were not significant in the multivariate model. It was found that children who had a very good relationship with their parents were more likely to report being depressed in the multilevel model (OR=2.59, 95% CI=1.59-4.24). In terms of school performances, students who had few friends, who sometimes felt like an outsider, who had skipped school, and those who had been treated badly at school were more likely to suffer from depression. For school-level variable, students who attended schools deemed as of moderate material deprivation, compared to minimum, were 2.04 times more likely to be depressed (OR=2.04, 95% CI: 1.53-2.72). However, social deprivation had no significant association with depression (moderate vs. minimal: OR=1.23, 95% CI: 0.94-1.61; severe vs. minimal: OR=0.86, 95%CI: 0.51-1.45).

Table 4.12: Final multilevel logistic regression model showing all significant correlates (individual level) associated with depression, Saskatoon, 2008/2009

Variable	Odds Ratio	95% Confidence Intervals	p-value
Demographic characteristics			
Gender			
Female	1		
Male	0.70	0.54-0.91	0.007
Family background			
Family structure			
Both mother and father	1		
Single parent	1.07	0.77-1.49	0.69
Other	2.39	1.13-5.07	0.02
Parents' education level			
At least one is high school or less	1		
Both college or university	3.28	1.07-10.06	0.04
Relationship with Parents			
Not very good	1		
Very good	2.59	1.59-4.24	0.0001
Physical activity			
BMI			
Normal	1		
Overweight/obese	1.73	1.07-2.80	0.03
Bullying			
Social bullying			
Never	1		
Once or twice	1.11	0.83-1.48	0.49
Many times a week	1.75	1.13-2.69	0.007
Electronic bullying			
Never	1		
Once or twice	3.18	1.97-5.14	<.0001
Many times a week	2.62	1.04-6.59	0.04
Social performance			
Have many friends			
False	1		
Sometimes true	0.74	0.38-1.45	0.38
True	0.47	0.26-0.88	0.02
Get Along with Others Easily			
False	1		

Sometimes true	1.62	0.62-4.26	0.33
True	1.04	0.42-2.53	0.94
Feel Like an Outsider			
All the time	1		
Sometimes	0.71	0.45-1.13	0.15
Rarely/never	0.26	0.17-0.42	<.0001
Skipped school			
Never	1		
Reported	4.71	2.75-8.14	<.0001
Been Treated Badly at School			
Never	1		
Reported	1.93	1.49-2.50	<.0001
Contextual variables			
Material deprivation			
Low	1		
Moderate	2.04	1.53-2.72	<.0001
High	1.26	0.61-2.60	0.53
Social deprivation			
Low	1		
Moderate	1.23	0.94-1.61	0.13
High	0.86	0.51-1.45	0.58

Table 4.13: Interaction terms in multilevel model

Interaction term	**Odds Ratio**	**95% Confidence Intervals**	**P-value**
*Family structure * BMI*			
Both parents			
Obese vs. Normal	1.24	0.87-1.76	0.2
Single parent			
Obese vs. Normal	2.48	1.43-4.28	0.0012
Other			
Obese vs. Normal	0.98	0.28-3.45	0.97
*Parents educational level * BMI*			
At least one has high school or less			
Obese vs. Normal	2.02	1.16-3.51	0.01
Both college graduates			
Obese vs. Normal	1.03	0.59-1.79	0.92
*Gender * Electronic bullying*			
Female			
Sometimes vs. Never	3.18	1.97-5.14	<.0001

Often vs. Never	2.62	1.04-6.59	0.04
Male			
Sometimes vs. Never	0.98	0.49-1.94	0.97
Often vs. Never	3.89	1.38-10.95	0.01
Parents' educational level Get along with others*			
At least one has high school or less			
Sometimes true vs. False	1.62	0.62-4.26	0.33
True vs. False	1.04	0.42-2.53	0.94
Both college graduates			
Sometimes true vs. False	0.45	0.19-1.09	0.08
True vs. False	0.27	0.12-0.63	0.002
Cross-level Interaction			
*Material deprivation * Skipped from school*			
Minimum deprivation			
Skipped vs. never	4.71	2.75-8.14	<.0001
Moderate deprivation			
Skipped vs. never	1.07	0.58-1.96	0.8
Severe deprivation			
Skipped vs. never	2.69	0.89-8.18	0.08

Full model:

$$\text{logit}(P) = \log\left(\frac{p}{1-p}\right)\left(\frac{p}{1-p}\right) = -0.65 - 0.36\,X_{\text{male}} + 0.07\,X_{\text{single parent}} + 0.87\,X_{\text{other}} + 1.19\,X_{\text{both college}} + 0.95\,X_{\text{good parental relations}} + 0.55\,X_{\text{overweight}} + 0.09\,X_{\text{social bullying}} + 0.60\,X_{\text{social bullying more}} + 1.16\,X_{\text{electronic bullying}} + 0.96\,X_{\text{electronic bullying more}} - 0.31X_{\text{some friends}} - 0.75X_{\text{many friends}} + 0.48\,X_{\text{good with others}} + 0.02\,X_{\text{very good with others}} - 0.31X_{\text{sometimes outsider}} - 1.25X_{\text{never outsider}} + 1.55X_{\text{skipped}} + 0.66\,X_{\text{treated badly}} + 0.71X_{\text{moderate material deprivation}} + 0.23\,X_{\text{severe material deprivation}} + 0.21X_{\text{moderate social deprivation}} - 0.15X_{\text{severe social deprivation}} + 0.69\,X_{\text{single parent}} * X_{\text{overweight}} - 0.23\,X_{\text{other}} * X_{\text{overweight}} - 0.67\,X_{\text{both college}} * X_{\text{overweight}} - 1.17\,X_{\text{male}} * X_{\text{electric bullying}} + 0.39\,X_{\text{male}} * X_{\text{electric bullying more}} - 1.28\,X_{\text{both college}} * X_{\text{good with others}} - 1.34\,X_{\text{both college}} * X_{\text{very good with others}} - 1.49\,X_{\text{moderate material deprivation}} * X_{\text{skipped}} + -0.56\,X_{\text{severe material deprivation}} * X_{\text{skipped}}$$

4.4.5 Interaction terms

When a model has significant interaction terms involving two covariates, it describes how the effect of a covariate depends on the level of another covariate. For instance, in the presence of an interaction between family structure and BMI, one cannot talk

about the effect of BMI on depression independently. One must divide students into different family structure categories, and discuss the association between BMI and depression in each category. The interaction terms and their Odds Ratios and 95% confidence intervals were provided in Table 4.13. There were 4 individual-level interaction terms and one cross-level interaction term included in the final model.

Cross-level interaction

Material deprivation, which served as a school contextual variable, impacted the association between depression and having skipped school. Among students from schools of minimum deprivation level, the odds of the skipping were 4.71 times greater than their peers (OR=4.71, 95% CI: 2.75-8.14), indicating that having skipped from school was strongly associated with depression. However, among students from schools of moderate deprivation and severe deprivation level, the association between having skipped from school and depression was insignificant (moderate deprivation: p=0.8; severe deprivation: p=0.08).

The following section provides a detailed description of how the interaction term was calculated, by taking the cross-level interaction term as an example.

The full model is:

$$Y = \text{logit}(P) = (\beta_0 + \ldots) + \beta_1 X_{\text{moderate dep}} + \beta_2 X_{\text{severe dep}} + \beta_3 X_{\text{skip}} +$$

$$\beta_4 X_{\text{moderate dep}} * X_{\text{skip}} + \beta_5 X_{\text{severe dep}} * X_{\text{skip}} + \ldots\ldots$$

The Log difference between a student with minimum material deprivation and having

skipped school and a student never skipped from school is:

$$\text{Logit Difference} = \beta_3 X_{skip} = 1.55$$

Thus, for students whose school had on average a minimum material deprivation level, the odds ratio for those who had skipped school compared to those who had never skipped school is:

$$OR = \text{Exp}\ \beta_3 = \text{Exp}\ (1.55) = 4.71$$

The Log difference between a student with moderate material deprivation and having skipped school and a student never skipped from school is:

$$\text{Logit Difference} = \beta_3 X_{skip} + \beta_4 X_{\text{moderate dep}*} X_{skip} = 0.06$$

Thus, for students whose school had on average a moderate material deprivation level, the odds ratio for those who had skipped school compared to those who had never skipped school is:

$$OR = \text{Exp}\ (\beta_3 + \beta_4) = \text{Exp}\ (0.06) = 1.07$$

The Log difference between a student with severe material deprivation and having skipped school and a student never skipped from school is:

$$\text{Logit Difference} = \beta_3 X_{skip} + \beta_5 X_{\text{severe dep}*} X_{skip} = 1.55 - 0.56 = 0.99$$

Thus, for students whose school had on average a severe material deprivation level, the odds ratio for those who had skipped school compared to those who had never skipped school is:

$$OR = \text{Exp}\ (\beta_3 + \beta_5) = \text{Exp}\ (0.99) = 2.69$$

Individual-level interaction

The association between BMI and depression was influenced by family structure. For those who lived with both their parents, BMI had no impact on depression (p=0.2). BMI was not significantly associated with depression among students who lived with people other than their parents (p=0.97). However, for students who lived in single families, the odds of being depressed was 2.48 times in overweight or obese students than those whose weights were normal (OR=2.48, 95% CI: 1.43-4.28).

The association between students' BMI and depression was also affected by their parents' educational level. If the students' parents had received a level of education lower than high school (at least one parent), then the odds of being depressed in overweight children was 2.02 times greater than normal weight students (OR=2.02, 95% CI: 1.16-3.51). However, for students whose parents both graduated from college, their BMI was not significantly associated with depression (p=0.92).

