# BULLYING VICTIMIZATION AND SUBJECTIVE HEALTH COMPLAINTS IN CANADIAN ADOLESCENTS: EXAMINING SPIRITUAL HEALTH CONNECTIONS AS PROTECTIVE HEALTH ASSETS

by

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## Abstract

**Background:** Young people victimized by bullying may draw on assets such as spiritual health to protect them from harm. Composed of the connections in our lives (to ourselves, others, nature, or something transcendent), spiritual health may moderate pathways between bullying and symptoms of poor mental health, but this has yet to be explored among adolescents.

**Objectives:** 1) Examine the structural validity of a 10-item Spiritual Health scale; 2) describe patterns in bullying victimization, health complaints and spiritual health; and 3) investigate if spiritual health connections act as effect modifiers in relationships between bullying victimization and subjective health complaints, as one indicator of impaired internalizing mental health. Differences between age and gender groups were also explored.

**Methods:** Data were used from the 2017/18 Canadian Health Behaviour in School-aged Children study. *Objective 1*: Factor analyses examined the structural validity of the 10-item Spiritual Health Scale. *Objective 2:* The prevalence of key variables was examined in different age and gender groups. *Objective 3:* Modified Poisson regression models with robust error estimation were used to estimate the relative risk for the association between bullying victimization and subjective health complaints. These models also estimated effect modification by spiritual health in age and gender groups.

**Results:** *Objective 1:* The latent structure of the Spiritual Health scale was consistent with the four theoretical domains. *Objective 2:* 21% of the total sample reported being bullied, with a higher prevalence among girls and younger students. *Objective 3:* Among girls, the strength of "connections to self" was found to act as an effect modifier. The strongest associations between bullying victimization and frequent health complaints were identified among girls with high connections to self. Relative risks for health complaints among these self-connected girls were 1.63 (95% CI: 1.26-2.12) and 1.25 (1.06-1.47) for younger and older girls, respectively. The same relationship was weaker in girls who placed lower importance on connections to self.

**Conclusion:** Relationships between bullying victimization and frequent health complaints differed by the strength of “self-connections”, suggesting effect modification. Associations were strongest among girls reporting high importance of connections to self. This may have implications for future adolescent health promotion.

# Co-Authorship

This thesis is the work of Nicole Shaver under the supervision of Dr. William Pickett.

**Manuscript**: *Do spiritual health connections protect adolescents when they are bullied: A national study of 12,593 young Canadians*. The idea to study spiritual health connections in bullied adolescents was generated collaboratively between Nicole Shaver and Dr. Pickett. Nicole Shaver performed the statistical analyses, interpretation of the results and writing of the manuscript, with continuous feedback from Dr. Pickett. Dr. Michaelson also contributed advice and feedback in the theoretical interpretation of results and during the writing of the manuscript.

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## List of Abbreviations

**AGFI** Adjusted goodness of fit index

**CI** Confidence interval

**GEE** Generalized estimating equation

**HBSC** Health Behaviour in School-aged Children

**OR** Odds Ratio

**PR** Prevalence ratio

**QIC** Quasi-likelihood under the independence model criterion

**RR** Relative risk

**SD** Standard Deviation

**SH** Spiritual Health

**SRMR** Standardized root mean square residual

**WHO** World Health Organization

# Chapter 1: Introduction

## 1.1 General Background

Victimization by bullying has been shown to have numerous mental health consequences in young people.[1,2] The high prevalence of bullying victimization, both globally and within Canada, necessitates the development of novel and focused public health interventions. With respect to adolescent mental health, an "asset-based" approach may help young people by buffering the effects of bullying on the risk of negative outcomes.[3,4] Spiritual health is one such asset that has recently re-emerged in contemporary conversations about optimizing adolescent well-being. Spiritual health is a multi-dimensional concept that involves important connections in our lives, whether to ourselves, to others, to nature, or to something transcendent.[5] A limited number of studies have suggested that strong spiritual health connections foster adolescent health.[5–7] However, little is known about the effect of these connections in vulnerable subpopulations of young people in Canada, including those exposed to victimization by bullying. These "at-risk" populations may benefit the most from fostering spiritual health connections, but evidence is required to inform public health interventions targeted to such populations.

## 1.2 Objectives

The **first objective (measurement)** of my thesis was to assess the structural validity and internal consistency of the 10-item Health Behaviour in School-aged Children Spiritual Health Scale. Factor analyses were performed to determine if the latent structure of the scale was consistent with the four domains established in the prior theoretical spiritual health literature.

A **second objective (descriptive)** was to describe sociodemographic patterns of bullying victimization in Canadian schools, as well as the prevalence of subjective health complaints and the self-reported importance of various connections inherent to spiritual health. This was examined to help inform where public health resources and interventions should be directed.

Finally, in my **third objective (analytical)**, I assessed if spiritual health connections act as effect modifiers to affect the strength of relationships between bullying victimization (primarily, an overall measure and secondarily, by subtype) and high subjective health complaints as one indicator of impaired mental health. The independent effects of each spiritual health domain were examined to determine which domains were associated with the greatest risk of experiencing frequent subjective health complaints. Variations in the direction and strength of these relationships between age and gender groups were also explored.

### 1.3 Hypotheses

For my validation component, I hypothesized that a four-factor structure consistent with the theoretical domains of spiritual health would be the best model for the 10-item HBSC Spiritual Health Scale. There were no *a priori* hypotheses for my descriptive objective.

For my analytical objective, it was expected that young people exposed to bullying victimization would have an increased risk of high subjective health complaints. I hypothesized that the spiritual health domains would operate as protective health assets, so that higher levels of spiritual health connections would buffer (attenuate) the strength of associations observed between bullying victimization and subjective health complaints. Based on past analyses using the four-domain model, I also hypothesized that the spiritual health domain of "connections to self" would confer the strongest protective effect on subjective health complaints, as one measure of poor internalizing adolescent mental health.

### 1.4 Thesis Rationale

Prior literature has supported that spiritual health connections are linked to reports of positive mental health status in young people, but the evidence is limited. Grounded in the theory of protective health assets, I hypothesized that strong spiritual health connections could act as substantial protective health assets in subpopulations known to be at particular risk of mental health consequences. I chose to focus on populations of bullied young people due to the strong epidemiological evidence of an association between bullying victimization and poor internalizing mental health in adolescents. Additionally, no previously published studies have examined the protective effects of spiritual health connections in such populations. This is an important and relevant topic to study, as bullying is prevalent and has been associated with an increased risk of poor mental health outcomes for its victims. I had the novel opportunity to use data from the 2017/18 Canadian Health Behaviour in School-aged Children study, a large national dataset of Canadian students, to explore spiritual health connections as potential effect modifiers in the relationship between bullying victimization and high subjective health complaints. The aim was to provide foundational evidence for future interventions that are appropriately targeted to protect bullied young people and other “at-risk” populations against poor mental health outcomes.

### 1.5 Overview of Study Design

A cross-sectional study design was utilized in this thesis. Data were obtained from the 2017/18 Canadian Health Behaviour in School-aged Children study (HBSC). The HBSC is a national representative survey with a sample of over 20,000 students in participating provinces and territories. The survey captures health-related information from students in grades six to ten. Information was also collected on the frequency of bullying victimization and common subjective health complaints, and as well as the self-reported importance of spiritual health connections. For the validation component, exploratory and confirmatory analyses were carried out to determine the structural validity of the 10-item Spiritual Health Scale. To explore sociodemographic patterns, the weighted prevalence of key variables was examined in groups stratified by age and gender, with confidence intervals generated to account for the clustered sampling design of the HBSC. Multivariable Modified Poisson regression models with robust error variance estimation were created to estimate associations and evaluate effect modification in different age and gender groups while simultaneously adjusting for confounding variables.

### 1.6 Organization of Thesis

This thesis conforms to the requirements outlined in the "General Forms of Theses" guidelines from the Queen's University School of Graduate Studies. The second chapter reviews the literature on bullying victimization and mental health in adolescents, and spiritual health connections as potential protective health assets. The third chapter of my thesis presents my analytical framework. The fourth chapter addresses the validation component of my thesis and presents factor analyses for the 2017/18 HBSC Spiritual Health Scale. The fifth chapter is my manuscript addressing my primary etiological thesis objective, formatted for the *Journal of Interpersonal Violence*. The sixth chapter provides supplemental findings related to the descriptive objective of my thesis and presents the results of sensitivity analyses. The seventh chapter provides a general discussion of my primary thesis results, including epidemiological principles, strengths and limitations, public health implications, and future research directions.

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# Chapter 2: Literature Review

## 2.1 Overview

The aim of this chapter is to critically review the literature pertaining to the etiological pathway that I address in my thesis, that being the association between bullying victimization and frequent health complaints in adolescents, and whether spiritual health connections modify this relationship. This review is not systematic but is intended to provide an overview of the current body of literature on these topics, clarify definitions and identify knowledge gaps to inform my thesis objectives. The literature was searched using online search engines such as PUBMED and Google Scholar using free-text keywords (e.g., bullying, peer violence, mental health, subjective health complaints, psychosomatic symptoms, spirituality, spiritual health) and combinations of keywords using the Boolean operators 'AND' and 'OR'. Sources were also hand-searched from the references of original studies/reviews and through relevant websites.

This chapter will first review contemporary research on bullying victimization in adolescents and its association with negative mental health outcomes, including the experience of frequent subjective health complaints. Next, a framework based on the theory that spiritual health connections act as protective health assets will be introduced. This framework will include a review of the theoretical mechanisms linking spiritual health and mental health, as well as the prior etiological research on this topic. Finally, I will identify gaps in the etiological literature that provide a rationale for the conduct of my thesis.

## 2.2 Adolescent Bullying

Bullying among young people is a global public health concern; almost one in three students experience bullying victimization each month worldwide.[1] While education is a basic human right[1], many young people experience bullying in schools[2] and do not have access to a safe and inclusive learning environment to enable quality education. Bullying, both in terms of victimization and perpetration, is also a serious problem in Canada. In 2018, a nationally representative sample of Canadian students reported that 20% of them were bullied more than once or twice in the past couple of months at school.[3] Only 6% of the same sample reported that they had bullied others, suggesting that either few students victimize several others or that students may underreport their perpetration of bullying behaviours.[3]

*Bullying Defined.* Bullying among adolescents is a relationship problem, characterized by a dynamic interaction between one (or more) aggressor(s) and a victim that involves targeted and destructive patterns of behaviours over time.[4,5] The aggressor has more power and repeatedly exploits this power imbalance to intentionally inflict pain on, cause distress to, or control the victim, either through their words or actions.[6] While there is no single definition of bullying, many researchers agree that aggressive behaviour between peers can be classified as bullying if it meets three key criteria: a repetition of behaviours over time, an intentionality to cause harm, and an imbalance of power (either real or perceived) in the relationship.[6,7] Bullying is, therefore, characterized as a systematic abuse of power and is distinguished from arguments/fights between those of the same power status.[7]

### 2.3 Relationships between Bullying Victimization and Mental Health

Bullying victimization can have lasting adverse impacts on both the mental and physical health of young people.[8,9] A meta-analysis published in the year 2000 examined twenty years' worth of cross-sectional studies and found associations of moderate strength between bullying victimization and depressive symptoms, loneliness, anxiety, and low self-esteem.[10] While associations identified from cross-sectional data are open to the potential for reverse causality – i.e., young people with poor mental health become targets of bullying, instead of the victimization being the cause of poor mental health – this concern has been repeatedly addressed through longitudinal research. Ttofi et al. conducted a systematic review of 20 longitudinal studies and found that students who were bullied had an increased long-term risk of depression (adjusted OR= 1.74, 95% CI: 1.54 to 1.97).[11] Another systematic review reported that bullied youth had a highly increased risk of psychosomatic problems in separate meta-analyses of both longitudinal studies (OR= 2.39, 95% CI: 1.76 to 3.24) and cross-sectional studies (OR= 2.17, 95% CI: 1.91 to 2.46).[12]

### 2.3.1 Subtypes of Bullying Victimization

Subtypes of bullying include physical bullying (e.g., hitting, kicking, damaging property), verbal bullying (e.g., name-calling, threats), and social/relational bullying (e.g., exclusion, ignoring).[6,7] Bullying can also be classified based on if the victimization is carried out directly (physical bullying or verbal harassment) or indirectly (social exclusion and rumour-spreading).[7]

Some research has suggested that the effect of bullying victimization on health may vary by direct or indirect forms of aggression. Låftman found that the effect of exposure to indirect bullying victimization (yes/no) on an 8-item subjective health complaint scale ranging from 8-40 was slightly weaker ($\beta$=-.32, $p$<.001) than that of exposure to direct bullying (yes/no) ($\beta$= -.42, $p$<.001).[13] Another study of 661 Italian students showed that unit increases in the frequency of both direct victimization (4-item scale, score range 0-16; $\beta$=.159, $p$<.001) and indirect victimization (3-item scale, score range 0-12; $\beta$=.116, $p$<.001) were associated with risk of somatic complaints on a 9-item scale (scores 0-18).[14] Neither of these studies used mutually exclusive victimization groups making it difficult to quantify the specific effect of each bullying subtype. Different forms of bullying victimization are correlated,[15] and research has suggested that experiencing multiple forms of bullying victimization could pose an increased risk of adverse health outcomes.[15,16]

Cyberbullying is a form of electronically-mediated bullying[17,18] that has been hypothesized to have a more severe impact on mental health than “traditional” forms of victimization. Although some have argued that cyberbullying may be classified as an indirect form of victimization[19], it is often examined as a distinct subtype due to several key differences. Cyberbullying is not bound by the same tempo-spatial restrictions as traditional victimization and allows for the perpetrators’ anonymity. While traditional bullying often occurs at school,[20,21] victims of cyberbullying may be bullied at home, at any hour of the day.

Gradinger and colleagues found that Austrian adolescents who experienced cyberbullying and traditional bullying victimization had higher numbers of depressive and somatic symptoms than non-victims and those who were victimized by traditional or cyberbullying alone.[22] Perren et al. observed similar results, with victims of cyberbullying reporting significantly higher numbers of depressive symptoms, even after controlling for exposure to traditional bullying victimization.[23] A more recent large-scale study found that American students who experienced both traditional and cyberbullying had an increased risk of internalizing symptoms (OR= 1.25, 95% CI: 1.09 to 1.44), compared to those who only faced traditional bullying.[24] However, these studies failed to control for potentially important confounding factors, such as social support. Beckman and colleagues found no differences in the risk of psychosomatic symptoms between cyberbullying and traditional bullying victims, after controlling for both sociodemographic and family structure variables.[19] They also failed to find significant differences in the combined effect of cyberbullying and traditional victimization on psychosomatic symptoms versus the effect of experiencing either form of victimization alone.

### 2.3.2 Subjective Health Complaints and Adolescent Mental Health

To foster mental health in bullied adolescents, it is important to not only examine clinical indications of mental illness, but to study mental health in relation to daily physical functioning and subjective well-being.[25] The World Health Organization (WHO) defines mental health as a state of well-being, in which *"every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community"*.[26] One manifestation of poor mental health is the frequent re-occurrence of subjective health complaints - a term given to medically unexplained symptoms experienced by an individual. These complaints are thought to be induced by a stress reaction due to psychosocial tension and are comprised of psychological and somatic symptoms.[27,28] Subjective health complaints cluster in young people[29–31] and individuals who report multiple complaints simultaneously are at increased risk of poor mental health.[32–34] While the consistency of associations requires careful evaluation due to the definition and measurement of symptoms varying drastically between studies, there has been strong evidence of a relationship between health complaints and internalizing mental health symptoms.[35] Reviews on this association have reported that greater numbers of somatic symptoms appear to be associated with a greater risk of anxiety and depression symptoms in youth, suggesting a potential dose-response relationship.[35] Additionally, one high-quality 15-year longitudinal study found that adolescents with somatic symptoms experienced an increased long-term risk of both mood (OR=2.2, 95% CI: 1.09 to 4.36) and anxiety disorders (OR=2.6, 95% CI: 1.15 to 5.95).[36] Thus, there is evidence that subjective health complaints are related to concurrent reports of internalizing mental health problems, as well as the development of future disorders.

## 2.4 The Health Asset Model

The clear risks for adverse health outcomes among victims of bullying call for clinical and public health responses. One form of intervention may be to employ novel health assets to protect and empower young people who are victimized. Recent models of adolescent health promotion have begun to incorporate positive youth development paradigms[37,38] and focus on fostering "assets" that enable young people to thrive.[39,40] Health assets are resources that enhance the ability of individuals to promote health and well-being.[39] An analogous term to describe health assets is "protective factors", which operate specifically in the context of risk.[39] These factors act as buffers (moderators) on the causal chain that links exposure to adversity and negative health outcomes.[41,42] Despite abhorrent circumstances, young people in challenging environments or survivors of various forms of violence can be remarkably resilient, often drawing on internal strengths to cope.[43–45]

Assets that promote resilience and reduce youth engagement with bullying or other aggressive behaviours may include both individual assets (empathy, self-esteem, self-efficacy) and external assets (support from family and peers, a caring school and community environments).[46] While few of these assets have been explored specifically as protective mental health assets in bullied adolescents, some research has suggested that social support may moderate the effects of bullying victimization on mental health. Elgar et al. found that frequent family dinners (as a proxy for family support) attenuated the effect of cyberbullying victimization on mental health in a sample of 18,834 American adolescents (interactive protective effect of 0.88, 95% CI: 0.87-0.90).[47] Other studies investigating social support variables as moderators in this relationship have produced mixed results,[48–51] possibly due to the increased level of study power needed to detect interaction effects.

Even fewer studies have examined protective health assets at the individual level. One study of students in the United States in grades 6-12 found that varying levels of "meaning in life" moderated the association between self-reported bullying victimization and suicidal ideation, but in boys alone.[52] Bullying victimization had a moderate positive association with suicidal ideation in boys with a weaker level of meaning in life, but this same effect was not observed among boys with stronger levels of meaning in life.

### 2.5 Spiritual Health as a Protective Health Asset

#### 2.5.1 Spiritual Health Defined

An ancient approach to the optimization of health[53] that has regained attention in recent years is an intentional focus on spirituality[54,55] as a health asset. Spirituality, or "spiritual health" as it is sometimes referred to in the public health field[56,57], has long been studied in relation to well-being. Spiritual health is distinct from – but associated with – the other dimensions of health, including mental or emotional health.[54,58–60] Since the late 1940's many[54,56,61] have argued for the official inclusion of spiritual health as a fourth domain in the WHO definition of health, alongside the physical, social and mental health domains.[62] Although excluded from the current WHO definition of health, spiritual health is important to adolescents. It is distinguished as a fundamental human right in articles 27 and 32 of the United Nations Convention of the Rights of the Child.[63] Spiritual health is also integral to various Indigenous conceptualizations of health. In many Indigenous traditions the balance and interconnectedness of the physical, emotional, mental and spiritual elements of life are necessary to support holistic health and well-being.[64–68]

Spiritual health is a challenging concept to define. While many varying definitions have been proposed,[69] there is some consensus that spiritual health is a multidimensional concept[69] that involves "the sacred qualities of life experiences" and the idea of "connectedness" in our lives.[57] This sense of relational connectedness has been explored in several conceptual frameworks related to spiritual health.[57,58,70] Connectedness was also a key component in a consensus definition of spiritual health generated by 74 young Canadians.[71] In each of these frameworks spiritual health connections are characterized by four domains[57,58,70]: connections with self (internalized feelings/experiences), with others (externalized feeling and associated action), with nature (the natural environment), and with the "transcendent" (a sense of mystery, broader meaning to life, or "whatever one considers to be ultimate").

Spiritual health is also often distinguished from the concept of religiosity, which focuses on the traditions of formal religion.[58,72] Spiritual health is considered a more universal concept than institutional religion, and adolescent spiritual health may be shaped both within or independently of religious traditions or beliefs.[69] It should be acknowledged, however, that there are natural overlaps between religion and the transcendent domain of spiritual health, as many adolescents may experience both in similar contexts.

*Measurement of Spiritual Health.* Spiritual health in this thesis is measured using the four domains described above. One scale developed to measure the perceived importance of spiritual health connections to these four domains in young people is the 8-item Spiritual Health Scale on the Health Behaviour in School-aged Children survey (HBSC).[57] This scale was adapted from Fisher's Spiritual Well-being scale for adolescent levels of literacy and brevity.[55,73] It has also undergone principal components and confirmatory factor analyses to confirm that the latent structure is consistent with the four theoretical domains of spiritual health.[57,74] However, a slightly expanded 10-item Spiritual Health scale was introduced in the 2017/18 cycle of HBSC, which requires testing to confirm that the scale also supports a four-domain model (**see Chapter 5**).

### 2.5.2 Theoretical Mechanisms Supporting Spiritual Health as a Protective Health Asset

While the exact mechanisms by which spiritual health domains could act as protective health assets have yet to be elucidated, I hypothesize that spiritual health may be protective of adolescent mental health by promoting physiological or cognitive processes. These are two broad categories of mechanisms that represent key targets for interventions supporting adolescent resiliency and positive youth development.[41]

*Cognitive Mechanisms.* In the context of a positive youth development framework, cognitive processes are thought to promote adolescent health through “perspective building”, which enables young people to develop meaning in their lives.[41] Benson et al. proposed that spirituality works as a “developmental engine” for young people to drive the search for connectedness, meaning, and purpose.[69] Similarly, psychologist Pargament held that the “sacred” acted as an emotional generator to lend coherence to goals and motivations.[75]

The cognitive processes promoted by spiritual health may enhance a “sense of coherence” in young people. Psychologist Antonovsky defined a “sense of coherence” as a sense of comprehensibility, meaningfulness and manageability in one’s life.[76] A strong sense of coherence has been found to have a positive, moderate correlation with spirituality[77] and religious/spiritual well-being ($r = .43$)[78] in a limited number of studies. However, this evidence is strictly correlational and has only been explored in small sample studies using adult participants. The relationship between sense of coherence and indications of positive mental health has been better established; one systematic review noted that a dose-response relationship appears to exist between increased an sense of coherence and fewer self-reported symptoms of perceived depression.[76] Additionally, a robust sense of coherence has been found to act as a protective health asset in a sample of 7580 Spanish adolescents.[79] García-Moya and colleagues demonstrated that among Spanish adolescents with a weaker sense of coherence, bullying victimization was more strongly associated with psychosomatic symptoms, than in adolescents with a strong sense of coherence.[79] While this study employed a cross-sectional design and could not establish temporality to inform the causal nature of this relationship, it provides evidence that a strong sense of coherence could act as a protective factor in bullied young people. Therefore, robust spiritual health could potentially act as a protective factor for mental health, mediated through the promotion of a strong sense of coherence in adolescents.

*Physiological Mechanisms.* An alternative theory is that spiritual health fosters health through physiological mechanisms and the promotion of self-regulation.[41] Emotional self-regulation is the ability to manage or change inner emotional states to achieve goals or function adaptively in stressful situations.[80] The health effects of spirituality have been hypothesized to be mediated by the influence of emotional regulation on our endocrine and autonomic stress responses.[81] However, there is limited population-based empirical research to support this proposed biological pathway. Pérez et al.[82] found that a unit increase direct coping scale scores (3-item scale, scores from 0-9) had a small direct effect on depressive symptoms ($\beta = -.17, p < .01$), partially mediating the association between spirituality and depressive symptoms measured through the 27-item *Children's Depression Inventory* (scores 0-54). The association was stronger among girls, suggesting the possibility of effect modification by gender. The authors noted that this gender difference might have been due to the study's conceptualization of direct coping through the social domain, as adolescent girls are generally more interpersonally competent than boys.[82]

Other studies have examined the effects of interventions that promote self-regulation through spiritual practices. Interventions using spirituality-based practices are already used in some educational and clinical settings for health promotion and include interventions such as exposure to nature,[83] meditation techniques,[84] and exercises to increase mindfulness.[85] A meta-analysis of mindfulness-based therapy for adults based on 39 studies found moderate improvements in anxiety symptoms (*Hedge's g* (difference in pre- vs. post-treatment means/pooled and weighted SD)=.63, $p < .01$) and mood symptoms ($g = .59$, $p < .01$).[86] Few studies have specifically examined such interventions in adolescents. One small randomized clinical trial of adolescent psychiatric outpatients found that those who received a mindfulness-based intervention had greater improvements in symptoms of depression (*Cohen's d* (difference in pre- vs. post-treatment /pooled SD)= .95 vs. 0.31, p=.001) and somatic distress ($d = .80$ vs. -.11, p=.0008) over those who received treatment-as-usual.[87] While mindfulness-based interventions show some promise in mental health promotion, studies that evaluate these interventions often suffer from a lack of methodological rigour, including issues with heterogeneity in training, small sample sizes, and insufficient details to enable replication.[85]

### 2.5.3 Relationships between Spiritual Health and General Health Status

Prior epidemiological research has supported the association between strong spiritual health connections and general health status in young people. Brooks et al. studied 26,701 students across England, Scotland and Canada and found strong and consistent associations between spiritual health measures and excellent self-perceived general health status.[88] Trends suggested a dose-response pattern, with associations of increased strength recorded for higher spiritual domain scores. Domains of "connections to self" (Boys RR=2.17, 95% CI: 1.84 to 2.57; Girls RR=3.35, 95% CI: 2.69 to 4.16) and "connections to others" (Boys RR=1.77, 95% CI: 1.60 to 1.96; Girls RR=2.46, 95% CI: 2.07 to 2.92) had the most substantial relationships in young

Canadians, while the domains of "connections to the transcendent" and "connections to nature" had weaker associations with positive health status.[88] These results are consistent with research showing that the domains of "nature" and "transcendent" have the largest declines in importance to young people by age.[57]

Others have studied the effect of spiritual health on various mental health outcomes. Yonker et al.[89] conducted a meta-analysis of 75 different studies and found that spiritual-religious measures had a small but significant ($r$ = -.11, $p$ <.001) effect on depression in adolescents. This modest effect size may be attributable to the fact that the measurement of spiritual health included only religious aspects and did not capture elements of non-institutional (secular) spiritual health. A more recent study using the four-domain model of spiritual health has focused on the relative effects of the four domains on psychosomatic health outcomes as a measure of internalizing mental health status. In a cross-national analysis adjusted for sociodemographic characteristics and social support, a high level of spiritual health for the "connections to self" domain was associated with low subjective health complaints in girls (Canada RR=1.58, 95% CI: 1.38 to 1.81, England RR=1.30, 95% CI: 1.09 to 1.56, Scotland RR=1.39, 95% CI: 1.18 to 1.62) and boys (Canada RR=1.05, 95% CI: 0.96 to 1.16, England RR=1.15, 95% CI: 0.99 to 1.33, Scotland RR=1.13, 95% CI: 1.00 to 1.28), with weaker associations observed for the "others" and "nature" domain.[74]

Additionally, in related structural equation models, the domain of "connections to self" was found to partially mediate associations between the other domains and mental health.[74] This finding challenges the previous assertion that spiritual health domains operate together as a single construct and that strong connections to each of the four subdomains are required to experience spiritual well-being.[70] Based on these findings, it was hypothesized that the "connections to self" may be the most important domain for bullied young people to cope with mental health adversity.

### 2.6 Gaps in the Existing Etiological Literature

Spiritual health can potentially act as a significant health asset among young people, but there are gaps in the existing etiological literature. A limited number of studies, both globally and in Canada, have examined the protective effects of spiritual health connections as we have defined them on adolescent mental health. Even fewer studies have examined the effects of spiritual health in vulnerable subpopulations of young people in Canada, including those who have been exposed to violence such as bullying. Identifying subpopulations of young people who could benefit from specific protective health assets is meaningful and necessary for informing interventions, as particular health assets may operate differently in specific contexts.[39,40] Additionally, there is a need to explore which aspects of spiritual health are protective to adolescents. The current literature is inconsistent about which spiritual health domains are most important to general adolescent health. Evidence is required on the independent effect of each spiritual health domain on mental health to inform public health interventions. This is especially critical for bullied adolescents, who are at higher risks of adverse mental health outcomes. If spiritual health is found to act as a protective mental health asset in bullied young people, it could inform public health interventions that are appropriately targeted to young people at the greatest risk of poor mental health.

### 2.7 Synopsis

Bullying victimization has been consistently associated with an increased risk of adverse mental health outcomes in adolescents, and there is a need to develop novel public health and clinical interventions to mitigate this risk. One such form of intervention may be to employ spiritual health connections as protective health assets. Spiritual health connections have the potential to buffer (moderate) some of the negative effects of bullying victimization on symptoms of poor internalizing mental health, possibly through either the proposed cognitive or physiological processes. A limited number of epidemiological studies have associated spiritual health connections with positive mental health status in general adolescent populations. However, no previously published studies have examined the effects of spiritual health in young Canadians exposed to bullying victimization. If spiritual health acts as a protective health asset in bullied young people, it could inform targeted public heath interventions for this vulnerable population of adolescents. In the following section, I will discuss how my thesis will contribute to addressing these gaps in knowledge.

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# Chapter 3: Analytical Framework

## 3.1 Overview

The purpose of this chapter is to present the analytical framework used in the etiological component of my thesis. A brief review of the etiological literature will also be included to justify the potential confounders and effect modifiers examined in my analytical model, as well as variables that were not included.

## 3.2 Analytical Framework

The association between bullying victimization and high subjective health complaints was studied in this thesis using the following analytical framework (**Figure 3.1**). The primary effect modifiers of interest were the four spiritual health domains. Potential confounders in this association were identified, as well as other effect modifiers in this relationship.

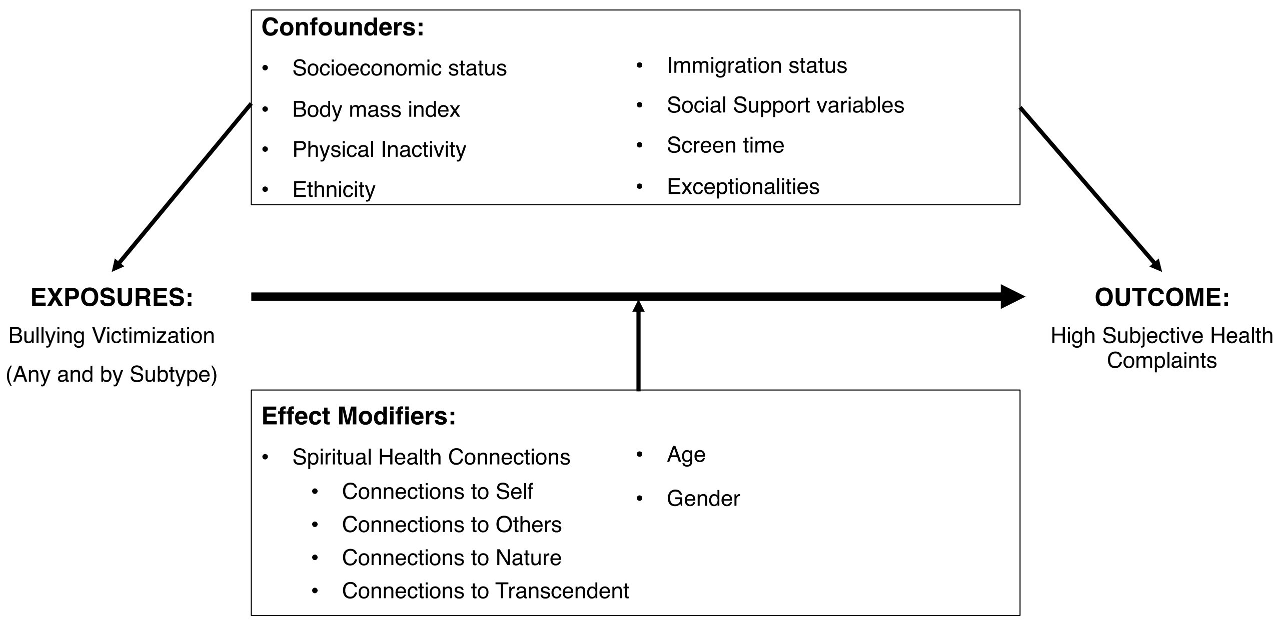


**Figure 3.1.** Summary of the analytical framework depicting relationships hypothesized between bullying victimization, subjective health complaints and spiritual health connections.

### 3.3 Confounders and Effect Modifiers

Potential confounders and effect modifiers were identified from etiological literature. Potential confounders were proposed based on 1) their association as causal risk factors for subjective health complaints or other indications of poor internalizing mental health, 2) their association with bullying victimization, 3) not being on the causal pathway that links bullying victimization to symptoms of poor internalizing mental health. A brief rationale for excluded covariates can be found at the end of this section.

*Potential Effect Modifiers*

**Gender and Sex:** There is some evidence that gender acts as an effect modifier in the association between bullying and psychosomatic symptoms, as one systematic review found that there was a small but significant decrease in effect sizes associated with greater numbers of female participants.[1] Gender disparities also exist in spiritual health; a higher percentage of girls consistently report rating spiritual health as “important” compared to boys.[2,3] Associations between spiritual health and health outcomes in adolescents are modified by gender,[4,5] with stronger protective effects in girls. Spiritual health may, therefore, have a more protective effect in victimized girls than boys.

**Age:** Many socio-biological changes occur in the developmental period between pre-adolescence and adolescence, and as such, age is an important potential effect modifier. A meta-analysis found that age was an effect modifier in the association between bullying victimization and internalizing symptoms, with the strength of the association increasing significantly for older adolescents.[6] Additionally, the importance of spiritual health declines with age in adolescents[3], and as such, spiritual health connections may act as stronger health assets in younger individuals than older.

*Potential Confounders*

**Socioeconomic Status:** Socioeconomic disadvantage is associated with a moderately increased risk of bullying victimization in adolescents (OR = 1.40; 95% CI: 1.24 to 1.58).[7] In addition, measures of low socioeconomic status are associated with increased health complaints[8] and internalizing symptoms.[9] The effect of socioeconomic status on subjective health may also vary by age or gender. Longitudinal studies have found that the influence of lower parental education on self-rated health changes over time in adolescents.[10] Also, the effect of socioeconomic disadvantage on health appears to be consistently stronger for females than males.[8,9]

**Social Support Variables:** Social support is a salient resource in the lives of young people. While many different forms of social support exist, the relationships between individuals and their peers, family, teachers, at school and within their community have been found to be meaningful during adolescence, and related to both bullying and mental health.

***Peer Support:*** Peer status is negatively correlated with bullying victimization ($r$ = -.35, 95% CI: -.28 to -.41).[6] Support in the form of high social capital and interpersonal communication among peers is associated with lower odds of health complaints and psychological complaints.[11]

***School Climate:*** Bullying rates are 7% higher in schools with poor discipline and where students feel that teachers mistreat them.[12] The inverse is also true, in that positive school climates are negatively correlated with bullying victimization among students ($r$ = -.16, 95% CI: -.10 to -.21).[6,13] Perceived school climate is also a salient risk factor associated with subjective health complaints and emotional well-being in adolescents.[11,13–15]

***Family Support:*** Positive family environments with higher communication are negatively correlated with risk of bullying victimization (*r* = -.10, 95% CI: -.07 to -.13).[6,12] Additionally, youth who report poor home environments are at increased risk of psychosomatic symptoms[16], while a positive family climate is protective against depressive symptoms.[17]

***Neighbourhood Social Capital:*** Community factors have a weak negative correlation with victimization in adolescence (*r* = -.15, 95% CI: -.08 to -.22)[6], with the incidence of bullying increasing in areas with limited neighbourhood social capital.[18,19] Neighbourhood social capital is associated with health complaints[11] and individuals less satisfied with perceived neighbourhood environment are at significantly greater risk of depressive symptoms.[20]

***Teacher support:*** One systematic review found that positive school climates (defined in part by respect and fair treatment of students by teachers) are negatively correlated with victimization among students (*r* = -.16, 95% CI: -.10 to -.21).[6] Support from teachers has been associated with fewer subjective health complaints in students, even after adjusting for other school-performance indicators.[21] Reporting more "difficulties with teachers" (per unit increase in score, 6-item scale ranging from 1-6) was also weakly associated with increased scores on a psychosomatic symptom scale (6 items, score range 0-18) in a sample of Norwegian adolescents ($\beta = .15$, $p<.001$).[22]

**Ethnicity:** Ethnic minority status is linked to a moderately increased risk of victimization,[12,23,24] but this risk factor also appears to vary by the level of support and ethnic diversity in schools.[25,26] Being a member of a minority ethnic group has also been shown to be negatively associated with mental health status among Canadian adolescents.[27]

**Overweight/Obese Body Mass Index:** Canadian youth who are overweight or obese are at increased risk of weight-based bullying and harassment from their peers, although this association appears to be stronger in obese girls (OR=2.85, 95% CI: 1.52 to 5.32) than in boys (OR=1.30, 95% CI: 0.72 to 2.35).[28] Additionally, high body mass index has been linked to some psychiatric conditions such as depression and anxiety,[29] with obese children and adolescents being at a moderately increased risk of depression and depression-related symptoms.[30]

**Immigration Background:** Immigrant adolescents are at increased risk of bullying victimization, even after controlling for race.[31,32] Immigration status has also been linked to health complaints, but this relationship may vary by country. In European studies, immigration background was associated with increased risk of heath complaints,[33,34] but a Canadian study reported the opposite effect: immigrant youth had fewer reports of psychosomatic and psychological illness, after adjusting for sociodemographic variables.[35]

**Screen Time**: A cross-sectional study found that boys who were victims of physical bullying (yes/no) ($\beta$=.33, 95% CI: .19 to .48) or cyberbullying (yes/no) in the last month ($\beta$=.45, 95% CI: .29 to .61) had more minutes per day of total screen time. Additionally, girls who were victims of cyberbullying had increased screen time related to communication ($\beta$=.49, 95% CI: .37 to .61).[36] Screen time has been weakly associated with subjective health complaints in adolescents,[37,38] potentially mediated through shorter sleep duration or increased physiological arousal.[38]

**Physical Inactivity:** Physical inactivity has been associated with bullying victimization in adolescents[39,40] Bullied students may have less motivation to participate in physical activity,[39] but physical inactivity may also lead to victimization if less athletic students are targeted by their peers. Subjective health is linked to physical activity in adolescents in both genders,[38] even after controlling for adiposity[41] This relationship may be bi-directional, as individuals who are feeling depressed or unwell usually tend to be less physically active than those who feel well.[42] On the other hand, participation in physical activity has also been shown to lower stress and improve internalizing mental health symptoms.[42,43]

**Exceptionalities:** A systematic review found that adolescents with chronic illnesses and/or physical or sensory disabilities were at increased risk of bullying victimization (OR = 1.65, 95% CI: 1.51 to 1.80).[44] Attention-deficit/hyperactivity disorder has been associated with risk of bullying victimization (OR=2.9, 95% CI: 1.5 to 5.7).[45] Psychosomatic symptoms are more frequent in adolescents with a diagnosed disease[46,47] and are also often comorbid with psychiatric conditions, such as attention-deficit/hyperactivity disorder.[48]

*Excluded Covariates*

Several known risk factors for health complaints or poor mental health were excluded from the analysis due to potential overlap in measurement with my primary study variables. Exposure to dating violence[49] or physical fighting[50,51] are both associated with subjective health complaints, but these measures of violence could overlap (be colinear) with reporting of bullying victimization.[52] Self-esteem may be weakly related to health complaints[53] but was excluded due to potential overlap with "connections to self". Variables associated with the outcome, but not with bullying victimization, such as shyness[54] or school demand,[22,55] were excluded.

Risk-taking behaviours in young people, including alcohol consumption,[56] tobacco consumption,[56–58] marijuana use,[59] early sexual activity,[59,60] and gaming addictions,[61] have all been associated with subjective health complaints. However, these behaviours are suspected to be on the causal pathway; Jochman and colleagues found that many of these behaviours mediate the relationship between bullying victimization and somatic and depressive symptoms.[62] Substance use may also be a consequence (downstream) of both bullying victimization and subjective health complaints; mental health symptoms have been found to mediate the relationship between bullying victimization and future substance use.[63]

Several plausible confounders were identified from the literature but are unmeasured on the Canadian HBSC. Sexual orientation may be a confounding variable, as students who identify or are perceived as LGBTQ are at higher risk for bullying and harassment than their heterosexual peers.[12,26] LGBTQ status has also been found to be associated with a greater number of psychiatric symptoms.[64] Another potential confounding variable for girls is the timing of puberty. Early menarche (a proxy for early maturation) has been associated with frequent bullying victimization,[65] and studies also show significant associations between early menarche and the development of internalizing mental health symptoms.[66,67]

### 3.4 Synopsis

In this chapter, I presented the analytical framework used in my manuscript. The following chapter of my thesis will present my thesis manuscript, addressing my etiological question (*Objective 3*): can spiritual health connections act as protective health assets to buffer the adverse effects of bullying victimization on frequent health complaints as symptoms of poor internalizing mental health in Canadian adolescents?

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# Chapter 4: Do spiritual health connections protect adolescents when they are bullied: A national study of 12,593 young Canadians

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The following thesis chapter is presented in manuscript format. The manuscript has been submitted to and is currently under review by *the Journal of Interpersonal Violence*.

## 4.1 Abstract

It has long been established that bullying has many negative impacts on the mental health of adolescents. Young people who are victimized by bullying may cope by drawing on available assets to protect them from harm. One such asset with ancient roots but the potential for contemporary application is the concept of spiritual health – the idea that the connections in our lives (whether to ourselves, to others, to nature, or to something transcendent) affect our well-being. In this study we examined 12,593 Canadians aged 11-15 years to determine the effects of being victimized by bullying on their mental health, as measured by frequent subjective health complaints. We then explored whether strong spiritual health connections were effect modifiers that buffer such negative pathways, thereby acting as protective health assets. Data were obtained from the 2017/18 Canadian Health Behaviour in School-aged Children study. Generalized linear regression models were used to estimate associations and evaluate effect modification in different age and gender groups. Approximately 21% of participants reported being victimized by bullying. Strength of "connections to self" (i.e., a sense of meaning/purpose or joy and happiness in one's life) was found to act as an effect modifier, but in girls alone. Contrary to expectations of a buffering effect based on prior research, the strongest associations between victimization and frequent health complaints were identified for girls with high connections to self. Relative risks for frequent health complaints among these highly self-connected girls were 1.63 (95% CI: 1.26-2.12) and 1.25 (95% CI: 1.06-1.47) for younger and older girls, respectively. We interpreted this unexpected finding in light of cognitive theories of trauma, which suggest that adverse events may lead to worse health outcomes among those who place particular value on their world being meaningful, controllable or benevolent. Implications for clinical intervention and health promotion are considered.