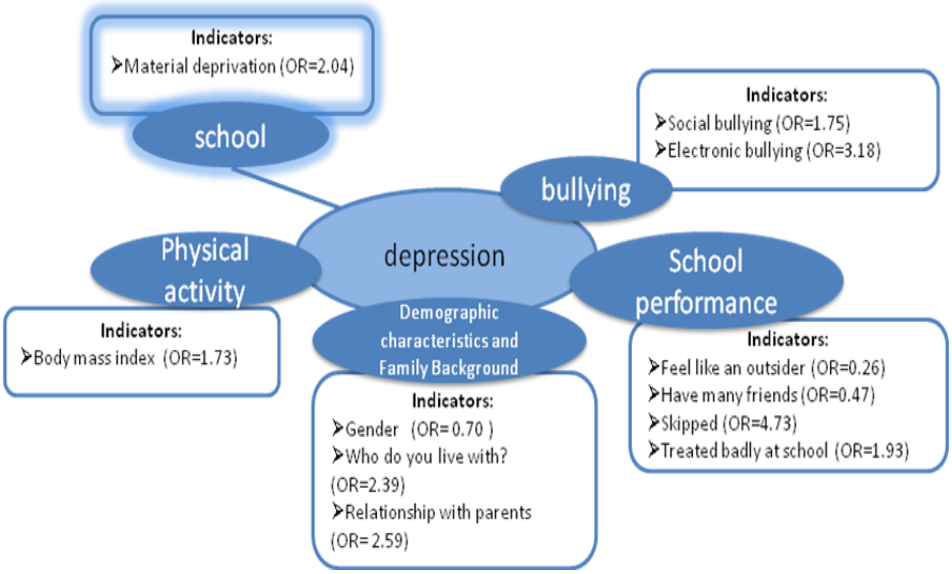
Parents' educational level also had an impact on the association between depression and students' get along with others. If the students' parents had a level of education lower than high school, their depressed mood was not associated with their ability to get along with others (sometimes true vs. false: p=0.33; true vs. false: p=0.94). For students whose parents had graduated from college, the odds of those who get along with each other very well was 0.27 times less than their counterparts (OR=0.27, 95% CI: 0.12-0.63).

Gender and electronic bullying was another interaction term. For girls, electronic bullying had a significant effect on their depressed mood regardless of how often they were bullied (sometimes vs. never: $p<.0001$; often vs. never: $p<0.04$). For boys, however, only those who experienced bullying many times a week suffered from a depressed mood (sometimes vs. never: $p=0.97$; often vs. never: $p=0.01$).

4.5 Summary

Figure 4-1 presented the variable framework with only variables that were significantly associated with depression in the multilevel model. For the demographic characteristic and family background factors, the students' gender, family structure and their relationship with parents were significantly associated with depression. For physical activity, only students' BMI was associated with depression. For bullying factors, both social bullying and electronic bullying were associated with depression. For the school performances factors, friendship with peers, feeling like an outsider, skipped from school and being treated badly at school were all significantly associated with depression. Finally, for the school contextual factors, only material deprivation was significantly associated with depression.

Figure 4-5: Significantly associated factors at individual- and school-level with depressed mood (main effects only)



CHAPTER 5: DISCUSSION

5.1 Summary of findings

My study focused on the prevalence of depression among children in Saskatoon elementary schools, and examined the association between depression and both individual-level factors and school-level factors. Results of the descriptive analysis indicated that among the 4200 students, there were 3648 students who responded to the depression questions (CES-D-12), and among them, 2835 students were deemed not depressed, while 813 were depressed. The rate of depressed mood was 22.3%. The results also showed that among all the covariates being considered some individual characteristics such as gender and relationship with parents, two types of bullying (electronic bullying and social bullying), and some indicators of school performance (feeling like an outsider, having skipped school, being treated badly at school) were significantly associated with depression. Covariates that contributed to the depression disparity between schools were demographic characteristics, family background and school performances.

For demographic characteristics, only gender was significantly associated with depression, while students' age and cultural status had no association with depression. There were in total 3635 students, including 1849 (50.9%) females and 1786 (49.1%) males, who responded to the questions for both depressed mood and gender. The

results showed that depressed mood more commonly occurred in girls than that in boys, which is similar to previous studies (Young, 1990, Bebbington et al., 1998; Silverstein & Lynch, 1998; Veijola et al., 1998).

According to the results of the multivariate analysis in our study, cultural status was significantly associated with depression only when demographic variables and family background variables were included in the model. It showed that Aboriginal students had a significantly higher prevalence of depression than Caucasian students. But the association was no longer significant after adding physical activity variables or school performances variables into the model. When including bullying covariates in the model, cultural status remained significantly associated with depression.

The results indicated that it is difficult to tell whether Aboriginal students or Caucasian students have a higher risk of becoming depressed since the relationship was influenced by other factors. Other studies focusing on health disparity among Aboriginal people had similar conclusions. One study explored depression from the National Population Health Survey with around 81,000 Canadian subjects. It indicated that Aboriginal Canadians experienced significantly more depressive symptoms than non-Aboriginal Canadians. After controlling for SES, however, Aboriginal Canadians no longer differed from non-Aboriginal Canadians in the level of depression (Wu et al., 2003). This further indicated that when considering cultural status, one must also take into account other factors rather than simply declaring which ethnic group has a

higher risk of health problems. These findings were also consistent with the previous findings from the Saskatoon Health Region, which showed that Aboriginal cultural status was not associated with depressed mood after controlling other covariates (Lemstra et al., 2008).