## 4.2 Introduction

Bullying among young people is a global public health concern. Almost one in three students experience some form of bullying victimization each month worldwide.[1] Experiences of victimization have pronounced and enduring impacts on the mental health of young people,[2,3] which necessitate the development of focused interventions. One strategy that can be used to minimize the effects of bullying is to employ an "asset-based" approach, which draws upon strengths both within and external to children to help them to develop in the healthiest possible manner, even in the face of adversity.[4] Fostering protective health assets can help young people by buffering (moderating) the effects of exposure to adversity - such as bullying - on the risk of negative health outcomes.[5]

One protective health asset with ancient roots but the potential for contemporary application is spiritual health.[6,7] Spiritual health is a challenging concept to define, and we adopt the following working definition:

> Spiritual health is a dimension of health that entails a condition of spiritual well-being. This is a "way of being" that involves some capacity for awareness of the sacred qualities of life experiences and is characterized by connections in four domains: (1) self, (2) others, (3) nature, and (4) a sense of mystery or larger meaning to life, or whatever one considers to be ultimate.[8]

Along with others,[9,10] we are attentive to distinguishing spirituality from the more formal concept of religiosity. The definition that frames our work focuses on the effects of connections that are both within (connections to self), and external (connections with others, to nature, and with the "transcendent") to children.[8] These spiritual health domains are associated with self-reported health and well-being in young people.[11] Whether measured in composite or by domain, spiritual health has been established as a possible determinant of positive mental health in cross-national samples of students.[8,11,12] However, the strength of associations between spiritual health connections and mental well-being have varied between studies; effects seem to depend on the mental health outcome, the individual domain, and demographically by age or gender.

While spiritual health appears to act as a moderately strong asset that fosters mental health within the general adolescent population, we hypothesize that it may confer an even stronger protective benefit to youth at increased risk of poor mental health outcomes. Protective health assets must be studied within specific marginalized or underserved populations, as assets may operate differently in particular contexts.[13,14] Evidence can then inform public health interventions that are appropriately targeted to such populations. While spiritual health has been established as an asset in general populations of adolescents, no published studies to date have focused on its protective effects among those who have been victimized by bullying-related violence.

In the current analysis, we had a novel opportunity to conduct a national study examining the association between bullying (overall and by subtype) and frequent subjective health complaints, as one specific indicator of poor internalizing mental health.[15,16] In addition, we explored whether or not stronger indications of spiritual health connections act as effect modifiers to buffer the strength of relationships between bullying and health complaints. Variations in the direction and strength of these relationships between age and gender groups were also investigated. Our hope was to provide foundational information in support of preventive interventions, clinically, educationally, and at the population level.

## 4.3 Methods

### 4.3.1 Data Source

Data were obtained from the 2017/18 (cycle 8) Canadian Health Behaviour in School-aged Children study (HBSC).[17] HBSC is a cross-sectional survey conducted every four years in collaboration with the World Health Organization.[18] Participating HBSC countries follow an international protocol to ensure that data collection is consistent and quality-controlled.[18] The Canadian HBSC involves an anonymous and self-completed school-based survey that is representative of the experiences of preadolescent and adolescent children in grades 6 to 10 (approximate ages 11 to 15 years).[17] Canadian students in grades 9 and 10 complete an extended questionnaire that is consistent with their experiences and literacy levels. Consent (active or passive depending on the practices within individual school boards) was obtained from the participating pupils, their parents/guardians, and participating schools.

*Ethics.* The Canadian HBSC survey has been granted ethics approval from the General Research Ethics Board at Queen's University. This analysis was also approved by the Queen's University Health Sciences and Affiliated Teaching Hospitals Research Ethics Board (HSREB).

### 4.3.2 Sample

Within each Canadian province (n=10) and territory (n=2; Nunavut did not participate), a list of eligible school jurisdictions was created and organized by school language, type of school board, and the population sizes of the school and its surrounding community.[17] Students excluded due to the Canadian sampling protocol (approximately 8% of the population[19]) were those in private schools, home schools, schools on First Nation reserves, and youth who were incarcerated. A multi-stage cluster sample (individuals nested within classes, schools, and then school boards) was then drawn for participant accrual.[17] All consenting students present on the date of the survey were included, and the achieved sample size was 21,745 students from 287 schools. The participation rate was 75% at the individual student level.

Further exclusion criteria were applied for this analysis (**Figure 4.1**): (1) young people who identified as "bully-victims", as they are known to be at particularly high risk of psychosocial consequences compared to those only involved in perpetration or victimization of bullying alone[20,21]; (2) students with a non-binary gender or who reported intellectual or physical disabilities, as small cell sizes posed a potential risk of re-identification, a risk precluded by our existing ethics agreements.

### 4.3.3 Measures

The primary relationship under study was the association between victimization by bullying and the reporting of frequent subjective health complaints related to internalizing mental health symptoms.[15,16] The four domains of spiritual health were examined as potential effect modifiers of this association. Based on precedent, we also examined student grade (as a proxy for age) and gender as possible effect modifiers,[3,8,12] while controlling for potential confounders.

*Victimization by bullying.* The frequency of victimization by any form of bullying at school in the past couple of months was reported by students. Responses were dichotomized as "bullied" ("2 or 3 times a month" or more often) or "not bullied". The use of this cut-point is supported theoretically as repeated incidents of targeted aggression are required according to the widely accepted Olweus definition of bullying.[22] The two identified groups are known to differ on psychosocial adjustment variables.[22] Subtypes of victimization, including direct (physical or verbal abuse), indirect (social exclusion, gossiping/spreading rumours), or cyber, were also identified according to the above cut-point.

*Subjective health complaints.* Our primary outcome was poor mental health, which was measured using a subjective health complaints scale previously verified for content validity and reliability.[17,23] This scale included eight items describing the frequency (range 0 – "*rarely or never*" to 4 – "*About every day"*) of psychological symptoms ("*feeling low (depressed)", "irritability or bad temper", "feeling nervous", "difficulties getting to sleep"*) and somatic symptoms known to relate to psychological distress ("*headache", "stomachache", "backache", "feeling dizzy"*). This scale represents a non-clinical measure of mental health and well-being with a long history of use in population health research.[24] Responses were summed to produce a composite scale (range 0 to 32), with high scores representing the most frequent reports of symptoms. This scale has shown good internal consistency (α=0.84) and test-retest reliability for the scale as a whole (r= 0.79), as well as for single psychological and somatic complaints (range r=0.61 to r=0.75).[17,23] Responses were categorized into tertiles, with individuals in the highest tertile of scores designating a "high" number of health complaints as my primary outcome. This allowed the comparison of students with many complaints with those who had relatively minor problems (individuals with scores below the top tertile). This approach is consistent with past research[17] and created roughly even groups, despite a heavily right-skewed distribution of scores.

*Effect modifiers.* Connections describing the four domains of spiritual health (self, others, nature and the transcendent) were measured via the HBSC Spiritual Health Scale, a validated adaptation[8] of an existing instrument created for older adolescents and young adults.[25] Students answered using a series of items describing the connections using a 5-point Likert-type scale ranging from 1 ("*Not at all important*") to 5 ("*Very Important*"). Each domain included 2-3 items. To affirm the validity of these items and measures, exploratory and confirmatory factor analyses were conducted. Each of the four domains showed high levels of consistency ($\alpha >$ 0.80), and the model fit was confirmed through good model fit indices (AGFI= 0.993, SRMR= 0.034) and low residuals. This analysis also confirmed that the four-domain model best represented spiritual health measures. We therefore created ordinal scores for each domain by summing corresponding domain items (score range 0-8 for self and nature, 0-12 for others and transcendent). We then transformed each domain into a binary variable consisting of "high" (cut point of scores >5 for self and nature, scores >9 for others and transcendent) vs. "low" connections. Gender (male vs. female) and grade (6-8 vs. 9-10) as a social proxy for student age were also examined as potential effect modifiers, in both our primary associations of interest and with confounders.

*Confounders.* Confounders were informed by past etiological literature based on 1) their association as likely causal risk factors for mental health outcomes, 2) their association with bullying victimization, and 3) not being on the causal pathway that links bullying victimization to mental health. These included perceived socioeconomic status *("How well off do you think your family is?",* with responses ranging from 0 *("Very well off")* to 4 *("Not at all well off"))*,[24,26] sources of social support measured using previously-developed HBSC scales, including Family Support (*$\alpha$= 0.91)*, Peer Support *($\alpha$= 0.92)*, Neighbourhood Social Capital (*$\alpha$=0.78*), School Climate (*$\alpha$=0.78),*[17] and Teacher Support (*$\alpha$= 0.82),*[24] ethnicity (groups based on 2016 Canadian Census of Population),[27] body mass index (weight classes determined using WHO growth charts),[28] immigration background (*born in Canada, immigrated >5 years* or *immigrated 1-5 years ago*), screen time (average number of daily hours),[24] physical inactivity (average number of days per week meeting recommended physical activity guidelines,[29] and exceptionalities (based on Ontario Ministry of Education classification).[30]

### 4.3.4 Minimal Detectable Differences

A simulation analysis was conducted using R software version 3.6.0 (R Core Team, 2019) to determine the minimum detectable multiplicative effect of spiritual health on our associations of interest, accounting for clustering (design effect of 1.2). Based on our final analytic sample size (n=12,593) and with the imposed design effect, the minimal detectable relative risk ratio (RRR) for multiplicative effect modification ($RR_{\text{high spiritual health}}$ / $RR_{\text{low spiritual health}}$) that could be identified for each domain of spiritual health was a protective effect of RRR=0.74 for younger boys, 0.70 for older boys, 0.52 for younger girls and 0.46 for older girls, at 80% power and alpha=0.05.

### 4.3.5 Statistical Analysis

Analyses were performed using SAS software version 9.4 (SAS Institute Inc., Cary, NC).

*Descriptive objectives.* The prevalence of key variables was examined, stratified by age group and gender. 95% confidence intervals that accounted for the nested and clustered nature of the sample were reported for each prevalence estimate. Estimated proportions were weighted using post-stratification weights to account for the disproportionate sampling of grades between provinces/territories and to ensure unbiased population estimates by grade.[32,33]

*Analytical objectives.* Generalized linear models were developed to estimate the strength of associations between bullying victimization and subjective health complaints, and to simultaneously determine if spiritual health domains act as effect modifiers in this relationship while controlling for other variables. Modified Poisson regression models with robust error variance estimation were used to generate prevalence proportion ratios as estimates of RR and their 95% confidence intervals. Due to the clustered nature of our sampling, intraclass correlation coefficients (ICC) were produced from empty models to determine the variability of subjective health complaints at the school and classroom levels. Variations in this outcome were modest: i.e., school (ICC=0.045) and classroom (ICC=0.006); we controlled for within-school correlation using a generalized estimating equation (GEE) approach with an exchangeable correlation type. Survey weights were not employed in our analytical analysis, as our goal was to investigate exposure-outcome relationships rather than estimate population proportions.

A backwards elimination approach using a liberal p-value (p=0.20) was used to create a parsimonious model. The initial model included all potential confounders and their 2-way interactions between gender and age. Wald (joint type 3) Chi-Squared tests were generated to examine the overall statistical significance of each parameter effect. Four 4-way interactions between our spiritual health domains, bullying victimization, gender and grade were forced into our models. ESTIMATE statements were then used to generate RR estimates for the effect of bullying victimization on high subjective health complaints between levels of spiritual health, and separately for boys and girls in different grades. Effect modification was evaluated by contrasting RR estimates between those with high vs. lower self-reported levels of connection within each domain for each sociodemographic group, with significance inferred by $p<0.05$ and changes in the direction and strength of these relationships.

## 4.4 Results

### 4.4.1 Sample

Following the list-wise deletion of students with missing data, the sample was comprised of 12,593 students (12,907 weighted) from 286 schools across Canada (**Table 4.1**). We examined covariate distributions in the students that were excluded for missing data and found that excluded students were younger and had stronger connections to the transcendent domain. No other differences were observed between excluded and included students.

### 4.4.2 Prevalence of Victimization by Bullying

When asked about the frequency of any form of bullying victimization, approximately 21% (95% CI: 19%-23%) of students reported victimization. The proportion of bullied students was highest among younger students (26% girls, 20% boys), and decreased in older age groups (22% girls, 15% boys). Overall, more girls reported bullying victimization than boys (24% girls, 18% boys).

For subtypes of bullying victimization, 9% of students (11% girls, 7% boys) reported multiple forms of bullying victimization, followed by 5% (both genders) who only had exposure to direct forms of victimization, and 4% (5% girls, 3% boys) who experienced indirect forms alone. The reported prevalence of victimization by these subtypes was also higher in younger grades than older. Only 1% of all students were victimized by cyberbullying alone. We were unable to generate reliable associations for this exposure group due to this extremely low prevalence, and results for this exposure were suppressed.

### 4.4.3 Associations between Bullying Victimization and Subjective Health Complaints, and the Modifying Effects of Spiritual Health Domains

Among girls in all grades, we found a consistent modifying effect of connections to self on the association between bullying victimization and subjective health complaints in both adjusted and unadjusted models. The effect of bullying victimization on the risk of subjective health complaints appeared to be strongest for girls with *high* self-connections (younger girls RR= 1.63 (95% CI: 1.26-2.12); older girls RR=1.25 (95% CI: 1.06-1.47)) (**Table 4.2**). This association was much weaker in strength for girls who did *not* have strong connections to self (younger girls RR= 1.21 (95% CI: 1.01-1.45); older girls RR=1.03 (95% CI: 0.91-1.17)) (**Figure 4.2**).

No other clear patterns emerged among girls with respect to effect modification in terms of the other spiritual health domains.

Among boys, we failed to find effect modification by any spiritual health domain on the primary association of interest. However, the majority of RR point estimates were slightly stronger among boys with stronger spiritual health connections than those reporting weaker domain-specific spiritual health connections (**Table 4.2**).

### 4.4.4 Associations between Subtypes of Bullying Victimization and Subjective Health Complaints, and the Modifying Effects of Spiritual Health Domains

We found evidence of effect modification by the "connections to self" domain in the association between exposure to multiple forms of victimization and subjective health complaints, among girls in all grades (**Table 4.3**). Consistent with the model measuring any form of victimization, associations were stronger among girls with *strong* connections to self (younger girls RR= 1.73 (95% CI: 1.33-2.26); older girls RR= 1.48 (95% CI: 1.23-1.79), and weaker among those with *weak* connections (younger girls RR= 1.14 (95% CI: 0.95-1.38); older girls RR=1.11 (95% CI: 0.96-1.27)). The same direction of effect modification for self-connections was observed in the RR point estimates among boys, though this effect was not statistically significant.

The transcendent domain appeared to modify the association between exposure to direct bullying victimization and subjective health complaints in boys, but not in girls. Older boys with high connections to the transcendent had stronger associations between direct bullying victimization and subjective health complaints compared to boys with lower connections (strong connections RR=3.13 (95% CI: 1.78 – 5.51); weak connections RR=1.80 (95% CI: 1.19 – 2.71), p=0.02). We did not observe this effect modification among younger boys.

### 4.5 Discussion

In this study, we set out to document some of the negative effects of bullying on the health and well-being of young people, and whether or not the connections afforded by strong spiritual health buffered such negative effects by acting as a protective health asset. The Canadian national data available to us included reports of being victimized by bullying, subjective health complaints as indicators of poor mental health status, and a simple scale that characterized connections inherent to spiritual health in four domains. Our primary finding was that relationships between being the victim of bullying and frequent health complaints were evident in some population sub-groups but were stronger among those who reported the highest levels of "connections to self". Such relationships were weaker or non-existent amongst those with lower perceived levels of self-connection.

Based on past theory this primary finding was unexpected. Past literature describing the importance of spiritual health in young people's lives has shown that strong self-connections are linked to positive mental health status.[12] Hence, *a priori,* we hypothesized that strong connections would act as substantial protective health assets in groups who are at particular risk of mental health consequences, such as bullied young people. Further, past psychological theory and associated empirical evidence support this view; psychological constructs that similarly emphasize meaning in life, such as a strong sense of coherence, are protective against psychosomatic complaints in bullied adolescents.[34] Our findings, therefore, are provocative. Why might young people who report strong connections to self - indicative of experiencing joy or meaning in their inner world - be more vulnerable to the effects of bullying victimization?

One possible explanation for this unexpected finding is that some young people place particular importance on a high level of joy and happiness. Speculatively, such individuals may face a burdensome amount of stress when this state is disrupted by victimization. Philosophers and psychologists have long debated whether the pursuit of pleasurable experiences (*hedonism*) or the active pursuit of virtue and meaning (*eudaimonism*) leads to greater flourishing.[35] For children, some have cautioned against the promotion of happiness and emotional well-being as explicit goals in themselves,[36] and our data may bear this out in real-world experiences. If children feel pressure to pursue and maintain happiness at all times, they could fail to develop resilience and learn how to process adversity; hence, they become more vulnerable to stress in the face of adversity.[36] Our findings are in keeping with such ideas.

The HBSC measure describing “connections to self” also focuses on the importance of meaning in life. Hence, it is also plausible that there are differential effects on mental health among young people whose meaning in life is especially affected by victimization. This hypothesis shares similarities with some cognitive models of trauma in the field of psychology. In her seminal theory of “Shattered Assumptions”, Janoff-Bulman posits that victimization “shatters an individual’s assumption that the world is meaningful, controllable and benevolent”. Such broken assumptions lead to stress in victims. The ensuing mental health problems are the result of trauma challenging an individual’s fundamental conceptual systems,[37] ; i.e., “[p]eople with more negative assumptions prior to victimization may not respond with as much psychological upheaval as a result of an extreme negative event”.[38] As a consequence, adolescents who place strong importance on meaning and happiness are particularly affected by victimization, while those who do not possess these expectations are less distressed. While further research is needed to affirm the application of cognitive theories of trauma in this context and confirm our findings, our results may have implications for health promotion and intervention efforts (see *Public Health Implications).*

The existence of different findings by gender also warrants comment. Relationships between the importance of the "self" domain and mental health were stronger among girls than boys, suggestive of possible effect modification. Past analyses have shown that gender moderates the effect of self-connections on health, with girls reporting a stronger protective effect than boys.[11,12] Trauma theory supports the idea that gender plays a role in the effects of victimization on mental health.[39] Such patterns could relate to gendered socialization in the development of peer relationships. Early adolescence is a developmental period where such relations are of heightened importance.[40] This is especially true for girls; relational-cultural theory posits that as girls develop, their sense of self is grounded in empathic connections with others.[41] Rather than a separate sense of self, girls explore their identity in relation to others, and these relationships typically result in positive outcomes.[41] When girls with a strong sense of self are victimized by their peers, it may create cognitive dissonance between their secure senses of self-worth and the positive, empathetic relationships that they pursue to develop identity. This may result in increased vulnerability in situations that involve bullying.

Beyond the overall findings, our bullying subtype analysis also yielded notable results. We observed a stronger association between being victimized by bullying directly and subjective health complaints among older boys who simultaneously reported strong connections to the transcendent. While the etiology of this finding remains uncertain, older boys with strong connections to the transcendent may have higher levels of "rejection sensitivity" (a disposition to overreact to social rejection), thus making them more sensitive to the potential negative effects of victimization.[42] Religiosity has been associated with rejection sensitivity in cohorts of marginalized adults[43] and research shows that some children who feel rejected by their peers may turn to religion to cope.[44] Rejection sensitivity has also been shown to mediate the effect of bullying victimization on depressive symptoms.[45]

While intriguing, the current finding related to the transcendent domain is exploratory; more evidence is required to confirm why analogous effect modifications were not observed for the other subtypes of bullying. Additionally, because the transcendent domain describes connections "to something ultimate" that may be religious or fall outside the bounds of organized religion, it should be verified which of these aspects contributes to the observed effects of this domain.

**4.6 Strengths & Limitations**

Our paper had several strengths. While unexpected, our findings contribute to an improved theoretical understanding of the value of spiritual health research in the public health domain and have practical implications for preventive interventions. Our research benefited from the use of theory-based modelling. Grounded in the theory of a four-domain model of spiritual health, we controlled for the individual effects of domains and examined each domain's independent effect on mental well-being. Furthermore, our use of a large and robust national dataset allowed for a well-powered primary analysis and the estimation of effect modification by both gender and age. This enabled us to evaluate the consistency of the domain effects between demographic groups, as well as generate new etiological hypotheses.

Limitations of this study should also be noted. First, although student participation was high, there was a possibility of selection bias; school absenteeism is associated with both bullying victimization[46] and frequent health complaints among students.[47] Second, health complaints are, by definition, dependent on an individual's interpretation of their symptoms. Bullied students may be more likely to interpret mild symptoms as problematic and report them than non-bullied students, which could overestimate relative risk. Our health complaints outcome also only captures one aspect of mental health and well-being. Frequent subjective health complaints may be a good indicator of internalizing problems but fail to capture other important dimensions of adolescent mental health, such as those characterized by externalizing behaviours. Furthermore, while the HBSC adaptation of the spiritual health scale has been evaluated for face validity, students may still misclassify their spiritual health connections, which could bias our interaction estimates.[48] Another potential concern is that spiritual health is merely one component of mental health, rather than its own distinct factor, making any effect modification uninterpretable.[49] While the "connections to self" domain shares some similarities with mental health, prior research has contended that they are indeed discrete constructs with independent meaning and theoretical underpinnings.[8,12] Finally, as with most cross-sectional designs, there is a lack of temporal data which limits our ability to draw causal inferences.

### 4.7 Public Health Implications

Practical implications of these findings warrant comment. Our results suggest that those who are "highly self-connected" may face worse mental health outcomes when they are simultaneously victimized by bullying. Public health responses to these findings must be nuanced because it could be harmful to the well-being of students to explicitly discourage the fostering of resilience through connectedness in their lives. Indeed, the search for joy, happiness and meaning has been deemed an essential protective resource against psychopathologies in young people.[50,51] In light of these considerations, rather than attempting to minimize these connections to self in bullied youth, which could actually be detrimental, we propose that public health efforts may be better directed to preventing bullying perpetration in the general school population (a primary prevention approach).[5] Addressing the underlying issue of victimization might benefit the health and mental well-being of students with both higher and lower levels of connections to self. Many interventions for bullying exist with varying degrees of success. In a systematic review of reviews evaluating school-based interventions, the majority of high-quality studies found that multi-component interventions for violence yield the most consistently positive results.[52] Thus, while high-quality randomized clinical trial evidence is optimal to compare approaches, preventing victimization through a whole-school multi-component intervention may provide the greatest net benefit to student mental health.

### 4.8 Conclusion

To summarize, the present study finds that young people who report strong connections to self and who are simultaneously victimized by bullying, may face a higher risk of frequent health complaints. Although further research is required to expand our findings and confirm the causal links between spiritual health, violence, and symptoms of poor internalizing mental health, there are implications for future health promotion and intervention efforts. While strong spiritual health connections are important to youth, a primary prevention method that addresses bullying perpetration in schools might provide the greatest contribution to the well-being of all students.

## 4.9 References


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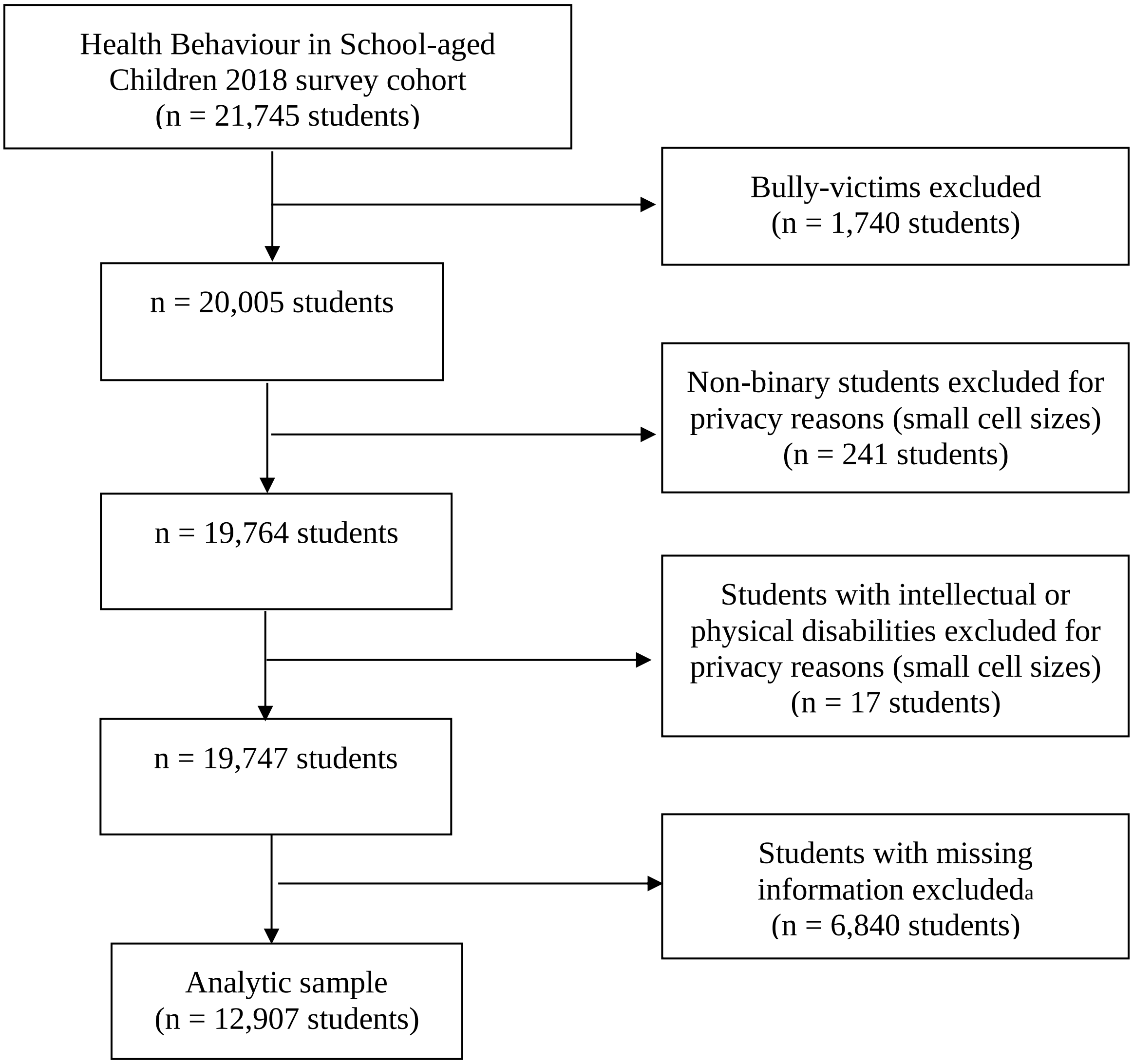


**Figure 4.1**. Flow diagram showing the 2017/18 Canadian Health Behaviour in School-aged Children (HBSC) study sample.

*Note.* All sample frequencies are weighted to ensure provincial and territorial representativeness by grade.
[a]Students with missing information for body mass index or learning exceptionalities were retained in the analysis by including a "missing" category for these variables, as these questionnaire items were not included on territorial versions of the HBSC.

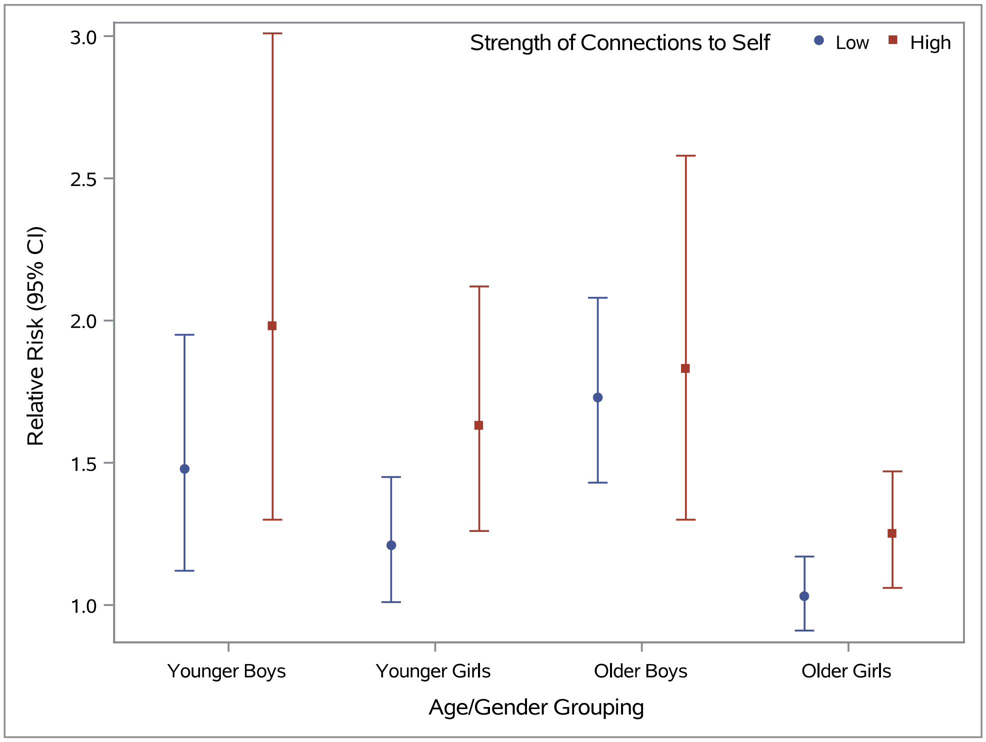


**Figure 4.2**. Relative risk estimates describing associations between bullying victimization and high subjective health complaints, as modified by the spiritual health domain of "connections to self".

**Table 4.1**. Epidemiological description of analytic student sample for key sociodemographic covariates, stratified by gender.

| | Analytic sample (n=12,907) | | Males (n=5,813) | | Females (n=7,094) | |
|---|---|---|---|---|---|---|
| | Number | Column % | Number | Column % | Number | Column % |
| Age (years) | | | | | | |
| Mean | 13.9 | | 13.9 | | 14.0 | |
| <=12 | 3668 | 44 | 1742 | 30 | 1926 | 27 |
| 13-14 | 5631 | 28 | 2464 | 42 | 3166 | 45 |
| >=15 | 3609 | 28 | 1607 | 28 | 2002 | 28 |
| Geography | | | | | | |
| Western Canada | 4201 | 33 | 1939 | 33 | 2262 | 32 |
| Northern Territories[a] | 57 | <1 | 29 | <1 | 28 | <1 |
| Central Canada | 7784 | 60 | 3431 | 59 | 4353 | 61 |
| Atlantic Provinces | 866 | 7 | 414 | 7 | 452 | 6 |
| Race/Ethnicity | | | | | | |
| White | 9311 | 72 | 4279 | 74 | 5032 | 71 |
| Black | 482 | 4 | 209 | 4 | 273 | 4 |
| East Indian and South Asian | 446 | 3 | 175 | 3 | 271 | 4 |
| East and Southeast Asian | 396 | 3 | 186 | 3 | 209 | 3 |
| Indigenous | 393 | 3 | 174 | 3 | 220 | 3 |
| Arab and West Asian | 221 | 2 | 95 | 2 | 125 | 2 |
| Latin American | 172 | 1 | 61 | 1 | 110 | 2 |
| Other | 1488 | 12 | 634 | 11 | 854 | 12 |
| Immigration status | | | | | | |
| Born in Canada | 9912 | 77 | 4286 | 74 | 5648 | 80 |
| Immigrated >5 years | 2331 | 18 | 1238 | 21 | 1093 | 15 |
| Immigrated 1-5 years | 1890 | 5 | 289 | 5 | 353 | 5 |
| Perceived SES | | | | | | |
| 1 ("Not at all well off") | 294 | 2 | 147 | 3 | 147 | 2 |
| 2 ("Not very well off") | 724 | 6 | 270 | 5 | 453 | 6 |
| 3 ("Average") | 4577 | 35 | 1916 | 33 | 2660 | 38 |
| 4 ("Quite well off") | 3936 | 30 | 1791 | 31 | 2145 | 30 |
| 5 ("Very well off") | 3377 | 26 | 1689 | 29 | 1689 | 24 |

*Note*. All frequencies are weighted by student grade and province/territory.
[a]Nunavut did not participate in 2017/18 HBSC.

**Table 4.2**. Relative risk (RR) estimates for the association between exposure to any bullying victimization and high subjective health complaints, estimated by strength of spiritual health (SH) connections, gender and grade.

| | Self | | Others | | Nature | | Transcendent | |
|---|---|---|---|---|---|---|---|---|
| | Non-Adjusted RR (95% CI) | Adjusted[a] RR (95% CI) | Non-Adjusted RR (95% CI) | Adjusted[a] RR (95% CI) | Non-Adjusted RR (95% CI) | Adjusted[a] RR (95% CI) | Non-Adjusted RR (95% CI) | Adjusted[a] RR (95% CI) |
| Girls Grades 6 - 8 | | | | | | | | |
| Low SH | 1.47 (1.23, 1.77) | 1.21 (1.01, 1.45) | 1.47 (1.23, 1.77) | 1.21 (1.01, 1.45) | 1.47 (1.23, 1.77) | 1.21 (1.01, 1.45) | 1.47 (1.23, 1.77) | 1.21 (1.01, 1.45) |
| High SH | 1.86 (1.42, 2.42) | 1.63 (1.26, 2.12) | 1.74 (1.43, 2.12) | 1.35 (1.11, 1.64) | 1.58 (1.25, 1.99) | 1.24 (0.99, 1.55) | 1.51 (1.16, 1.98) | 1.24 (0.94, 1.64) |
| p[b] | .02 | <.001 | .16 | .35 | .55 | .83 | .78 | .78 |
| Girls Grades 9 - 10 | | | | | | | | |
| Low SH | 1.27 (1.13, 1.43) | 1.03 (0.91, 1.17) | 1.27 (1.13, 1.43) | 1.03 (0.91, 1.17) | 1.27 (1.13, 1.43) | 1.03 (0.91, 1.17) | 1.27 (1.13, 1.43) | 1.03 (0.91, 1.17) |
| High SH | 1.49 (1.25, 1.78) | 1.25 (1.06, 1.47) | 1.31 (1.15, 1.50) | 1.08 (0.94, 1.24) | 1.33 (1.15, 1.54) | 1.03 (0.88, 1.22) | 1.39 (1.14, 1.69) | 1.13 (0.93, 1.37) |
| p[b] | .02 | .01 | .66 | .54 | .55 | .98 | .24 | .22 |
| Boys Grades 6 - 8 | | | | | | | | |
| Low SH | 1.86 (1.42, 2.43) | 1.48 (1.12, 1.95) | 1.86 (1.42, 2.43) | 1.48 (1.12, 1.95) | 1.86 (1.42, 2.43) | 1.48 (1.12, 1.95) | 1.86 (1.42, 2.43) | 1.48 (1.12, 1.95) |
| High SH | 2.55 (1.67, 3.88) | 1.98 (1.30, 3.01) | 2.47 (1.82, 3.36) | 1.87 (1.36, 2.57) | 1.57 (1.06, 2.32) | 1.40 (0.94, 2.07) | 1.52 (0.99, 2.34) | 1.17 (0.76, 1.80) |
| p[b] | .07 | .10 | .15 | .23 | .30 | .75 | .27 | .19 |
| Boys Grades 9 - 10 | | | | | | | | |
| Low SH | 2.17 (1.81, 2.58) | 1.73 (1.43, 2.08) | 2.17 (1.81, 2.58) | 1.73 (1.43, 2.08) | 2.17 (1.81, 2.58) | 1.73 (1.43, 2.08) | 2.17 (1.81, 2.58) | 1.73 (1.43, 2.08) |
| High SH | 1.90 (1.32, 2.74) | 1.83 (1.30, 2.58) | 2.52 (1.88, 3.37) | 1.83 (1.40, 2.39) | 1.85 (1.33, 2.58) | 1.38 (1.00, 1.92) | 2.55 (1.67, 3.89) | 2.00 (1.32, 3.01) |
| p[b] | .44 | .69 | .35 | .72 | .31 | .10 | .38 | .43 |

[a]Model fully adjusted for selected confounders (socioeconomic status, body mass index, physical activity, race/ethnicity, immigration, family support, neighbourhood social capitol, school climate, teacher support, screen time, exceptionalities) and significant interactions with gender or age (gender*immigration, gender* body mass index, gender*school climate, age*screen time).
[b]P-values are for hypothesis test that RR estimates are equivalent between SH levels, within each gender and age group. Each linear combination of the parameter estimates was tested (L'β=0) using a generalized score statistic for GEE models.

**Table 4.3**. Relative risk (RR) estimates for the association between exposure to subtypes of bullying victimization and high subjective health complaints, estimated by strength of spiritual health (SH) connections, gender and grade.

| | | Self | | Others | | Nature | | Transcendent | |
|---|---|---|---|---|---|---|---|---|---|
| Bullying Exposure | SH Level | Adjusted[a] RR (95% CI) | p-value[b] | Adjusted[a] RR (95% CI) | p-value[b] | Adjusted[a] RR (95% CI) | p-value[b] | Adjusted[a] RR (95% CI) | p-value[b] |
| Girls Grades 6 - 8 | | | | | | | | | |
| Direct | Low | 1.03 (0.69,1.53) | .53 | 1.03 (0.69, 1.53) | .57 | 1.03 (0.69, 1.53) | .13 | 1.03 (0.69, 1.53) | .51 |
| | High | 1.13 (0.72, 1.77) | | 1.16 (0.81, 1.65) | | 1.37 (0.90, 2.07) | | 1.16 (0.64, 2.08) | |
| Indirect | Low | 1.33 (1.04, 1.71) | .14 | 1.33 (1.04, 1.71) | .39 | 1.33 (1.04, 1.71) | .11 | 1.33 (1.04, 1.71) | .21 |
| | High | 1.71 (1.15, 2.56) | | 1.54 (1.16, 2.04) | | 1.04 (0.75, 1.43) | | 1.64 (1.05, 2.56) | |
| Multiple forms | Low | 1.14 (0.95, 1.38) | <.0001 | 1.14 (0.95, 1.38) | .30 | 1.14 (0.95, 1.38) | .25 | 1.14 (0.95, 1.38) | .53 |
| | High | 1.73 (1.33, 2.26) | | 1.28 (1.06, 1.56) | | 1.29 (1.04, 1.59) | | 1.07 (0.80, 1.42) | |
| Girls Grades 9 - 10 | | | | | | | | | |
| Direct | Low | 1.02 (0.84, 1.25) | .17 | 1.02 (0.84, 1.25) | .57 | 1.02 (0.84, 1.25) | .35 | 1.02 (0.84, 1.25) | .41 |
| | High | 1.21 (0.96, 1.53) | | 1.09 (0.87, 1.38) | | 0.92 (0.70, 1.22) | | 1.14 (0.83, 1.55) | |
| Indirect | Low | 0.89 (0.71, 1.12) | .26 | 0.89 (0.71, 1.12) | .15 | 0.89 (0.71, 1.12) | .38 | 0.89 (0.71, 1.12) | .51 |
| | High | 1.00 (0.75, 1.34) | | 1.07 (0.88, 1.29) | | 0.98 (0.76, 1.27) | | 0.97 (0.68, 1.38) | |
| Multiple forms | Low | 1.11 (0.96, 1.27) | <.001 | 1.11 (0.96, 1.27) | .74 | 1.11 (0.96, 1.27) | .53 | 1.11 (0.96, 1.27) | .23 |
| | High | 1.48 (1.23, 1.79) | | 1.08 (0.92, 1.26) | | 1.05 (0.89, 1.25) | | 1.22 (0.97, 1.52) | |
| Boys Grades 6 - 8 | | | | | | | | | |
| Direct | Low | 1.33 (0.84, 2.10) | .18 | 1.33 (0.84, 2.10) | .41 | 1.33 (0.84, 2.10) | .15 | 1.33 (0.84, 2.10) | .83 |
| | High | 2.03 (0.97, 4.25) | | 1.78 (1.02, 3.10) | | 0.83 (0.42, 1.66) | | 1.23 (0.55, 2.77) | |
| Indirect | Low | 1.26 (0.72, 2.20) | .52 | 1.26 (0.72, 2.20) | .50 | 1.26 (0.72, 2.20) | .33 | 1.26 (0.72, 2.20) | .12 |
| | High | 1.53 (0.78, 2.97) | | 1.58 (0.75, 3.39) | | 1.72 (0.95, 3.14) | | 0.72 (0.29, 1.81) | |
| Multiple forms | Low | 1.85 (1.39, 2.47) | .06 | 1.85 (1.39, 2.47) | .77 | 1.85 (1.39, 2.47) | .91 | 1.85 (1.39, 2.47) | .07 |
| | High | 2.86 (1.70, 4.82) | | 1.74 (1.19, 2.54) | | 1.89 (1.22, 2.94) | | 1.30 (0.80, 2.12) | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Boys Grades 9 - 10 | | | | | | | | | |
| Direct | Low | 1.80 (1.19, 2.71) | .82 | 1.80 (1.19, 2.71) | .50 | 1.80 (1.19, 2.71) | .39 | 1.80 (1.19, 2.71) | .02 |
| | High | 1.91 (1.15, 3.17) | | 1.53 (1.02, 2.28) | | 1.39 (0.64, 3.05) | | 3.13 (1.78, 5.51) | |
| Indirect | Low | 1.32 (0.70, 2.50) | .33 | 1.32 (0.70, 2.50) | .97 | 1.32 (0.70, 2.50) | .88 | 1.32 (0.70, 2.50) | .23 |
| | High | 1.84 (0.77, 4.42) | | 1.34 (0.86, 2.09) | | 1.26 (0.54, 2.96) | | 0.44 (0.07, 3.03) | |
| Multiple forms | Low | 1.62 (1.26, 2.09) | .34 | 1.62 (1.26, 2.09) | .45 | 1.62 (1.26, 2.09) | .22 | 1.62 (1.26, 2.09) | .60 |
| | High | 1.92 (1.30, 2.83) | | 1.87 (1.37, 2.56) | | 1.33 (0.91, 1.94) | | 1.85 (1.05, 3.27) | |

*Note*. Estimates for those exposed to cyberbullying alone were repressed due to unreliable estimates due to extremely small number.
[a]Model fully adjusted for selected confounders (socioeconomic status, body mass index, physical activity, race/ethnicity, immigration, family support, neighbourhood social capitol, school climate, teacher support, screen time, exceptionalities) and significant interactions with gender or age (gender*immigration, gender* body mass index, gender*school climate, age*screen time).
[b]P-values are for hypothesis test that RR estimates are equivalent between SH levels, within each gender and age group. Each linear combination of the parameter estimates was tested (L'β=0) using a generalized score statistic for GEE models.