Children who lived in single parent families or lived with others were more likely to be depressed. But when school-level covariates were added to the model, the prevalence of depression among children in single parent families did not differ from those who lived with both parents. However, our results did not find any cross-level interaction between school-level deprivation and family structure. Thus, how school-level covariates affect the impact of family structure on depression cannot be answered directly from our study, and therefore needs further examination.

The most interesting and surprising finding in our study was that those who were reported to have a very good relationship with their parents had a significantly higher prevalence of depressed mood, although it was hypothesized that depression would be more common among children who report poor relationships with their parents. This was an expected finding that poses some difficulty to the interpretation and therefore merits some specific further study. One interpretation might be that this was caused by some specific and systematic study bias such that many depressed students who had a bad relationship with their parents refused to respond to the survey, leading to a higher percentage of depression in the group having a good relationship with their

parents. As part of further exploring this relationship sensitivity analysis was conducted and the association between those children who responded and who did not respond to the relationship with parents and depression questions was examined. There was no significant difference in depression prevalence between responders (22.4%), and non-responders (20.9%). Another hypothesis that should be tested in subsequent studies is that children who report a "very good" relationship with parents may also be vulnerable to being "pressured" to achieve or influenced by them to some degree.

Although the association between physical activity and mental health was discussed thoroughly in the literature review section, the results showed that Saskatoon children's physical activity levels had no significant association with depression. Only overweight/obese BMI had a significant association with depression—the overweight/obese children were more likely to be depressed. However, this relationship does not directly pertained to physical activity level. In conveying the results, one can at least assert that physical activity may not be the prioritized factor when examining depression and its indicators among Saskatoon children in grade 5 to 8.

Among four kinds of bullying, electronic bullying was more harmful than any other types of bullying in terms of the negative effect on children's depressed mood. The difference between these four types of bullying was that physical and verbal bullying

are direct face-to-face interactions, while electronic and social bullying are less visible forms of bullying. Our study showed that girls were more vulnerable to electronic bullying and had a relatively higher prevalence of depression than boys when a victim of bullying. This result was the same to previous studies, which indicated that girls are more exposed to indirect bullying than boys (Arseneault et al., 2010). Thus, according to these results, more attention should be paid to girls when interventions to reduce electronic bullying are implemented, as girls are more likely to be the main victims, more incline to be impacted, and have a higher risk of becoming depressed as a consequence of electronic bullying. According to our results, for Saskatoon children, social and electronic bullying are the two types of bullying that are more harmful in terms of increasing the risk of having a depressed mood.

The results also indicated negative experiences at school or demonstrating school refusal behaviours were not the experience of a substantial or majority of students. Most of the students were found to have relatively good experiences at school, perform well, and presumably are harmonious with others at school. Yet, there were still some students who reported having school refusal behaviours. Among all the school refusal or negative experiences at school, the experiences of feeling like an outsider, having skipped school and having been treated badly at school were the three covariates that were significantly associated with depression. There was a higher percentage reported depression among children who reported negative experiences or school refusal behaviours than those who did not. The results also indicated that

friendship at school was not associated with depressed mood. Previous studies indicated that friendship at school could reduce the impact of unhappy experiences and enhance children's self-esteem, and being popular at school could alleviate bad experience at school (Bolger et al., 1998; Schwartz et al., 2008). Thus although in our study there was no direct relationship between friendship and depression, one should still consider friendship at school as a factor of concern, because it can affect other school performance factors, and could consequently influence depression in an indirect way. Generally, the results were consistent with previous studies such that school refusal behaviour and school absenteeism are major factors correlated with depression (Huebner & Mancini, 2005; Kearney, 1993).

Having skipped school had a negative effect on children's mental health status. This result was consistent with other studies which indicated that depression was more likely to occur among those who had school refusal behaviors and those who had unhappy experiences and bad feelings at school (Hersov, 1960; Kearney, 2007; Kearney, 1993).

The effect of school

With regards to the effects of the school context, only moderate material deprivation had a significant association with depression. Having conducted both logistic regression analysis and multilevel regression analysis in each modeling step, the results did not differ greatly from each other. One of the reasons that multilevel

analysis was used was that it has been assumed that the association between depression and covariates would be different from the general population when clustered by school. It was expected that the correlation between depression and some covariates would be altered when school effects due to clustering by school is statistically taken into account. However, the extremely similar results indicated that adjusting by school-level random effects does not influence the association between depressed mood and its covariates. However, our results still supported the assumption that disparities in depression are seen among schools. Thus, the assumption that poor mental health in students were more common in some schools than others was shown to be true, but the extent to which these disparities were attributable to independent variables were not clear. Among the factors measured and included in the models, school experience and performances were the main factors that contributed to the disparity of depression between schools, while physical activity did not have any impact on depression.