# Chapter 5: Supplementary Results I

# Structural Validity of the 10-item Spiritual Health Scale

## 5.1 Overview

The purpose of this chapter is to explore the structural validity of the 10-item Spiritual Health Scale on the Health Behaviour in School-aged Children (HBSC) survey (*Objective 1*). This supplementary objective was performed to provide foundational evidence for the use of the scale in my thesis. This chapter will not be submitted for publication and is, therefore, not formatted as a manuscript. However, these analyses will be applied to international HBSC data and the results will be published as a separate (non-thesis) manuscript with the candidate as the first author. This future manuscript will explore the structural validity of the HBSC scale for the measurement of adolescent spiritual health in nine countries (Canada included).

*Background.* The 2013/14 Canadian HBSC measured spiritual health through an 8-item spiritual health module, originally proposed as a scale.[1] Principal components and confirmatory factor analyses supported a four-factor structure for this scale, consistent with four theoretical domains used to study adolescent spiritual health: self, others, nature and the transcendent.[1,2] While the scale appears to be best modelled by domain, prior exploratory factor analysis has suggested that spiritual health may also be measured through a single composite unidimensional scale.[3] This is of interest, as seminal qualitative work has also advocated for a unidimensional conceptualization of spiritual health.[4]

The 2017/18 HBSC survey added two new spiritual health items based on expert input. This new version of the scale was found to have adequate face validity in focus group testing conducted in Kingston, Ontario. However, the modified scale required psychometric testing.

Therefore, it was a thesis objective to evaluate the structural validity of the 10-item scale for use in measuring adolescent spiritual health. This validation component includes three sections: an exploratory factor analysis to determine the number of latent factors, confirmatory factor analysis to test the hypothesized model based on the four domains, and finally, the evaluation of internal scale consistency. Based on past factor analyses with the 2014 HBSC scale,[1] as well as analyses that examined the four domains in relation to mental health outcomes,[2] a four-factor structure was hypothesized to be the best conceptualization to assess spiritual health.

## 5.2 Methods

*Sample.* Data from the 2017/18 (cycle 8) of the Canadian HBSC were applied (n=21,745 students from 287 schools). An overview of the HBSC survey design is found in chapter four of this thesis. Our sample consisted of all students with complete data (list-wise deletion) on the spiritual health questionnaire items (n=18,232 students) (**Figure 5.1**).

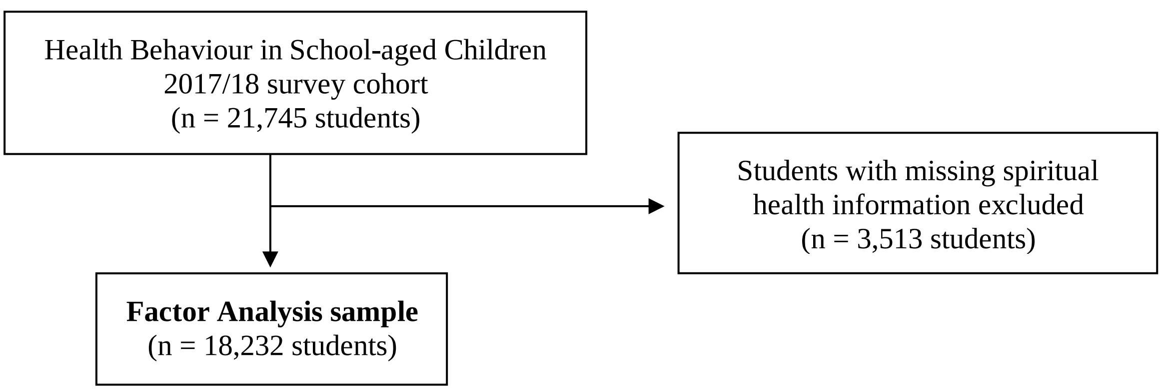


**Figure 5.1**. Flow diagram showing the final factor analytic sample derived from the 2017/18 Health Behaviour in School-aged Children survey Canadian sample.

*HBSC Questionnaire Items.* The 2017/18 HBSC Spiritual Health Scale asks about the importance of spiritual health using ten questions. Students answered using a 5-point Likert-like set of response items ranging from 1 ("Not at all important") to 5 ("Very Important") for each item. **Table 5.1**. contains the ten Spiritual Health Scale survey items and their corresponding domain.

Factor analyses were performed using SAS University Edition software (SAS Institute, Inc., Cary, NC), using the PROC FACTOR procedure for exploratory factor analysis and PROC CALIS for confirmatory factor analysis.

**Table 5.1.** Items on the 2017/18 Health Behaviour in School-aged Children (HBSC) survey comprising the 10-item Spiritual Health Scale.

| Spiritual Health Domain | Variable Name | HBSC Survey Item *"How Important is it for you to … ?"* |
|---|---|---|
| Others | SPR1 | Be kind to other people |
| | SPR2 | Be forgiving of others |
| | SPR3 | Show respect for other people[a] |
| Self | SPR4 | Feel that your life has meaning or purpose |
| | SPR5 | Experience joy in life |
| Nature | SPR6 | Feel connected to nature or wilderness |
| | SPR7 | Care for the natural world |
| Transcendent | SPR8 | Meditate or pray |
| | SPR9 | Feel a connection to a higher power |
| | SPR10 | Feel a sense of belonging to something greater than yourself[a] |

[a]New items added in the 2017/18 HBSC survey (not present on the 2013/14 HBSC 8-item scale)

## 5.3 Results

### 5.3.1 Exploratory Factor Analysis

The goal of the exploratory factor analysis was to determine the number of latent factors underlying the 10-item Spiritual Health Scale and estimate factor loadings for each of the spiritual health items (the manifest variables).

*Assumption testing.* Key assumptions were evaluated before the start of the analysis. The factorability of the 10-item scale was examined to determine if the manifest variables were correlated enough to be able to identify meaningful factors. Most correlations were at least 0.3 (reasonable factorability),[5] and no correlations exceeded 0.8, indicating that multicollinearity was likely not an issue. The overall Kaiser-Meyer-Olkin measure of sampling adequacy had a value of 0.85 and these values for individual items were all acceptable (>.5), suggesting that there was suitable intercorrelation to allow for factor analysis.[5] Initial communalities of the spiritual health items also showed a high proportion of common variance (>.5). Therefore, all ten Spiritual Health Scale items were deemed appropriate to include in the factor analysis.

A standard guideline for adequate sample size for factor analysis is a ratio of at least five subjects per manifest variable to be analyzed.[6] My sample of 18,232 students yielded a ratio of approximately 1800:1, meaning that this analysis should have been adequately powered for all planned analyses.

Several of the manifest variables had heavily left-skewed distributions (skew of ~ -2), potentially violating the assumption of multivariate normality. Although this assumption is considered to be robust,[7] this potential violation was considered in my choice of methodology.

*Type of Factor Analysis.* An iterated principal axis factor analysis was used for factor extraction. Although maximum likelihood methods are commonly used in exploratory factor analysis, a principal axis factor analysis was selected due to the highly left-skewed distributions of some of the spiritual health variables. Maximum likelihood methods require that the distribution of manifest variables is multivariate normal and can produce misleading results if this assumption is violated.[7] Principal axis factor analysis has been suggested to be a good alternative to maximum likelihood when normality assumptions are severely violated.[7]

Because spiritual health domains are theorized to be latent variables, factor analysis was chosen over principle components analysis. Furthermore, factor analysis allows for unique factors in the model rather than assuming that all variance is common, which may better account for intercorrelations among manifest variables.[7]

*Number of Factors Retained and Rotation.* Factor retention was determined using parallel analysis, a scree plot, and conceptual knowledge. A parallel analysis compares eigenvalues from the reduced correlation matrix with eigenvalues obtained from random data. Each eigenvalue of a correlation matrix is equal to the variance explained in the manifest variables by the corresponding factor.[6] The rationale for a parallel analysis is that the eigenvalues from the observed sample should be larger than the eigenvalues obtained from a corresponding "random" dataset (a dataset with the same sample size and number of manifest variables, but with no latent factors).[5] After 1000 iterations, only two observed eigenvalues were greater than the simulated eigenvalues, suggesting a two-factor solution (**Table 5.2**).

**Table 5.2.** Parallel analysis results comparing observed and simulated eigenvalues.

| Factor Position | Eigenvalue from Actual Data | Eigenvalue from Simulated Data |
|---|---|---|
| 1 | 5.12[a] | 1.04 |
| 2 | 1.71[a] | 1.03 |
| 3 | 0.82 | 1.02 |
| 4 | 0.70 | 1.01 |
| 5 | 0.38 | 1.00 |
| 6 | 0.37 | 1.00 |
| 7 | 0.26 | 0.99 |
| 8 | 0.24 | 0.98 |
| 9 | 0.21 | 0.97 |
| 10 | 0.19 | 0.96 |

[a]Eigenvalues from the reduced correlation matrix that are larger than those generated from the simulated random dataset (1000 iterations).

Additionally, a scree plot was generated to plot the eigenvalues of the correlation matrix against the corresponding factor number (**Figure 5.2**). The plot showed a rapid drop in additional explained variance after the first two eigenvalues, and then a smaller drop and plateau after the fourth eigenvalue. Therefore, while the scree plot supports both a two-factor or a four-factor solution, the largest amount of variance was accounted for in the four-factor solution.

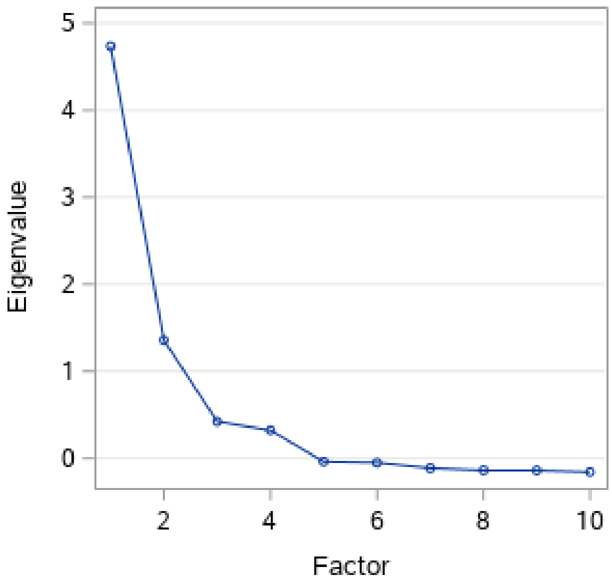


**Figure 5.2.** Scree Plot, plotting eigenvalues from the reduced correlation matrix against the number of common factors for the 10-item Spiritual Health Scale.

After four extracted factors, subsequent factors had little interpretability, as factors with single items were retained. A four-factor structure was deemed ideal due to the increased factor interpretability and theoretical basis of a four-domain spiritual health model. Next, the factor loading matrix was rotated for better interpretability of the solution. Factors were rotated for better interpretability using a Promax rotation,[8] an oblique rotation supported by SAS. Oblique rotations allow correlation among factors,[7] and domains were expected to correlate.

*Results.* The pattern matrix confirmed that each of the ten HBSC manifest variables loaded on the respective spiritual health domain that they were hypothesized to measure (**Table 5.3**). The original domain names were, therefore, selected as factor labels. All primary factor loadings were of moderate to high strength.[9] Questionnaire items 8-10 loaded highly on factor one, “transcendent” (loadings range from .60 to .86), items 1-3 on factor two, “others” (loadings range from .67 to .92), items 6-7 on factor three, “nature” (.82 and .79, respectively), and items

4-5 on factor four, "self" (.80 and .78, respectively). All cross-loadings of the variables on other factors were low (<.1). These patterns were also observed in the structure pattern matrix.

**Table 5.3.** Factor pattern matrix showing loadings and communalities for the final rotated component matrix.

| Manifest Variable | Factor 1 (Transcendent) | Factor 2 (Others) | Factor 3 (Nature) | Factor 4 (Self) | Communalities |
|---|---|---|---|---|---|
| SPR1 | -0.008 | **0.916** | -0.006 | 0.003 | 0.831 |
| SPR2 | 0.095 | **0.666** | 0.058 | 0.027 | 0.577 |
| SPR3 | -0.037 | **0.799** | 0.021 | 0.102 | 0.753 |
| SPR4 | 0.050 | 0.071 | 0.000 | **0.801** | 0.753 |
| SPR5 | -0.025 | 0.113 | 0.051 | **0.777** | 0.769 |
| SPR6 | 0.046 | -0.037 | **0.821** | 0.049 | 0.724 |
| SPR7 | -0.006 | 0.138 | **0.788** | -0.009 | 0.751 |
| SPR8 | **0.824** | 0.039 | 0.005 | -0.020 | 0.695 |
| SPR9 | **0.978** | -0.015 | -0.010 | -0.049 | 0.909 |
| SPR10 | **0.681** | 0.007 | 0.042 | 0.125 | 0.576 |

*Note*. Loadings for the extracted factors are bolded.

The final communality estimates after rotation were high, indicating that each item had a high proportion of variance explained by the extracted factors. Item 2 ("Be forgiving of others") and item 10 ("Feel a sense of belonging to something greater than yourself") had the lowest communalities (.58 each), while item 9 ("Feel a connection to a higher power") had the highest communality (.91).

The decision to allow for inter-factor correlations seemed to be warranted, as correlations of moderate strength were found between factors. Factor correlations ranged from weak ($r$=.35 between transcendent and others) to moderate ($r$=.65 between self and others).

In summary, the exploratory factor analysis suggested that the ten spiritual health items had four underlying latent factors, consistent with the four domains of spiritual health.[1,4] The domains of spiritual health were moderately correlated, and all primary loadings were high.[9]

### 5.3.2 Confirmatory Factor Analysis

A confirmatory factor analysis[10] tested the fit of the four-factor model of spiritual health. The four-factor model was also compared with a unidimensional model to determine which of the two provided the overall best fit.

*Hypothesized Model.* The hypothesized model of spiritual health connections was a four-factor structure, consistent with the four domains of spiritual health (**Figure 5.3**). These domains were hypothesized to represent latent variables, which loaded on two or three observed manifest variables. The four latent spiritual health domains were calculated as free parameters and hypothesized to be correlated. Unique item variances (error) were specified as uncorrelated free parameters. One loading for each latent variable was fixed to 1 to provide a reference scale to identify the model. Thus, there were six factor loadings to estimate as free parameters.

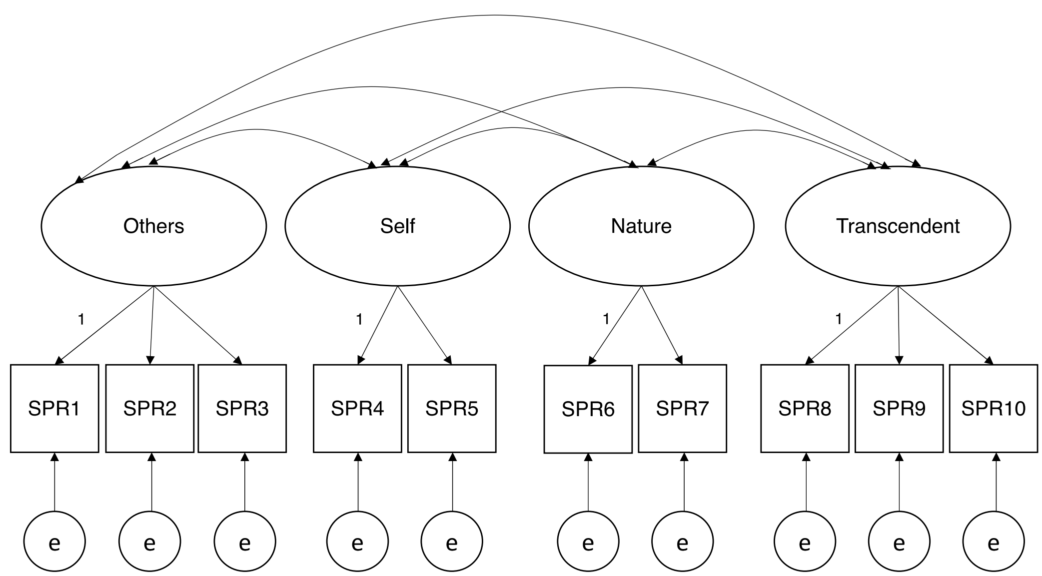


**Figure 5.3**. Hypothesized four-factor structure of the 10-item Spiritual Health Scale for confirmatory factor analysis, e=error.

It was also an objective to compare our four-factor model of spiritual health to a unidimensional model (**Figure 5.4**). The unidimensional model contends that there is only one latent factor and that spiritual health can be examined as a total sum score, regardless of domain.

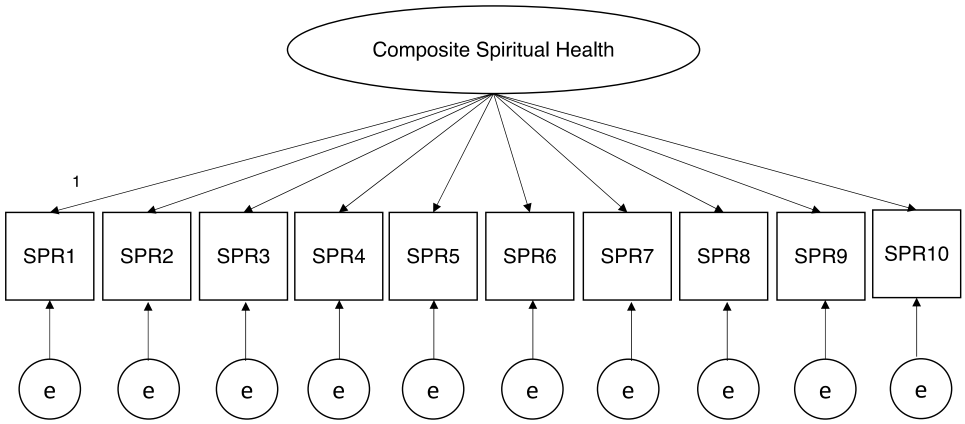


**Figure 5.4.** Hypothesized alternative unidimensional model of 10-item Spiritual Health Scale for confirmatory factor analysis, e=error.

*Assumption testing.* The assumptions for a confirmatory factor analysis are similar to those required for an exploratory factor analysis, and include multivariate normality, factorability and adequate sample size.[10] For stable parameter estimates a minimum ratio of 10:1 participants to each free parameter is recommended.[10] The four-factor model required estimation of 26 free parameters (6 factor loadings, 10 unique variances, and 10 covariances), which resulted in a ratio of approximately 701:1.

*Model Estimation.* A diagonally weighted least squares procedure was selected for parameter estimation. This method uses a weighted least squares estimator with the polychoric correlations of included variables to create the asymptotic covariance matrix.[11,12] Diagonally weighted least squares has been shown to produce less biased parameter estimates and standard error when used in factor analysis for ordinal variables.[11,12] Unlike the more common maximum likelihood estimation procedure, it does not require the multivariate normality of the manifest variables, circumventing potential violations by the spiritual health variables.

*Four-Factor Model Results.* **Figure 5.5** contains the standardized parameter estimates (factor loadings). The unstandardized estimates and the squared multiple correlation values are shown in **Table 5.4.** Correlation between factors ranged in strength, with the “self” and “others” domains having the strongest correlation ($r$=.75). The weakest correlations were between the "transcendent" and "others" domains ($r$=.41), and the transcendent and self domains ($r$=.41). This may suggest that the "transcendent" domain is the most distinct domain, conceptually.

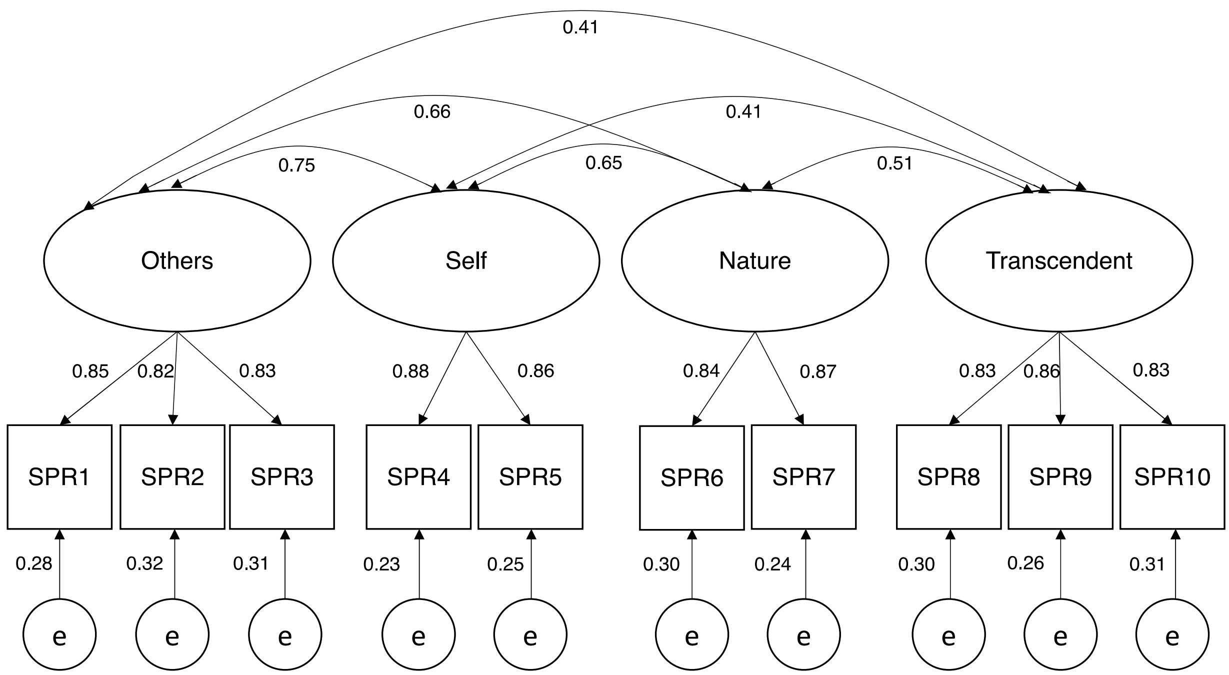


**Figure 5.5**. Standardized results from the confirmatory factor analysis for the four-factor spiritual health model. AGFI= 0.993, SRMR= 0.034, e=error.

**Table 5.4**. Standardized and unstandardized coefficients for the confirmatory factor analysis of the four-dimensional spiritual health model.

| Observed variable | Latent variable | Standardized coefficients | Unstandardized coefficients | Squared multiple correlation |
|---|---|---|---|---|
| SPR1 | Others | 0.85 | 1.00 | 0.72 |
| SPR2 | Others | 0.82 | 1.10 | 0.68 |
| SPR3 | Others | 0.83 | 0.92 | 0.69 |
| SPR4 | Self | 0.88 | 1.00 | 0.77 |
| SPR5 | Self | 0.86 | 0.86 | 0.75 |
| SPR6 | Nature | 0.84 | 1.00 | 0.70 |
| SPR7 | Nature | 0.87 | 0.94 | 0.76 |
| SPR8 | Transcendent | 0.83 | 1.00 | 0.70 |
| SPR9 | Transcendent | 0.86 | 1.03 | 0.74 |
| SPR10 | Transcendent | 0.83 | 0.97 | 0.69 |

Model fit was evaluated via parameter estimates, descriptive fit indices, and residuals. Overall, spiritual health domains explained a large amount of the variance in each spiritual health item in the four-factor model. Parameter estimates were high (Std. loadings range .82 to .88), but these values were plausible. The adjusted goodness of fit index (AGFI) and the standardized root mean square residual (SRMR) were used to quantify the discrepancy between the hypothesized model and the data. The AGFI had a value of .993, suggesting a good fit (>.95)[10] and the SRMR had a value of .034, below the recommended value of .08.[10] Standardized model residuals were also examined, as large values can indicate that the model is misspecified. The majority of the residuals were centred around zero, with no extreme values. No post-hoc model modifications were made, as both the fit indices and residuals pointed to good model fit.

*Unidimensional Model Results.* A confirmatory factor analysis was also performed for the unidimensional model, which submits that spiritual health has a single underlying factor and should be measured via a composite scale. While the factor loadings were smaller and explained less of the manifest variable variance than the four-domain model, loadings remained moderately strong (**Figure 5.6**). Absolute fit indices revealed a discrepancy between the unidimensional model and the data. Both indices fell outside acceptable ranges (AGFI=.907<0.95, SRMR=.153>.08),[10] indicating problems with model fit. Standardized residuals for the unidimensional model were larger than the four-dimensional spiritual health model, but still clustered around zero, with no major outliers.

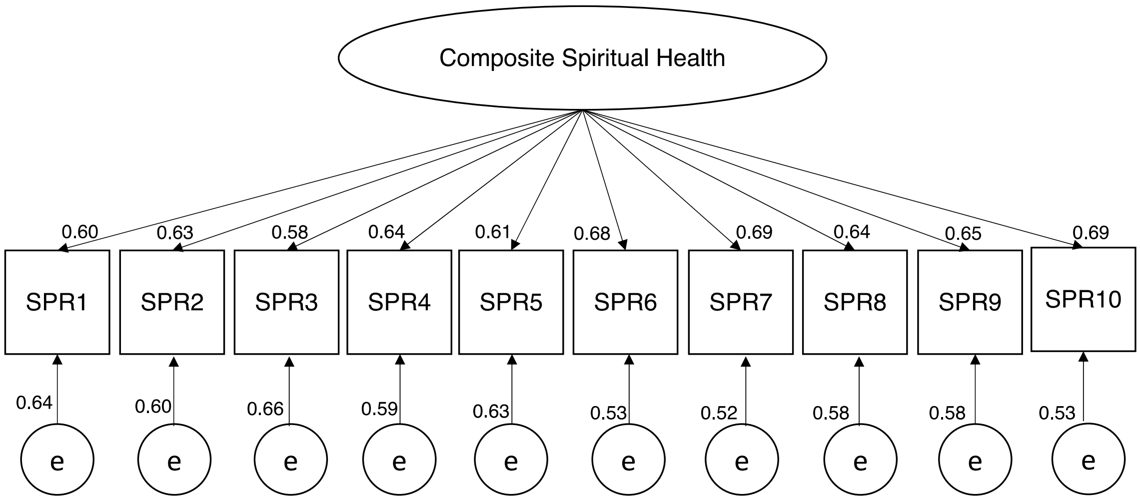


**Figure 5.6.** Standardized results from the confirmatory factor analysis for the unidimensional spiritual health model. AGFI=0.907, SRMR=0.153, e=error.

### 5.3.3 Internal Consistency of Scales

Scale reliability testing was conducted by calculating Cronbach's coefficient alpha, which represents the average correlation of items in a domain. Non-standardized alpha coefficients are reported, as it was not assumed that item variances were equal. The alphas for each spiritual health domain showed high levels of consistency: 0.87 for "others" (3 items), 0.86 for "self" (2 items), 0.83 for "nature" (2 items), and 0.88 for "transcendent" (3 items).

## 5.4 Discussion

The factor analysis supported a four-factor solution for the 10-item Spiritual Health Scale, confirming that the four-domain model is acceptable to measure spiritual health in young people. All items loaded highly on the domains that they were hypothesized to measure (Std. loadings >.80), and the spiritual health domains had strong internal consistency (Cronbach's alpha for each domain >.80). These findings are consistent with psychometric results from the 8-item HBSC Spiritual Health Scale.[1] Additionally, the current analysis found problems with model fit for the 10-item unidimensional scale, confirming that the four-factor structure is preferred over a unidimensional model.

The validation component of my thesis had several strengths; a large and representative sample of Canadian students allowed for a well-powered study to investigate the latent factors underlying the 10-item Spiritual Health Scale. I was able to confirm and support the use of a four-factor model to measure adolescent spiritual health in my thesis.

This analysis also had limitations that must be noted. Firstly, factor analysis results are optimal when factors are overdetermined (i.e. there are many manifest variables for the common factors). It is generally recommended to include at least 3 to 5 measured manifest variables for each common factor,[7] while this analysis was only performed with 2 or 3 variables per factor. However, this was necessary, as the HBSC requires the use of a succinct scale to minimize response burden in the young adolescent population of interest.[1] While it is possible that that factor solutions could be altered if more manifest variables were included, the clear agreement between our current results and previous findings for the 8-item scale provides strong support for a four-factor solution.

The possibility of sampling bias should also be considered. A number of students with missing spiritual health data were excluded from this analysis due to the list-wise deletion of incomplete cases. If students were not missing at random, it might have resulted in an unknown change in the variances and covariances of the latent variables, as well as factor loadings.[13]

Another potential limitation is introduction of bias related to the use of data from a complex survey design. The cluster sampling used in the HBSC could potentially result in a sample student population with reduced variance in spiritual health. Reduced variance will tend to attenuate correlations between manifest variables, which can, in turn, influence factor loadings and correlations among factors.[13]

### 5.5 Synopsis

In conclusion, both exploratory and confirmatory factor analyses indicated that the latent structure of this 10-item scale was consistent with the four domains established within the prior theoretical spiritual health literature. The four-domain model provided a better fit for the scale than the unidimensional model. Additionally, the 10-item Spiritual Health Scale had good psychometric properties, both in terms of structural validity and internal consistency, reinforcing its utility as a measure of adolescent spiritual health in this thesis. In the next chapter I will present more supplementary findings related to my manuscript.

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# Chapter 6: Supplementary Results II

# Descriptive Findings and Sensitivity Analyses

## 6.1 Overview

This supplementary chapter presents findings that were not thoroughly presented in my thesis manuscript, i.e., (1) those related to the descriptive objective of my thesis, (2) results from a sensitivity analysis conducted in support of my primary manuscript findings; (3) a missing data analysis.

Concerning descriptive findings, sociodemographic patterns that describe variations in the prevalence of bullying victimization, subjective health complaints, and the domain-specific spiritual health connections will be profiled. This provides new information on the current burden of bullying victimization faced in schools by Canadian adolescents, and in turn, informs where future public health resources and clinical interventions should be directed.

The sensitivity analysis results are also important and discuss the impact of excluding bully-victims from my analytical sample. Bully-victims were excluded from the sample, as this combined exposure was expected to result in differential and potentially more severe effects on adolescent subjective health compared to students who were “victimized only”.

Lastly, I address and quantify the impact of missing data on my etiological findings. This supports the use of a complete case analysis in my thesis.

## 6.2 Sociodemographic Patterns in the Prevalence of Bullying Victimization

In **Table 6.1**, findings describing the prevalence of bullying victimization are presented, both overall and by population subgroup.  Approximately 21% (95% CI: 19% to 23%) of the total analytic sample reported that they were victimized in this manner. The proportion of victimized students was the highest among younger students (26% girls, 20% boys), and decreased in older age groups (22% girls, 15% boys). Irrespective of age, more girls reported that they were bullied than boys (24% girls, 18% boys).

Approximately 20% (95% CI: 18% to 22%) of participants reported that they were victimized by a specific subtype of bullying. Gender and age patterns showed some consistency: a higher proportion of girls reported experiencing some subtype of bullying victimization (22% girls, 16% boys), and the proportions that were victimized decreased with increasing age among both girls and boys. Approximately 9% of all students (11% girls, 7% boys) reported multiple forms of bullying victimization, followed by 5% (both genders) who only had exposure to direct forms of victimization, and 4% (5% girls, 3% boys) who experienced indirect forms alone. The prevalence of victimization by these subtypes was higher among younger participants than older. Only 1% of students (of both genders) were victimized solely by cyberbullying, indicating a substantial overlap between traditional and cyberbullying victimization.

**Table 6.1** Epidemiological description of the prevalence of subtypes of bullying victimization in the analytical sample, stratified by age (grade) and gender.

| Age Group | All ages | | | Younger Grades | | | Older Grades | | |
|---|---|---|---|---|---|---|---|---|---|
| | N | Col %[a] | 95% CI | N | Col %[a] | 95% CI | N | Col %[a] | 95% CI |
| Girls (n=7094) | | | | | | | | | |
| Not bullied | 5503 | 78 | 75 to 80 | 3076 | 77 | 74 to 79 | 2427 | 79 | 76 to 82 |
| Direct | 356 | 5 | 4 to 6 | 211 | 5 | 4 to 6 | 145 | 5 | 3 to 6 |
| Indirect | 389 | 5 | 4 to 6 | 206 | 5 | 4 to 6 | 183 | 6 | 4 to 7 |
| Cyberbullying | 61 | 1 | <1 to 1 | 32 | 1 | <1 to 1 | 29 | 1 | <1 to 1 |
| Multiple forms | 785 | 11 | 10 to 13 | 486 | 12 | 10 to 14 | 299 | 10 | 7 to 12 |
| Boys (n=5813) | | | | | | | | | |
| Not bullied | 4867 | 84 | 82 to 84 | 2810 | 82 | 79 to 84 | 2057 | 87 | 84 to 90 |
| Direct | 295 | 5 | 4 to 6 | 197 | 6 | 4 to 7 | 98 | 4 | 3 to 5 |
| Indirect | 165 | 3 | 2 to 3 | 113 | 3 | 2 to 4 | 52 | 2 | 1 to 3 |
| Cyberbullying | 55 | 1 | <1 to 1 | 36 | 1 | 1 to 2 | 19 | 1 | <1 to 1 |
| Multiple forms | 431 | 7 | 6 to 9 | 281 | 8 | 7 to 10 | 150 | 6 | 5 to 8 |

*Note.* All sample frequencies are weighted to ensure provincial and territorial representativeness by grade. 95% confidence intervals (CI) were generated to account for clustered sampling. [a]Column percentages are reported (proportion of students who report a subtype of bullying victimization out of all students in that gender/age category.

### 6.3 Sociodemographic Patterns in the Prevalence of Subjective Health Complaints

My outcome describing frequent subjective health complaints was primarily treated in a binary fashion. To facilitate the exploration of sociodemographic patterns in the distribution of health complaints, I also examined the health complaints scale as a continuous measure (range 0 to 32) in this section. Differences in mean health complaints scores were examined between gender and age groups.

Overall, girls of all ages appeared to have higher subjective health scale scores than boys (10.0 vs. 6.5, p-value = <.0001). This can be interpreted as girls having either more frequent health complaints or a greater range of the eight measured symptoms. For girls, average scores appeared to increase with student age (younger girls 9 vs. older girls 12, p-value = <.0001), while this trend was reversed for boys (younger boys 12 vs. older boys 6, p-value = <.0001).

### 6.4 Sociodemographic Patterns in the Prevalence of Spiritual Health Connections

Spiritual health connections are described in detail in **Table 6.2**. A higher proportion of girls reported stronger indications of the importance of connections within each of the four domains than boys (**Table 6.2**). In both boys and girls, the proportion of students reporting high connections to “nature” and “transcendent” decreased in older age groups, suggestive of potential age-related or developmental effects. Conversely, the proportion of students reporting strong connections to “self” or “others” remained consistent across the various age groups.

Across all gender and age groups, higher proportions of students reported strong connections to the “self” and “others” domains. The majority of students had high scores for the “self” domain scale (81% boys, 85% girls) and “others” domain scale (79% boys, 86% girls). Participating students also appeared to place strong importance on connections to nature, as approximately 72% of girls and 64% of boys had scores in the high range on this scale. Students reported lower perceived importance of connections to the transcendent, with the majority of students (79% boys, 86% girls) reporting lower connections to this domain

**Table 6.2** Epidemiological description of the perceived importance of the four spiritual health domains in the analytical sample, stratified by age (grade) and gender.

| Age group | All ages | | | Younger Grades (6-8) | | | Older Grades (9-10) | | |
|---|---|---|---|---|---|---|---|---|---|
| Spiritual Health Domain | N | Column %[a] | 95% CI | N | Column %[a] | 95% CI | N | Column %[a] | 95% CI |
| Girls (n=7094) | | | | | | | | | |
| Self | | | | | | | | | |
| Low | 1075 | 15 | 14 to 16 | 627 | 16 | 14 to 18 | 448 | 15 | 13 to 16 |
| High | 6019 | 85 | 84 to 86 | 3384 | 84 | 82 to 86 | 2635 | 85 | 84 to 87 |
| Others | | | | | | | | | |
| Low | 963 | 14 | 12 to 15 | 516 | 13 | 11 to 14 | 447 | 15 | 12 to 17 |
| High | 6131 | 86 | 85 to 88 | 3495 | 87 | 86 to 89 | 2637 | 85 | 83 to 88 |
| Nature | | | | | | | | | |
| Low | 1960 | 28 | 25 to 30 | 919 | 23 | 20 to 26 | 1041 | 34 | 31 to 36 |
| High | 5134 | 72 | 70 to 75 | 3092 | 77 | 74 to 80 | 2042 | 66 | 64 to 69 |
| Transcendent | | | | | | | | | |
| Low | 4802 | 68 | 64 to 71 | 2635 | 66 | 62 to 69 | 2166 | 70 | 65 to 75 |
| High | 2293 | 32 | 29 to 36 | 1376 | 34 | 31 to 38 | 917 | 30 | 25 to 35 |
| Boys (n=5813) | | | | | | | | | |
| Self | | | | | | | | | |
| Low | 1085 | 19 | 17 to 20 | 628 | 18 | 16 to 21 | 457 | 19 | 17 to 22 |
| High | 4728 | 81 | 80 to 83 | 2808 | 82 | 79 to 84 | 1919 | 81 | 78 to 83 |
| Others | | | | | | | | | |
| Low | 1220 | 21 | 19 to 23 | 705 | 21 | 18 to 23 | 515 | 22 | 19 to 24 |
| High | 4593 | 79 | 77 to 81 | 2732 | 79 | 77 to 82 | 1861 | 78 | 76 to 81 |
| Nature | | | | | | | | | |
| Low | 2069 | 36 | 33 to 38 | 1036 | 30 | 27 to 33 | 1033 | 43 | 40 to 47 |
| High | 3744 | 64 | 62 to 67 | 2401 | 70 | 67 to 73 | 1344 | 57 | 53 to 60 |
| Transcendent | | | | | | | | | |
| Low | 4151 | 71 | 68 to 75 | 2407 | 70 | 66 to 74 | 1744 | 73 | 69 to 78 |
| High | 1663 | 29 | 25 to 32 | 1030 | 30 | 26 to 34 | 633 | 27 | 22 to 31 |

*Note.* Low scores for the self and nature domains range from 0-5, and high scores 6-8. Low scores for the others and transcendent domains range from 0-8, and high scores 9-12.
All sample frequencies are weighted to ensure provincial and territorial representativeness by grade. 95% confidence intervals (CI) were generated to account for clustered sampling.
[a]Column percentages are reported (proportion of students in a domain score range out of all students in that gender/age category.

## 6.5 Sensitivity Analyses

### 6.5.1 Bully-victims

The small subset of bullied young people who identified as "bully-victims" (those who both perpetrate bullying and who are bullied themselves) was excluded from the analytic sample. Bully-victims are known to experience increased risks for psychosocial consequences compared to those only involved in one aspect of bullying.[1,2] Possible mental health consequences of experiencing such behaviours include increased subjective health complaints,[3] depressive symptoms,[4] and suicidal ideation and behaviours.[5] *A priori,* bully-victims were therefore expected to critically differ from "victimized only" students in their subjective health. To maintain a homogenous sample when quantifying the strength of exposure effects, this group was excluded.

A sensitivity analysis was performed to determine the impact of this specific exclusion on the parameter estimates of interest (relative risk for the effect of bullying victimization on health complaints, estimated by level of spiritual health, age and gender) (**Table 6.3**). This analysis showed that the inclusion of bully-victims in the sample exerted only a minimal impact on the strength of most relative risk estimates. Minor increases in estimate precision were also observed. However, the inferences drawn from both analyses are equivalent, and the same contrasts were found to be statistically significant in both samples (i.e., effect modification by "self-connections" was observed for girls in both older and younger age groups).

**Table 6.3** Sensitivity analysis to determine the effect of excluding bully-victims from the analytic sample on relative risk estimates of the association between exposure to any bullying victimization and high subjective health complaints.[a]

| Relative risk estimate | Bully-victims excluded (n=12,593) | 95% CI | Bully-victims included (n=13,724) | 95% CI | % Change |
|---|---|---|---|---|---|
| Girls grades 6 - 8 | | | | | |
| Low spiritual health (ref) | 1.21 | 1.01 to 1.45 | 1.24 | 1.06 to 1.45 | 3 |
| High self | **1.63** | **1.26 to 2.12** | **1.70** | **1.34 to 2.16** | 4 |
| High others | 1.35 | 1.11 to 1.64 | 1.37 | 1.14 to 1.65 | 2 |
| High nature | 1.24 | 0.99 to 1.55 | 1.25 | 1.01 to 1.53 | 0 |
| High transcendent | 1.24 | 0.94 to 1.64 | 1.30 | 1.02 to 1.66 | 5 |
| Girls grades 9 -10 | | | | | |
| Low spiritual health (ref) | 1.03 | 0.91 to 1.17 | 1.04 | 0.92 to 1.17 | 1 |
| High self | **1.25** | **1.06 to 1.47** | **1.26** | **1.08 to 1.46** | 1 |
| High others | 1.08 | 0.94 to 1.24 | 1.10 | 0.97 to 1.26 | 2 |
| High nature | 1.03 | 0.88 to 1.22 | 1.02 | 0.88 to 1.18 | -1 |
| High transcendent | 1.13 | 0.93 to 1.37 | 1.15 | 0.95 to 1.39 | 2 |
| Boys grades 6 - 8 | | | | | |
| Low spiritual health (ref) | 1.48 | 1.12 to 1.95 | 1.45 | 1.14 to 1.86 | -2 |
| High self | 1.98 | 1.30 to 3.01 | 1.96 | 1.35 to 2.85 | -1 |
| High others | 1.87 | 1.36 to 2.57 | 1.87 | 1.39 to 2.50 | 0 |
| High nature | 1.40 | 0.94 to 2.07 | 1.43 | 1.00 to 2.04 | 2 |
| High transcendent | 1.17 | 0.76 to 1.80 | 1.20 | 0.80 to 1.80 | 3 |
| Boys grades 9 - 10 | | | | | |
| Low spiritual health (ref) | 1.73 | 1.43 to 2.08 | 1.67 | 1.43 to 1.95 | -3 |
| High self | 1.83 | 1.30 to 2.58 | 2.02 | 1.53 to 2.66 | 10 |
| High others | 1.83 | 1.40 to 2.39 | 1.75 | 1.34 to 2.28 | -5 |
| High nature | 1.38 | 1.00 to 1.92 | 1.44 | 1.05 to 1.98 | 4 |
| High transcendent | 2.00 | 1.32 to 3.01 | 1.77 | 1.23 to 2.55 | -12 |

*Note*. Statistically significant contrasts ($p<.05$) between relative risk estimates for students with high spiritual health and relative risk estimates for students with low spiritual health are bolded. Each linear combination of the parameter estimates was tested ($L'\beta=0$) using a generalized score statistic for GEE models.

[a]Relative risks are estimated separately by level of spiritual health, gender and grade.