However, it is too hasty to simply conclude that school environments are a major explanatory factor underpinning the disparities seen in depression between schools. The disparity among schools might also be due to neighborhood effects. There are several neighborhoods in Saskatoon and their SES, social interactions, physical conditions, and many other aspects differ from each other, which may lead to health disparity. Although it is not always the case that all students in one school come from the same neighborhood, one can still believe that there is a huge overlap between

school and neighborhood, that is to say, most of the children in the same school were also coming from the same neighborhood, because parents are tend to choose the school nearby. Therefore, the characteristics manifested by children in the same school might virtually reflect characteristics of the neighborhood they belong to, and it is possible that it was the neighborhood rather than the school that affected depression disparity. However, neighbourhood-level information was not available in Student Health Survey 2008, and was not being considered in my study.

5.2 Strengths and limitations

5.2.1 Strengths

This study used a dataset from Saskatoon Health Region, which has several advantages. First, the 2008/2009 Saskatoon Student Health Survey is the second survey concerning Saskatoon children's health status. The first survey was conducted in 2006/2007 school year. The design of the second survey was based on the findings of the first one, so the second survey focused on health factors of the greatest concern. Also, bullying was taken into consideration in the second survey, given the concerns with this issue expressed by both School Boards in Saskatoon. Additionally, our study had a relatively large sample size, which ensured the variety of the subjects, and guaranteed that the subjects' percentage of each category within variables could well-represent the situation of the general population.

Another strength of my study is that it took school-level factors into account by

conducting multilevel analysis. This multilevel approach allows for the exploration of data at both the individual-level and school-level. By obtaining school-level information, we were able to better describe the characteristics of schools that account for depression disparities. In addition, the study also conducted both one-level logistic regression and multilevel logistic regression in each step. By comparing the two statistical approaches, it was possible to know which factors and which relationships with depression were influenced by school. Our study is the first study of its kind that has conducted school-level modeling of Saskatoon students' mental health status.

5.2.2 Limitations

There were some factors that could impact external and internal validity.

Selection bias

If the association between exposure and outcome do not exist in reality even though we observed an apparent association in the experiment or analysis results, we would call this "selection bias". One reason that might cause selection bias is non-response. In the Student Health Survey 2008, students who refused to respond might differ from the respondents in many aspects such as demographic characteristics, SES, cultural status, and so on, which could result in a consequence that the subjects who participated somehow being systematically different in relation to factors we are concerned compared to those who didn't.

Information bias

Information bias occurs when the approach to obtain information is inadequate; thus, some of the information collected is inaccurate or even incorrect. In this study, the information was obtained by self-report survey, so one could misclassify participants into incorrect groups; this may result in a misclassification bias. For instance, some children who did not have a depressed mood may be misclassified as depressed because they had an inaccurate estimation on themselves when filling the CES-D-12 depression questionnaire. It is known to researchers that girls are more likely to express a negative mood than boys, thus girls' self-estimation of depressed mood might be more severe. One might also misclassify children's exposure status. For instance, children who had been asked questions about bullying experiences may lack of a clear concept of bullying. Some may have thought that hitting by their peers was bullying, while isolating behaviour or gossiping were not. Others might have mistaken bullying with other kinds of violence and considered abuse or mistreatment from their parents to be bullying as well. The misunderstanding of the exposure would result in an incorrect estimation of personal exposure, leading to misclassification. Another possible situation is that some children who have had a certain kind of exposure, such as having few friends or feeling like an outsider, were not willing to admit the truth. This might not because that they want to skew research results, but simply because they were reluctant to face the reality of failure, and this could lead to another information bias.

Lack of SES information

Another limitation of this study is that information about family income of participants, as a component of SES, was not available, although it has been considered to be an essential factor when addressing health disparity in Saskatoon. As stated in the literature review, the impact of cultural status to depression changed by adjusting for SES factors (Samann, 2000; Ralph-Campbell et al., 2006; Dalstra et al., 2005). My results could be more convincible if having included family income into the model.

CHAPTER 6: CONCLUSION

The results of my study do not differ much from other previous studies. However, it provides a more comprehensive view of the pattern linking Saskatoon children's daily life and their mental health status. The results show that depressed mood is associated with gender, family structure, parents' educational level, relationship with parents, indirect bullying, and some bad experiences at school, such as feeling like an outsider at school, having skipped school and being treated badly at school. There is a disparity in depression between schools, and the covariates that most contributed to the disparity are students' social life and their experiences at school.

Future studies need to focus more on children's social lifestyle and experiences, as well as feelings at schools. As this is a cross-sectional study that can only explore the association between depression and other factors, a cohort study design would be needed to better explore the causality between depression and its associated factors. Meanwhile, researchers need to take into account of how children's relationships with parents impact depression, and try to figure out why better relationships with parents was connected with worse mental health status.

Our study is attempted to address mental health disparity within schools, and increase awareness in Saskatoon Health Region and among stakeholders about mental health

disparity and its complex determinants among Saskatoon's children. We expect to inform appropriate interventions to reduce depression rates and eliminate mental health disparity between schools in Saskatoon and beyond by disseminating the summary of the results to Saskatoon Health Region, stakeholders, elementary school policy-makers, and administrators.

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APPENDICES

Saskatoon Student Health Survey (2008)

You are being asked to participate in a research project. This is not part of your regular class work and is therefore optional.

This is a survey with questions about your physical activity, health, depressed mood and bullying. Your answers will help the Saskatoon Health Region and the School Board plan programs and services for young people like yourself. The survey will take approximately 30 minutes to complete.

This is not a test and there are no right or wrong answers. You can choose whether or not to fill out the survey. If you need help with any question, you may ask your teacher. We encourage you to answer each question but you can skip any questions that make you feel uncomfortable. No one will be upset or angry if you do not complete the survey.

When you answer these questions, fill in the circle ○ like this ●

Remember that the KIDS HELP PHONE is available to help you any time if you feel like you would like to talk to someone about a problem. **1 -(800) -668 -6868**

The Saskatoon Health Region will keep your individual answers PRIVATE.
No one from your home or your school will see what you write.
Your individual answers will not be shared with other children, parents, or teachers.

THANK YOU FOR YOUR HELP!

I understand the study. I understand that participation is voluntary. I agree to participate.

_____

(Sign your name here)

Should you wish to discuss the survey in more detail, you may contact Mark Lemstra at any time at the Saskatoon Health Region at 655-4449. As well, you may contact the Ethics Office at the University of Saskatchewan at 966-2084.

Section A: Me and My Family

1. Name: _____
(*Print*)

2. What is your gender? o Male o Female

3. What grade are you in?
o Grade 5 o Grade 6 o Grade 7 o Grade 8

4. How old are you?
o 9 o 10 o 11 o 12 o 13 o 14 o 15

5. What is the name of your school?
_____
(*Print*)

6. How many schools did you attend last year?
o 1 o 2 o 3 o 4 o 5 or more

7. What is your cultural status?
o White
o Aboriginal (First Nations, Métis)
o Other (i.e., Arab, Chinese, Latin American)

8. Who do you live with?
o Both my mother and father
o Mother only
o Father only
o Half with my mother, half with my father
o Guardian (grandparent(s), aunt, uncle)
o Other

9. Does your father have a job? o Yes o No

10. If yes, what is your father's occupation (or job)?
_____
(*Print*)

11. Does your mother have a job? o Yes o No

12. If yes, what is your mother's occupation (or job)?
_____
(*Print*)

13. What is your father's education level?

- o Less than high school graduate
- o High school graduate
- o Some college or university but did not graduate
- o College or university graduate (examples., SIAST or University of Saskatchewan)

14. What is your mother's education level?

- o Less than high school graduate
- o High school graduate
- o Some college or university but did not graduate
- o College or University graduate (examples., SIAST or University of Saskatchewan)

15. Please show how much you agree or disagree with the following statements. (*Please mark one circle for each line*).

	Strongly disagree	**Disagree**	**Neither agree nor disagree**	**Agree**	**Strongly agree**
a. My parents understand me	O	O	O	O	O
b. I have a happy home life	O	O	O	O	O
c. My parents expect too much from me	O	O	O	O	O
d. My parents trust me	O	O	O	O	O
e. I have a lot of arguments with my parents	O	O	O	O	O
f. There are times when I would like to leave home	O	O	O	O	O
g. What my parents think of me is important	O	O	O	O	O
h. My parents expect too much from me at school	O	O	O	O	O

Section B: Physical Activities

Physical Activity is any activity that increases your heart rate and makes you get out of breath some of the time. Some examples of physical activity are running, brisk walking, rollerblading, biking, skateboarding, dancing, swimming, soccer, basketball, football and hockey.

> **Hard** physical activities are jogging, team sports, fast dancing, jump rope and any other physical activities that increase your heart rate and make you breathe hard and sweat.

16. Mark how many minutes of **HARD** physical activity you did on each of the last 7 days. This includes physical activity during physical education class, lunch, recess, after school, evenings and spare time.

Monday	O 0 minutes	O15 minutes	O30 minutes	O 45 minutes	O 60 minutes
Tuesday	O 0 minutes	O15 minutes	O30 minutes	O 45 minutes	O 60 minutes
Wednesday	O 0 minutes	O15 minutes	O30 minutes	O 45 minutes	O 60 minutes
Thursday	O 0 minutes	O15 minutes	O30 minutes	O 45 minutes	O 60 minutes
Friday	O 0 minutes	O15 minutes	O30 minutes	O 45 minutes	O 60 minutes
Saturday	O 0 minutes	O15 minutes	O30 minutes	O 45 minutes	O 60 minutes
Sunday	O 0 minutes	O15 minutes	O30 minutes	O 45 minutes	O 60 minutes

> **Moderate** physical activities are lower intensity activities such as walking, biking to school and recreational swimming.

17. Mark how many minutes of **MODERATE** physical activity you did on each of the last 7 days. This includes physical activity during physical education class, lunch, recess, after school, evenings and spare time.