### 6.5.2 Missing Data Analysis

The HBSC questionnaire is lengthy and asks a broad range of health-related questions. The survey is voluntary, and participating students were not required to complete it in its entirety and were instructed to leave any questions they did not wish to answer blank. This resulted in a large amount of missing data; 35% of the 2017/18 sample had at least one missing value for our variables of interest.

In the end, a complete case sample was employed as a missing data approach in the regression analysis. A multiple imputation approach was also considered. Simulation studies have shown that complete case analysis for binary outcomes generally yields unbiased estimates, as long as data are missing at random.[6] If there is selection bias in the sample, both complete case and multiple imputation methods have been shown to yield biased risk estimates.[6,7]

In an attempt to assess the impact of excluding students with missing data, distributions of key study variables and confounders were compared between the complete case sample and in excluded students who had provided data for that variable (**Table 6.4**). The reported prevalence of exposure to any bullying was similar between students included and excluded from the analysis (24% vs. 25%), and the same proportion (33%) of included and excluded students reported high levels of subjective health complaints. Furthermore, the distribution of self-rated importance of spiritual health connections was similar between both groups, with one exception; excluded students had reported higher importance of connections to the transcendent than included (69% vs. 32%; p=.0083).

To examine the impact of my choice of using a complete case sample, a sensitivity analysis was conducted where the most extreme patterns of missing data were imputed and analyzed. Eight different extreme value scenarios were created, where all missing data were imputed as one value for each of the exposure, outcome and effect modifier variables (i.e., all missing students imputed as "exposed" or "unexposed" for bullying victimization, "yes" or "no" frequent health complaints, and "high" or "low" levels of spiritual health for each domain). The multivariable analysis using the complete case sample was compared to results from models 1 to 8, each showing a different extreme combination of the exposure, outcome and primary effect modifier categories. In reality, it is very unlikely that all missing data fell into the same category for each key variable, as the distribution of our primary variables were similar between included complete cases and excluded students.

**Table 6.5** shows the results of this sensitivity analysis. The "extreme scenario" imputation models differed in both the strength and significance of effect modification for many of the spiritual health domains. This result is not unexpected due to the large amount of missing data and the extreme imputation scenarios. This analysis revealed that in the majority of extreme missing data scenarios, relative risk estimates were further from the null than actually observed using the complete case sample. Statistically significant effect modification by the spiritual health domains was found in several of the sociodemographic groups that were not present when using a complete case sample. However, there was consistency between models in effect modification by "connections to self" among girls, with girls with higher "self-levels" showing stronger associations in most models. This lends support to the results and theory drawn from the complete case analysis. Overall, this analysis demonstrated that the use of a complete case sample likely biased the observed risk estimates closer to the null, rather than further away. This suggests that for any observed association in our analysis, the true effect could be greater. There was also likely an increased risk of making a type II error and missing a true effect of spiritual health connections on our associations of interest.

**Table 6.4** Comparison of the distribution of sociodemographic characteristics (unweighted) and key covariates between students included in the final analytic sample and those excluded.

| | Included in analysis (N=12593) Column % | Excluded from analysis (N=7354) Column % |
|---|---|---|
| Age (years) | | |
| <=12 | 28 | 37 |
| 13-14 | 43 | 41 |
| >=15 | 29 | 22 |
| | | |
| Race/Ethnicity | | |
| White | 69 | 63 |
| Black | 3 | 5 |
| East Indian & South Asian | 3 | 3 |
| East & Southeast Asian | 3 | 3 |
| Indigenous | 6 | 9 |
| Arab & West Asian | 1 | 2 |
| Latin American | 1 | 1 |
| Other | 14 | 14 |
| | | |
| Immigration status | | |
| Born in Canada | 79 | 77 |
| Immigrated >5 years | 15 | 16 |
| Immigrated 1-5 years | 6 | 7 |
| | | |
| Perceived socioeconomic status | | |
| 1 ("Not at all well off") | 3 | 3 |
| 2 ("Not very well off") | 6 | 6 |
| 3 ("Average") | 37 | 39 |
| 4 ("Quite well off") | 29 | 26 |
| 5 ("Very well off") | 25 | 26 |
| | | |
| Subjective Health Complaints | | |
| Low | 33 | 36 |
| Medium | 33 | 31 |
| High | 33 | 33 |
| | | |
| Bullying Victimization (any form) | | |
| Bullied | 24 | 25 |
| Non-bullied | 76 | 75 |
| | | |
| Bullying Victimization (subtypes) | | |
| Not bullied | 78 | 77 |
| Direct | 5 | 5 |
| Indirect | 5 | 5 |
| Cyberbullying | 1 | 1 |

| | | |
|---|---|---|
| Multiple forms | 11 | 11 |
| Connections to self | | |
| 0 to 2 | 4 | 5 |
| 3 to 5 | 14 | 16 |
| 6 to 8 | 83 | 80 |
| Connections to others | | |
| 0 to 3 | 2 | 2 |
| 4 to 8 | 15 | 17 |
| 9 to 12 | 83 | 80 |
| Connections to nature | | |
| 0 to 2 | 6 | 7 |
| 3 to 5 | 24 | 25 |
| 6 to 8 | 70 | 69 |
| Connections to transcendent | | |
| 0 to 3 | 30 | 7 |
| 4 to 8 | 38 | 25 |
| 9 to 12 | 32 | 69 |
| Family Support Scale[a] | | |
| Mean | 16.2 | 15.5 |
| Median | 18 | 17 |
| Social Capitol Scale[b] | | |
| Mean | 13.8 | 13.5 |
| Median | 14 | 14 |
| School Climate Scale[c] | | |
| Mean | 10.6 | 10.3 |
| Median | 11 | 11 |
| Teacher Support Scale[d] | | |
| Mean | 23.0 | 22.4 |
| Median | 23 | 23 |

[a]Family Support scale (4-item scale, score range 0-24)
[b]Neighborhood Social Capital (5-item scale, score range 0-20)
[c]School Climate scale (4-item scale, score range 0-16)
[d]Teacher Support scale (8-item scale, score range 0-32)

**Table 6.5**. Results of the multivariable Modified Poisson regression models assuming extreme missing data scenarios for bullying victimization, subjective health complaints and spiritual health connections. Relative risk estimates are shown for the association between bullying victimization and high subjective health complaints, estimated by level of spiritual health, gender and grade.

| | Complete Case | Model 1[a] | Model 2[b] | Model 3[c] | Model 4[d] | Model 5[e] | Model 6[f] | Model 7[g] | Model 8[h] |
|---|---|---|---|---|---|---|---|---|---|
| <u>Girls Grades 6 - 8</u> | | | | | | | | | |
| Low spiritual health | 1.21 | 2.07 | 0.70 | 0.39 | 3.03 | 1.18 | 1.42 | 1.34 | 1.17 |
| | (1.01, 1.45) | (1.82, 2.36) | (0.61, 0.79) | (0.31, 0.48) | (2.50, 3.66) | (0.99, 1.41) | (1.18, 1.70) | (1.12, 1.62) | (0.98, 1.40) |
| High self | **1.63** | **2.54** | **1.08** | **0.59** | 3.33 | **1.72** | 1.69 | 1.58 | **1.65** |
| | **(1.26, 2.12)** | **(2.04, 3.16)** | **(0.87, 1.33)** | **(0.44, 0.80)** | (2.43, 4.57) | **(1.34, 2.22)** | (1.32, 2.17) | (1.21, 2.07) | **(1.27, 2.15)** |
| High others | 1.35 | 1.73 | **1.10** | **0.94** | **1.93** | 1.35 | 1.59 | 1.48 | 1.31 |
| | (1.11, 1.64) | (1.44, 2.08) | **(0.94, 1.29)** | **(0.75, 1.18)** | **(1.50, 2.49)** | (1.12, 1.64) | (1.32, 1.93) | (1.22, 1.79) | (1.07, 1.59) |
| High nature | 1.24 | 1.85 | **0.89** | **0.53** | 2.41 | 1.27 | 1.35 | 1.33 | 1.25 |
| | (0.99, 1.55) | (1.50, 2.28) | **(0.74, 1.06)** | **(0.40, 0.71)** | (1.76, 3.29) | (1.02, 1.58) | (1.08, 1.68) | (1.06, 1.67) | (0.99, 1.56) |
| High transcendent | 1.24 | 2.19 | 0.71 | 0.38 | 3.18 | **1.76** | **0.77** | **0.63** | **1.86** |
| | (0.94, 1.64) | (1.74, 2.76) | (0.56, 0.89) | (0.28, 0.50) | (2.38, 4.24) | **(1.36, 2.27)** | **(0.59, 1.01)** | **(0.46, 0.86)** | **(1.41, 2.45)** |
| <u>Girls Grades 9 - 10</u> | | | | | | | | | |
| Low spiritual health | 1.03 | 1.42 | 0.84 | 0.36 | 2.17 | 1.06 | 1.12 | 1.11 | 1.01 |
| | (0.91, 1.17) | (1.29, 1.57) | (0.77, 0.91) | (0.30, 0.43) | (1.87, 2.53) | (0.94, 1.20) | (0.99, 1.27) | (0.98, 1.25) | (0.89, 1.13) |
| High self | **1.25** | 1.61 | **1.13** | **0.53** | 1.92 | **1.29** | **1.35** | 1.28 | **1.21** |
| | **(1.06, 1.47)** | (1.38, 1.87) | **(0.98, 1.32)** | **(0.43, 0.66)** | (1.56, 2.35) | **(1.10, 1.53)** | **(1.15, 1.59)** | (1.08, 1.51) | **(1.02, 1.43)** |
| High others | 1.08 | 1.26 | **1.03** | **0.79** | **1.47** | 1.12 | 1.14 | 1.15 | 1.08 |
| | (0.94, 1.24) | (1.11, 1.43) | **(0.91, 1.16)** | **(0.66, 0.94)** | **(1.24, 1.74)** | (0.98, 1.28) | (1.00, 1.30) | (0.99, 1.33) | (0.94, 1.24) |
| High nature | 1.03 | 1.36 | 0.88 | **0.44** | 2.02 | 1.11 | 1.06 | 1.04 | 1.07 |
| | (0.88, 1.22) | (1.18, 1.58) | (0.78, 1.00) | **(0.35, 0.55)** | (1.66, 2.46) | (0.95, 1.28) | (0.91, 1.24) | (0.88, 1.23) | (0.91, 1.25) |
| High transcendent | 1.13 | 1.58 | 0.91 | 0.38 | 2.41 | **1.43** | **0.90** | **0.55** | **1.62** |
| | (0.93, 1.37) | (1.32, 1.89) | (0.78, 1.07) | (0.30, 0.47) | (1.94, 2.98) | **(1.19, 1.72)** | **(0.75, 1.08)** | **(0.43, 0.70)** | **(1.31, 1.99)** |
| <u>Boys Grades 6 - 8</u> | | | | | | | | | |
| Low spiritual health | 1.48 | 3.24 | 0.65 | 0.44 | 2.97 | 1.38 | 1.97 | 1.58 | 1.43 |
| | (1.12, 1.95) | (2.66, 3.93) | (0.54, 0.78) | (0.33, 0.59) | (2.24, 3.93) | (1.05, 1.81) | (1.48, 2.61) | (1.19, 2.08) | (1.09, 1.88) |
| High self | 1.98 | 3.72 | **1.29** | **0.75** | 2.99 | **2.15** | 2.37 | 1.99 | 1.97 |
| | (1.30, 3.01) | (2.62, 5.28) | **(0.90, 1.85)** | **(0.45, 1.25)** | (1.85, 4.82) | **(1.42, 3.24)** | (1.58, 3.55) | (1.29, 3.08) | (1.28, 3.03) |
| High others | 1.87 | 2.87 | **1.34** | **1.16** | 2.58 | 1.91 | 2.35 | 1.92 | 1.84 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1.36, 2.57) | (2.17, 3.85) | **(1.04, 1.73)** | **(0.77, 1.73)** | (1.75, 3.80) | (1.41, 2.61) | (1.74, 3.18) | (1.39, 2.67) | (1.33, 2.54) |
| High nature | 1.40 | **2.28** | 0.71 | 0.60 | 2.51 | 1.30 | **1.37** | 1.47 | 1.45 |
| | (0.94, 2.07) | **(1.61, 3.22)** | (0.52, 0.97) | (0.36, 1.00) | (1.61, 3.92) | (0.88, 1.93) | **(0.95, 1.97)** | (0.98, 2.19) | (0.97, 2.18) |
| High transcendent | 1.17 | 2.70 | 0.55 | 0.33 | 2.31 | **2.66** | **0.60** | **0.46** | 1.73 |
| | (0.76, 1.80) | (1.87, 3.91) | (0.37, 0.83) | (0.21, 0.50) | (1.49, 3.58) | **(1.79, 3.97)** | **(0.39, 0.90)** | **(0.29, 0.71)** | (1.10, 2.71) |
| Boys Grades 9 - 10 | | | | | | | | | |
| Low spiritual health | 1.73 | 3.00 | 0.91 | 0.54 | 2.96 | 1.70 | 1.97 | 1.87 | 1.71 |
| | (1.43, 2.08) | (2.61, 3.44) | (0.78, 1.07) | (0.42, 0.68) | (2.42, 3.61) | (1.40, 2.06) | (1.63, 2.38) | (1.55, 2.25) | (1.42, 2.06) |
| High self | 1.83 | 2.54 | **1.28** | **0.79** | 2.43 | 1.68 | 2.09 | 1.99 | 1.77 |
| | (1.30 to 2.58) | (1.92, 3.37) | **(0.94, 1.74)** | **(0.49, 1.26)** | (1.63, 3.62) | (1.19, 2.36) | (1.50. 2.91) | (1.39, 2.85) | (1.25, 2.51) |
| High others | 1.83 | 2.44 | **1.48** | **1.30** | 2.33 | 1.90 | 2.00 | 1.96 | 1.86 |
| | (1.40, 2.39) | (1.73, 3.16) | **(1.19, 1.85)** | **(0.94, 1.80)** | (1.70, 3.20) | (1.46, 2.47) | (1.53, 2.61) | (1.47, 2.61) | (1.42, 2.43) |
| High nature | 1.38 | 2.34 | 0.84 | 0.47 | **2.22** | 1.75 | **1.35** | **1.20** | 1.46 |
| | (1.00, 1.92) | (1.73, 3.16) | (0.63, 1.12) | (0.32, 0.68) | **(1.57, 3.14)** | (1.28, 2.37) | **(1.00, 1.84)** | **(0.81, 1.76)** | (1.05, 2.04) |
| High transcendent | 2.00 | 3.46 | 1.04 | 0.63 | 3.51 | **3.75** | **1.04** | **0.67** | **3.09** |
| | (1.32, 3.01) | (2.36, 5.06) | (0.70, 1.53) | (0.39, 1.03) | (2.30, 5.35) | **(2.57, 5.47)** | **(0.73, 1.47)** | **(0.38, 1.18)** | **(2.04, 4.69)** |

*Note*. Statistically significant contrasts ($p<.05$) between relative risk estimates for students with high spiritual health and relative risk estimates for students with low spiritual health are bolded. Each linear combination of the parameter estimates was tested ($L'\beta=0$) using a generalized score statistic for GEE models.

[a]Model 1: Assume missing students have been exposed to bullying victimization, have high subjective health complaints and that all spiritual health connections are “low”

[b]Model 2: Assume missing students have not been exposed to bullying victimization, have high subjective health complaints and that all spiritual health connections are “low”

[c]Model 3: Assume missing students have been exposed to bullying victimization, have low subjective health complaints and that all spiritual health connections are “low”

[d]Model 4: Assume missing students have not been exposed to bullying victimization, have low subjective health complaints and that all spiritual health connections are “low”

[e]Model 5: Assume missing students have been exposed to bullying victimization, have high subjective health complaints and that all spiritual health connections are “high”

[f]Model 6: Assume missing students have not been exposed to bullying victimization, have high subjective health complaints and that all spiritual health connections are “high”

[g]Model 7: Assume missing students have been exposed to bullying victimization, have low subjective health complaints and that all spiritual health connections are “high”

[h]Model 8: Assume missing students have not been exposed to bullying victimization, have low subjective health complaints and that all spiritual health connections are “high”

### 6.6 Synopsis: Supplementary Findings

In this supplementary chapter, I profiled sociodemographic patterns in the prevalence of my key study variables. The major sociodemographic findings were:

(1) Approximately 21% of participants reported experiences of bullying victimization, consistent with past national estimates);[8]

(2) Most students reported that they were exposed to multiple subtypes of victimization;

(3) Very few participants reported victimization by cyberbullying alone. This was not entirely unexpected based on past analyses;[4,9] however, it did have repercussions for my analytical objective, as the extremely low prevalence meant that I was unable to examine cyberbullying victimization alone in my "subtypes" exposure analytical model.

(4) Girls of all ages faced higher levels of victimization than boy and reported higher levels of subjective health complaints. These results were consistent with prior literature[8,10] and suggest that future public health efforts should focus on this gender-based disparity and target interventions that could mitigate these disparities.

(5) Girls reported stronger connections to all four spiritual health domains than boys.[11,12] Among all gender and age groups, participants reported the strongest connections to the "self" and "others" domains, suggesting that these domains continue to be particularly salient resources to adolescents as they develop.[11,12]

The final section of this chapter presented findings related to two methodological issues. They are presented in the form of sensitivity analyses:

(1) The first sensitivity analysis examined the impact of excluding "bully-victims" from our analytic sample. While there were minor shifts in the strength and precision of the relative risk

estimates between samples, the overall impact appeared minor and there were no changes in the inferences drawn between analyses.

(2) The second analysis explored the potential impact of missing data on my primary findings. Excluded students were younger and had stronger connections to the transcendent domain, but there were no observed differences in health complaints, bullying victimization, gender, race/ethnicity, immigration background or perceived socioeconomic status. A related sensitivity analysis revealed that, in the most extreme missing data scenarios for combinations of our key variables, effects were biased away from the null. This suggests that my use of a complete case sample could have biased the observed relative risk estimates towards the null.

## 6.7 References


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# Chapter 7: General Discussion

## 7.1 Summary of Main Findings

The primary purpose of this thesis was to quantify the strength and significance of associations between exposure to bullying victimization and poor internalized mental health (more frequent subjective health complaints) among young Canadians and determine if connections afforded by spiritual health connections act as effect modifiers in such relationships. Additionally, I examined variations in these relationships between specific groups defined by age and gender. As foundational work for this study, I explored the validity of a 10-item HBSC Spiritual Health scale and estimated its basic psychometric properties. Sociodemographic patterns in the prevalence of my key study variables (bullying victimization, spiritual health connections, and health complaints as my indicator of poor internalized mental health) were also profiled.

*Assessment of Spiritual Health (Objective 1).* With respect to the HBSC measure used to assess the importance of spiritual health, exploratory and confirmatory factor analyses indicated that the latent structure of this 10-item scale was consistent with the four domains established within the prior theoretical spiritual health literature. The scale also had good psychometric properties and internal consistency, reinforcing its utility as a measure of adolescent spiritual health.

*Key Descriptive Information (Objective 2).* Approximately 21% of participants reported experiences of bullying victimization, with a higher prevalence reported by girls and among younger students. For bullying subtypes, the highest number of students reported that they were exposed to multiple forms of bullying victimization, and the fewest reported victimization by cyberbullying alone.

Consistent with prior literature,[1] girls reported more frequent health complaints than boys. Girls also reported stronger connections to all four spiritual health domains. Among all participants, connections to the "self" and "others" were considered to be more important, while connections to the "nature" and "transcendent" domains were perceived as less important.

*Potential Etiology (Objective 3).* The main etiological finding was that, contrary to my hypothesis, the strength of the relationship between bullying victimization and frequent health complaints was strongest among girls who placed high importance on their connections to self. The same relationship was weaker or absent in girls who placed lower importance on connections to self. This effect was observed in both age groups and in both the exposure model examining all types of bullying victimization, and the exposure model that assessed subtypes of bullying victimization (for exposure to multiple forms of victimization). In both adjusted and unadjusted models, effect modification by "connections to self" was present in girls alone, indicating the possibility of effect modification by gender.

No consistent patterns of effect modification were observed for connections to "nature" or "others", for either exposure model.

There was evidence of effect modification by the transcendent domain in the association between direct forms of victimization and health complaints. However, this association was only observed among boys in older grades. Older boys who reported strong connections to the transcendent had stronger relationships between being victimized by bullying directly and their reporting of frequent subjective health complaints. The same effect modification by transcendent connections was not observed for exposure to the other subtypes of bullying victimization.

### 7.2 Discussion of Epidemiologic principles

In this section, I will discuss my findings in light of basic methodological principles in the field of epidemiology. This will include the likelihood of chance findings, considerations related to internal and external validity, and the potential that my findings are causal.

#### 7.2.1. Chance

The use of a large national dataset of Canadian students allowed for a well-powered primary analysis, even after accounting for the clustered nature of the sample and exclusion of incomplete cases (see **Appendix C** for minimal detectable difference calculations). There was sufficient statistical power to detect multiplicative interaction effects of the spiritual health variables on the association between exposure to global bullying victimization and high subjective health complaints of 0.74 for younger boys, 0.70 for older boys, 0.52 for younger girls and 0.46 for older girls. It should be noted that each spiritual health domain's effect was examined separately, and I did not control for multiple comparisons. This may have increased the probability of making a type I error. Additionally, my analysis examining bullying subtypes could have been underpowered due to low prevalence of some of these exposure types. Power calculations were only performed for my primary objective relating to exposure to "any type" of bullying victimization, as determining potential effect modification in the association between bullying subtypes and health complaints was considered a secondary objective.