Monday	O 0 minutes	O15 minutes	O30 minutes	O 45 minutes	O 60 minutes
Tuesday	O 0 minutes	O15 minutes	O30 minutes	O 45 minutes	O 60 minutes
Wednesday	O 0 minutes	O15 minutes	O30 minutes	O 45 minutes	O 60 minutes
Thursday	O 0 minutes	O15 minutes	O30 minutes	O 45 minutes	O 60 minutes
Friday	O 0 minutes	O15 minutes	O30 minutes	O 45 minutes	O 60 minutes
Saturday	O 0 minutes	O15 minutes	O30 minutes	O 45 minutes	O 60 minutes
Sunday	O 0 minutes	O15 minutes	O30 minutes	O 45 minutes	O 60 minutes

18. In an average week, when you are in school, on how many days do you go to physical education classes (or gym classes)?

_____ days per week

19. Your closest friends are the friends you like to spend the most time with. How many of your closest friends exercise regularly?

o None o 1 -2 friends o 3 -4 friends o 5 or more friends

20. How tall are you? (please guess if you are not sure)
_____feet _____inches OR _____metres _____centimetres

21. How much do you weigh? (please guess if you are not sure)
_____pounds OR _____kilograms

22. During a typical week, how often:

	Never	**1-2 days**	**3-4 days**	**5-6 days**	**Every day**	**I have no brother(s) and/or sister(s)**
a) Do your brother(s) and/or sister(s) encourage you to do sports or physical activities?	O	O	O	O	O	O
b) Do your brother(s) and/or sister(s) do physical activity or play sports with you?	O	O	O	O	O	O

23. How much do you agree with the following statements?

	Strongly disagree	**Somewhat disagree**	**Somewhat agree**	**Strongly agree**
a) At home there are enough supplies and pieces of sports equipment (like balls, bicycles, skates) to use for physical activity	O	O	O	O
b) It is difficult to walk or jog in my neighbourhood because of things like traffic, no sidewalks, gangs and so on	O	O	O	O
c) There are playgrounds, parks, or gyms, close to my home or that I can get to easily	O	O	O	O
d) It is safe to walk or jog in my neighbourhood during the day	O	O	O	O

24. During a typical week, how often has a member of your household (For example, your father, mother, brother, sister, relatives, or guardian)…

	Never	**1-2 days**	**3-4 days**	**5-6 days**	**Every day**
a) Watched you participate in physical activity or play sports?	O	O	O	O	O
b) Encouraged you to do sports or physical activity?	O	O	O	O	O
c) Provided transportation to a place where you can do physical activity?	O	O	O	O	O
d) Done a physical activity or played sports with you?	O	O	O	O	O

25. In the past 12 months how often have you…

	Never	**Less than once a week**	**1 to 3 times a week**	**4 or more times a week**
a. Played sports or done physical activities **without** a coach or instructor (e.g., biking, skateboarding, etc.)	O	O	O	O
b. Played sports **with** a coach or instructor other than in gym class (e.g., swimming lessons, hockey, etc.)?	O	O	O	O
c. Taken part in dance, gymnastics, karate, or other group lessons, other than in gym class?	O	O	O	O

26. During a typical week, how often:

	Never	**1-2 days**	**3-4 days**	**5-6 days**	**Every day**
a) Do your friends encourage you to do sports or physical activities?	O	O	O	O	O
b) Do your friends do physical activity or play sports with you?	O	O	O	O	O

c) Do your friends or classmates tease you about not being good at physical activities or sports?	O	O	O	O	O
d) Do your friends ask you to walk or bike to school or to a friend's house?	O	O	O	O	O
e) Do your friends tell you that you are doing well in physical activities or sports?	O	O	O	O	O

27. What do you think your school can do to helps kids your age become more physically active?

_____
_____
_____
_____

Section C: Health and Feelings

28. In general would you say your health is :

O Excellent O Very good O Good O Fair O Poor

29. In general, would you say your mental health is:

O Excellent O Very good O Good O Fair O Poor

30. Choose the answer that best describes how you feel:

	False	Mostly False	Sometimes True Sometimes False	Mostly True	True
a) In general, I like the way I am	O	O	O	O	O
b) Overall I have a lot to be proud of	O	O	O	O	O
c) A lot of things about me are good	O	O	O	O	O
d) I like the way I look	O	O	O	O	O

31. How often have you felt or behaved this way during the past week (7 days)?

Rarely or none of the time (less than 1 day)	Some or little of the time (1 to 2 days)	Occasuinally or a moderate amount of time (3 to 4 days)	Most or all the time (5 to 7 days)

a) I did not feel like eating; my appetite was poor	O	O	O	O
b) I felt I could not shake off the blues even with help from my family and friends	O	O	O	O
c) I had trouble keeping my mind on what I was doing	O	O	O	O
d) I felt depressed	O	O	O	O
e) I felt that everything I did was an effort	O	O	O	O
f) I felt hopeful about the future	O	O	O	O
g) My sleep was restless	O	O	O	O
h) I was happy	O	O	O	O
i) I felt lonely	O	O	O	O
j) I enjoyed life	O	O	O	O
k) I had crying spells	O	O	O	O
l) I felt people disliked me	O	O	O	O

32. This section presents you with a number of reasons why you might be depressed (or sad). Each reason is given as a statement in the form of "When I am depressed (or sad) it is because…" followed by a specific reason. For each statement, consider whether or not this particular reason causes you to be depressed (or sad). If you are not currently depressed (or sad), think of a time in the past when you were depressed (or sad) and answer the questions according to what the reasons were at that time.

When I am depressed (or sad) it is because…	**Definitely not a reason**	**Probably not a reason**	**Probably a reason**	**Definitely a reason**
a) I don't feel loved	O	O	O	O
b) My family treated me poorly as a child	O	O	O	O
c) Other people isolate me	O	O	O	O
d) Of certain things that happened to me as a child	O	O	O	O
e) Other people criticize me	O	O	O	O
f) I haven't worked through things that happened to me as a child	O	O	O	O

g) I've had a difficult childhood	O	O	O	O
h) Other people don't like me	O	O	O	O
i) I can't make friends	O	O	O	O
j) People treat me poorly	O	O	O	O
k) People don't give me the respect I deserve	O	O	O	O

33. In the past 12 months, did you seriously consider suicide? o Yes o No

34. What do you think your school can do to helps kids your age not be sad or depressed?

_____
_____
_____
_____

Section D: Bullying

This section asks about bullying. There are many ways to bully someone. A bully wants to hurt the other person (it's not an accident). A bully does or says the same thing over and over again. Bullying is UNFAIR. Sometimes a group of students will bully another student.

35. In the past 4 weeks at school, how often have you been bullied by other students…

	Never in 4 weeks	**Once or twice**	**Every week**	**Many times a week**
a) **physically?** Examples: hit, kicked, pushed, slapped, spat on or hurt in any physical way	O	O	O	O
b) **verbally?** Examples: said mean things to you, teased you, called you names, threatened you or tried to hurt your feelings	O	O	O	O
c) **socially?** Examples: left you out on purpose, refused to play with you, said bad things behind your back, got other students to not like you	O	O	O	O

d) **electronically?** Examples: used Internet, e -mail, phone or cellular phone text messages to threaten you or make you look bad	O	O	O	O

36. Please answer the following statements about your friends and others your age.

	False	**Mostly False**	**Sometimes True Sometimes False**	**Mostly True**	**True**
a. I have many friends	O	O	O	O	O
b. I get along easily with others my age	O	O	O	O	O

37. How often do you feel like an outsider (or left out of things) at school?

O All the time O Most of the time O Some of the time O Rarely o Never

38. Since the beginning of the school year, how many times have you….

a) skipped a day of school without permission?

O Never O Once or twice O 3 or 4 times O 5 times or more

b) been suspended from school?

O Never O Once or twice O 3 or 4 times O 5 times or more

39. In the past 4 weeks at school, how often have you been left out or treated badly…..

	Never in 4 weeks	**Once or twice**	**Every week**	**Many times a week**
a) Because of your religion?	O	O	O	O
b) Because of the colour of your skin?	O	O	O	O
c) Because of the country you or your family came from?	O	O	O	O
d) Because of a physical disability?	O	O	O	O
e) Because of a mental disability? (such as a learning disability)?	O	O	O	O
f) Because of another disability	O	O	O	O
g) Because you are a boy or a girl?	O	O	O	O
h) Because you do well in school?	O	O	O	O
i) Because school is hard for you?	O	O	O	O
j) Because of your weight?	O	O	O	O
k) Because of the way you look, your height, or your body shape?	O	O	O	O
l) Because of how you dress?	O	O	O	O

m) Because of how little money you have?	O	O	O	O
n) Because of your physical weakness?	O	O	O	O

40. Where does bullying happen the most? (*Check as many as you want*)

O Classrooms
O On the school bus
O Hallways
O Lunch or eating area
O Library o On the way to and from school
O Computer Room o Coatroom
O Gym
O Outdoor areas around school
O Change Rooms
O Malls or stores
O Washrooms
O On the computer or cell phone
O Other places (please describe where):
_____

41. Think of the last time that you saw or heard another student being bullied. What did you do? (*Check as many as you want*)
O I ignored it
O I told my parents about it
O I told my brother/sister about it
O I told an adult at school about it
O I told an adult outside of school about it (such as the babysitter, coach, neighbour, etc.)
O I told another student about it
O At the time, I helped the person being bullied
O Later on, I helped the person being bullied
O I stood and watched
O I joined in with the bullying
O I got someone to stop it
O I got back at the bully later
O I have not seen or heard another student being bullied

42. What do you think your school can do to prevent or reduce bullying?
_____
_____
_____
_____

THANK YOU FOR DOING THE SURVEY…

You are helping the Saskatoon Health Region and your School Board plan programs and services for young people like yourself.

This page is for you to keep. Please tear off this page from the rest of the survey and place the survey in the envelope provided. Please seal the survey and hand it to your teacher.

If you would like help from someone who is not part of your school, you can call the Kids Help Phone at 1 -800 -668 -6868 (FREE from a payphone, no money needed)

You can check out their website at: www.kidshelpphone.ca