#### 7.2.2. Internal Validity

*Selection Bias.* Although participation rates were high in the 2017/18 HBSC (75% at the individual student level) selection bias could have occurred if students who did not participate (due to absenteeism, lack of consent etc.) systematically differed on both their exposure and outcome status, and the strength with which they related to each other. Concerning bias in the estimation of bullying prevalence introduced due to the school-based sampling method, bullying victimization has been linked to school absenteeism.[2] This could impact the descriptive component of this thesis by underestimating the prevalence of bullying victimization. Absentee students may also have had higher frequencies of subjective health complaints,[3] and if these two factors co-occurred and were related to selection, this could have biased the association between bullying victimization and health complaints towards the null. While the relationship between school absenteeism and spiritual health has not been widely studied, it is plausible that students who did not participate may have also varied in their strength of spiritual health connections. Again, if these absent students also systematically differed by their exposure and outcome status, our estimates could be biased. However, the strength or direction that this form of selection bias could have on our associations when stratified by spiritual health level is difficult to determine.

*Misclassification*. At the time of implementation of the HBSC survey, students were asked to report the frequency that they were bullied in the prior two months at school. Students' recall of bullying victimization could have depended on their outcome status, as, speculatively, young people who feel generally unwell may be more likely to dwell on and recall incidents of aggression by their peers. This could introduce recall bias and result in an overestimation of the association between bullying victimization and subjective health complaints.

The self-reported assessments of bullying victimization may have also been problematic; students who are victimized could underreport their exposure to bullying due to concerns of social desirability, self-presentation or fear of retaliation from bullies.[4] However, this concern is somewhat mitigated by the anonymity afforded by the HBSC survey. Underreporting of bullying victimization by students would underestimate its prevalence in my descriptive objective. Any misclassification, however, would likely be non-differential and bias estimates towards the null, as students who are underreporting bullying for this reason would be unlikely to also differ by their outcome status. Moreover, the use of the HBSC scale for the measurement of bullying victimization has empirical and theoretical support. This scale has been shown to good construct validity and internal reliability in measuring both bullying victimization and perpetration among adolescents.[5] Other methods of measuring bullying prevalence that avoid self-report, such as peer nomination, are subject to their own problems concerning the accuracy and reproducibility of assessment.[6] The HBSC scale consistently captures relationships between bullying and psychosocial adjustment outcomes across countries,[7] and measures information on several bullying subtypes. In combination, these qualities form a strong rationale for its use.

The HBSC scale used to measure subjective health complaints also has a long history of use in population health research[8] and has excellent psychometric properties in terms of content validity, internal consistency and test-retest reliability.[9,10] However, some participants may still have misclassified their symptoms since subjective health complaints are, by their very nature, dependent on an individual's interpretation of their symptoms. Bullied students may be more likely to interpret neutral symptoms as problematic and report them than non-bullied students, resulting in differential misclassification and biasing risk estimates away from the null.

While the HBSC Spiritual Health Scale has been evaluated for face and construct validity,[11] students may still misclassify their spiritual health experiences. Misclassification would have the potential to be either produce spurious effect modification or mask true effect modification depending on if errors are differential or not.[12]

Additionally, the HBSC Spiritual Health Scale captures the perceived importance of various connections inherent to spiritual health rather than directly measuring these items. This is a subtle but important distinction and should be noted in the interpretation of my results. For example, I cannot conclude that it is bullied kids with high levels of joy or meaning in their lives who have a higher risk of internalizing mental health symptoms. Instead, my results indicate that it is kids who report that meaning or joy is *important* in their lives that may suffer more severely when victimized. This was one meaningful way to operationalize the reporting of these connections for kids. However, it also is congruent with the interpretation of my results using cognitive theories of trauma. In the theory of "shattered assumptions", mental health stress is posited to result from adverse events challenging an individual's *expectations* about meaning in their world[13], not necessarily from the individual actually having strong meaning in their life.

This thesis also relies on the assumption that an individual's level of spiritual health measured at the time of the survey completion is a good proxy for the level of spiritual health at the time of bullying exposure. Since the study asks about the current perceived importance of self-connections, the level of spiritual health during the exposure window could be misclassified and lead to erroneous conclusions about its effect. Nevertheless, it is unlikely that an individual's spiritual health level would change drastically over a period of a couple of months, to be categorized from "low" to "high" or vice-versa.

*Prevalence-Incidence bias.* A cross-sectional design cannot distinguish between outcome prevalence being due to incidence or duration. This could introduce prevalence-incidence bias, as prevalence proportion ratios (PPR) were used as relative risk (RR) estimates.[14] Duration ratio bias is one such form of prevalence-incidence bias that occurs when the exposure of interest is also related to survival or the duration of the disease.[14] Bullying victimization is related to suicidal ideation and behaviours in adolescents,[15] which could ultimately affect student survival and result in an underestimate of the RR. However, though suicide is a leading cause of death in adolescents, the absolute number of young Canadians who die by suicide each year is relatively low.[16] Accordingly, there would not likely be a large effect of duration-ratio bias on estimates.

Point prevalence complement ratio bias[14] could be an issue, as high levels of health complaints was not a rare outcome in my adolescent population. Complement ratio bias occurs when prevalence is used to estimate incidence and the outcome prevalence is not rare, as prevalence is exactly equivalent to incidence*duration*(1-prevalence). When calculating PPR (prevalence$_{exp}$/ prevalence$_{unexp}$), the associated point prevalence complement ratio ((1-prevalence$_{exp}$)/(1- prevalence$_{unexp}$)) would decrease with higher outcome prevalence.[14] Thus, using PPR as an estimate of RR could underestimate the true strength of association between bullying victimization and health complaints.

*Confounding.* Potential confounding variables were identified during the literature review and there were strong attempts to control for available measures in my analysis. However, a few plausible confounders were identified from the literature that were unmeasured on the 2017/18 Canadian HBSC, which may have resulted in uncontrolled confounding. Sexual orientation and pubertal timing are each both associated with bullying victimization and symptoms related to poor mental health (**see Chapter 3**). Lack of adjustment for these factors could have potentially distorted my associations of interest. As true with any study, there was also likely to be some residual confounding. Many of my confounding variables were measured using self-reported HBSC scales. While psychometrically sound, these scales are unlikely to be perfect proxies for the confounders of interest and some mismeasurement will have occurred.

### 7.2.3. External Validity

The use of data from a large representative national dataset of students supports the generalizability of my descriptive findings to the Canadian population in the 11-15-year-old age range. The observed effect modification of strong "self-connections" on the association between bullying victimization and subjective health complaints should also be generalizable (qualitatively, not quantitatively) to the majority of Canadian young people in this age range. Theoretically, my results suggest that experiencing adverse events, such as bullying victimization, may increase the risk of symptoms related to poor internalizing mental health among those who place particular importance on joy, happiness or meaning in their lives. This theory is consistent with existing psychological models of cognitive trauma and may be generalizable to Canadian adolescents and, potentially, other international populations adolescents. The surrounding sociocultural context may partially limit the generalizability of the effects of spiritual health connections on mental health.[11] For example, strong connections to self may have a different effect on mental health in young people from highly collectivist cultures, where a strong focus on "self" may have more negative connotations. In the prior psychological literature, it has been suggested that those who possess individualistic values, but live within collectivist cultures, may be at greater risk of poor mental health.[17] Thus, it may be important to consider different cultural connotations of the spiritual health domains when generalizing their effect on adolescent mental health.

### 7.2.4. Causality

There is a lack of temporal data for causal inference with the use of a cross-sectional design. However, the causal relationship between bullying victimization and symptoms of poor internalized mental health already has support in a wide body of epidemiological, sociological and clinical literature through consistent and reproducible associations found through meta-analyses of longitudinal data.[18,19] The concern remains, however, in the evaluation of spiritual health, as there is no way to ensure the level of this asset that exists prior to the outcome development and at the time of exposure. To evaluate the potential causal effect modification of strong "connections to self" on the association between bullying victimization and subjective health complaints, a longitudinal study design will need to be employed. Beyond temporality, other Bradford-Hill criteria for evaluating causality include the strength of the relationship, consistency between studies, a dose-response relationship and biological plausibility.[20]

To my knowledge, this is the first study to examine effect modification by spiritual health, including "connections to self" in bullied students. However, some psychological constructs that similarly emphasize meaning in life, such as a strong sense of coherence, are protective against psychosomatic complaints in bullied adolescents.[21] Additionally, high levels of "meaning in life" have also been shown to attenuate the association between bullying victimization and suicide ideation in a sample of adolescents from the United States.[22] My results are, therefore, unexpected in the context of prior research. Future studies should be performed to determine if the observed effect modification by "self" is reproducible.

While an examination of how spiritual health effects are mediated was not included in this thesis, several mechanisms explaining the observed effect modification were hypothesized in my manuscript. Though unexpected, my results do fall into the realm of biological plausibility and are congruent with some theories in the existing psychological literature.

In terms of effect strength, the relative risks when estimated by level of spiritual health were generally weak in strength. However, when evaluating the strength of effect modification by spiritual health, the multiplicative difference in relative risks ($RR_{high\ spiritual\ health}$ / $RR_{low\ spiritual\ health}$) should also be considered. Overall, there was a large range in the strength of effect modification, which varied depending on the domain and sociodemographic group. Moderate shifts in the strength of RR estimates were observed between levels of the self-domain for girls (21% for younger girls, 35% for older girls). This moderate shift in the association strength between levels of "self" may support that the observed effect modification is a real effect.

To summarize, further research is needed to confirm the causal nature of my findings. However, this thesis does contribute initial evidence towards a causal relationship between bullying victimization and subjective health complaints, and the ability of spiritual health to modify this association.

## 7.3 Strengths/Limitations

### 7.3.1 Strengths

First, this thesis benefits from the use of theory-based modelling. Previous spiritual health research has often operated under the assumption that domains operate as a single construct, and failed to consider the distinct effects of domains.[23] My analysis was informed through seminal research indicating that the domains may have differential effects.[24] The separation of the spiritual health domains in the analytical model allowed the evaluation of each domain's independent effect on frequent health complaints. Second, the use of a large and robust national dataset allowed for a well-powered primary analysis, as well as the estimation of effect modification separately for different gender and age groups. This enabled the evaluation of the consistency of the domain effects between demographic groups and generated new etiological hypotheses. A final strength of this thesis is the inclusion of a structural validation component for the 10-item 2017/18 Spiritual Health Scale. Consideration was taken to explore and evaluate the latent structure of the 10-item spiritual health scale through factor analysis, rather than relying on antecedent use of the HBSC scale. This supported the four-factor model and the 10-item Spiritual Health Scale's use in measuring the four domains of spiritual health in my thesis. (Note: This in itself is an important contribution to the literature and will be published as a separate (non-thesis) manuscript with the candidate as the first author).

### 7.3.2 Limitations

First, it should be acknowledged that effect modification by the spiritual health domains was only evaluated on a multiplicative scale in this thesis. While this enabled the comparison of relative risks between spiritual health strata and statistically significant effects were observed for some of the spiritual health domains, effect modification may have been missed if the effect existed on another scale, such as an additive one.

One potential concern is the possibility of overlap between spiritual health connections and mental health; for effect modification to be interpretable, all spiritual health domains must be distinct from my mental health outcome.[25] Connections to self may share the most obvious similarities to mental health, but prior research has contended that they are distinct constructs.[24] Furthermore, there are clear differences in how these constructs are measured in this thesis; "self-connections" are determined through experiences of meaning, purpose and joy, whereas my measured mental health outcome is determined through reoccurring psychological and somatic symptoms.

Another limitation is the substantial amount of missing data due to item non-response from the students. Parameter estimates will be biased if data is not missing at random, and this is true for both complete case analysis or multiple imputation to handle missing data.[26,27] While there was a possibility for the introduction of bias, an effort was made to assess and acknowledge the potential impact of this missing data on my findings (**see section 6.5.2**).

A final limitation is that my outcome of high subjective health complaints is only one measure of adolescent mental health. Subjective health complaints may be an adequate indicator of internalizing mental health problems but fail to capture other important dimensions of adolescent mental health, such as those characterized by externalizing behaviours. With this being said, my use of subjective health complaints as an indicator of poor mental health in this study offers several advantages. This outcome accounts for how individuals interpret their own symptoms in their reporting and may capture the inner experience of adolescents more accurately than objective measures alone. The scale also allows the measurement of health complaints on a continuum, whereas relying on a clinical diagnosis would only capture extreme cases. For most young people, the experience of subjective health complaints is not at a clinical level of severity but may still impair day-to-day functioning and well-being.[1] These characteristics, along with the strong psychometric properties of the HBSC subjective health complaints scale, provide a rationale for the use of frequent subjective health complaints as my mental health outcome.

### 7.4 Public Health Recommendations

This study is among the first epidemiological studies to explore effect modification by spiritual health domains, and as such, more research to confirm and expand these findings should be undertaken before any changes in current practice are made. With this in mind, these results do have important implications for future health promotion and intervention efforts.

Results from this thesis suggest that individuals with strong self-connections may be more vulnerable to the adverse effects of bullying victimization on frequent health complaints. It is important to carefully consider the application of these findings to student health, as it could be harmful to the well-being of adolescents to explicitly discourage the fostering of connectedness in their lives. The field of positive psychology has found that the search for joy and happiness is an essential resource against psychopathologies in the general population of young people.[28,29] Furthermore, strong self-connections have been associated with positive mental health in multi-national samples of students.[24] However, my findings indicate that interventions that focus solely on developing strong "connections to self" in bullied youth, could actually be detrimental rather than protective to the mental health of these young people. In light of these considerations, rather than a restricted focus on developing resilience for "at risk" youth, it may be better to direct public health efforts to addressing the underlying issue of bullying victimization in schools. In other words, primary prevention strategies to reduce bullying in schools might provide the greatest contribution to the health of all students.

There are a variety of existing school-based bullying interventions, but the effectiveness of these programs depends largely on the intervention type, sociocultural context, and the age of the student population.[30] In a systematic review of reviews evaluating school-based interventions, the authors concluded that most high-quality studies supported multi-component interventions for bullying violence.[31] Interventions that combine whole-school initiatives, including school policy changes, parental involvement and work with local communities yielded the most consistently positive results.[31] Ideally, evidence generated from a high-quality randomized controlled trial would be optimal to compare the effects of whole-school interventions to prevent bullying victimization (primary interventions) or interventions targeted specifically to "at-risk" students (secondary interventions). However, based on this thesis's findings, preventing victimization through a whole-school multi-component intervention may provide the greatest net benefit to student mental health.

## 7.5 Future Research Directions

While this thesis has contributed to an initial understanding of how indications of strong spiritual health may affect relationships between violence and mental health, it has also generated new questions to be explored in future research.

Any causal inferences were limited due to an inability to establish temporality. To confirm the causal nature of the associations and effect modification observed in this thesis, it would be ideal to employ a longitudinal design in future studies. This would allow one to measure the self-reported level of spiritual health that exists prior, during, and following bullying victimization, to determine if these connections remain constant over time in bullied youth.

In my literature review, several cognitive and physiological pathways were proposed in which spiritual health connections could act as protective health assets. However, in light of my findings, new underlying biological and psychological mechanisms should potentially be explored. Informed through cognitive models of trauma,[13] one possibility is that those with strong "self" connections may actually experience more stress when victimized. It may be worthwhile to examine and compare levels of stress across groups defined by their exposure to bullying and reported importance of "self" connections.

Additionally, to gain a deeper understanding surrounding the complex cognitive processes and mental health effects of self-connections, gender and victimization, it would be useful to include a qualitative component in future research. Students could offer valuable insight into how these intersecting exposures interact to affect their own perceptions of subjective well-being, which is difficult to capture using traditional quantitative epidemiological methods.

Finally, it may be worth expanding research on the effect of spiritual health connections in other high-risk, underserved groups of young people. We set out to explore spiritual health connections in bullied young people due to the high prevalence of bullying among Canadian students and the strong previously established mental health consequences of victimization. If the hypothesized theories of cognitive trauma relating to the self-domain are correct, we may observe similar patterns of mental health vulnerability in those who have high connections to self, but who are exposed to other forms of violence or trauma. This may help to confirm my hypotheses and inform interventional research for these groups of young people.

### 7.6 Conclusion

This thesis explored the potential for spiritual health connections to modify the effect of bullying victimization on frequent subjective health complaints, as one measure of poor internalizing mental health in Canadian adolescents. Contrary to hypotheses that strong spiritual health connections would act as protective health assets, girls reporting high self-connections and who were simultaneously victimized by bullying had a higher risk of frequent health complaints. Future research is warranted to explore the underlying etiological pathways and confirm the causal nature of this relationship. With these limitations in mind, this thesis provides nuanced suggestions for health promotion and intervention efforts. While spiritual health is important for general adolescent development, a sole focus on fostering these connections could be detrimental rather than protective to the mental health of “at risk” adolescents. Future public health and clinical interventions that instead directly address bullying in schools may benefit adolescent health.

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# Appendix A. Ethics

The 2017/2018 Canadian HBSC survey has been granted ethics approval from the General Research Ethics Board at Queen's University. Additionally, the analysis of the 2017/2018 HBSC survey data for use in my thesis was revised and approved by the Queen's University Health Sciences and Affiliated Teaching Hospitals Research Ethics Board (HSREB). The HSREB clearance letter is included in this appendix.

Guiding ethical principles were considered during each stage of this thesis. Respect for privacy and confidentiality were ensured by using data that is free from personal identifiers. All student data were kept confidential. Respect for free and informed consent was upheld during HBSC data collection through voluntary participation and the obtainment of (active or passive) consent from the school jurisdiction, school principal, and from students' parents.

**Queen's University Health Sciences & Affiliated Teaching Hospitals Research Ethics Board (HSREB)**

**HSREB Initial Ethics Clearance**

August 28, 2019

Ms. Nicole Shaver
Department of Public Health Sciences
Queen's University

**TRAQ #: 6027387**
**Department Code: EPID-682-19**
**Study Title: "EPID-682-19 Bullying Victimization among Canadian Adolescents and Spiritual Health as a Mental Health Asset"**
**Supervisor: Dr. C William L Pickett**
**Review Type: Delegated**
**Date Ethics Clearance Issued: August 28, 2019**
**Ethics Clearance Expiry Date: August 28, 2020**

Dear Ms. Shaver:

The Queen's University Health Sciences & Affiliated Teaching Hospitals Research Ethics Board (HSREB) has reviewed the application and granted ethics clearance for the documents listed below. Ethics clearance is granted until the expiration date noted above.

- Survey: Grades 6 – 8 v.2019AUG21
- Survey: Grades 9-10 v.2019AUG21
- Questionnaires: Personally Identifiable Information V.2019AUG21
- Proposal v.2015MAR15
- Recruitment Material: Publication Plan v.2019AUG21

**Documents Acknowledged:**

- Thesis Committee Approval 2019AUG21
- Supervisor’s Letter v.2019AUG21
- Research Ethics Training Completion: Pickett and Shaver

**Amendments:** No deviation from, or changes to the protocol, informed consent form and conduct of study should be initiated without prior written clearance or an appropriate amendment from the HSREB, except when necessary to eliminate immediate hazard(s) to study participants or when the change(s) involves only administrative or logistical aspects of the study.

**Renewals:** An annual renewal event form or a study closure event form must be submitted annually as per the TCPS 2 2014 Article 6.14. As a courtesy, the Office of Research Ethics may send reminders 30 days in advance of the ethics clearance expiry date. All lapses in ethics clearance will be documented on the annual renewal clearance letter. Suspension letters may be issued for lapses in ethics clearances one day or greater, with subsequent termination and closure of the ethics file for lapses greater than 10 business days. Terminations should be reported to applicable regulatory authorities (e.g., Health Canada, FDA).

**Completion/Termination:** The HSREB must be notified of the completion or termination of this study through the submission of a study closure event in TRAQ.

**Reporting of Serious Adverse Events:** Any unexpected serious adverse events occurring locally must be reported within 2 working days or earlier if required by the study sponsor. All other serious adverse events must be reported within 15 days after becoming aware of the information.

**Reporting of Complaints**: Any complaints made by participants or persons acting on behalf of participants must be reported to the Research Ethics Board within 7 days of becoming aware of the complaint.

**Note: All documents supplied to participants must have the contact information for the Research Ethics Board.**

Investigators please note that if your study is registered by the sponsor, you must take responsibility to ensure that the registration information is accurate and complete.

Regards,

Albert F. Clark.

Albert F. Clark, PhD
Chair, Queen's University Health Sciences and Affiliated Teaching Hospitals Ethics Board

The HSREB operates in compliance with, and is constituted in accordance with, the requirements of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS 2); the international Conference on Harmonisation Good Clinical Practice Consolidated Guideline (ICH GCP); Part C, Division 5 of the Food and Drug Regulations; Part 4 of the Natural Health Product Regulations; Part 3 of the Medical Devices Regulations, and the provisions of the Ontario Personal Health Information Protection Act (PHIPA 2004) and its applicable regulations. The HSREB is qualified through the CTO REB Qualification Program and is registered with the U.S. Department of Health and Human Services (DHHS) Office for Human Research Protection (OHRP). Federalwide Assurance Number: FWA#: 00004184, IRB#: 00001173. HSREB members involved in the research project do not participate in the review, discussion or decision.

# Appendix B. HBSC Survey Items

This appendix is included to show survey items for key variables (bullying exposures, subjective health complaints outcome, spiritual health items) from the 2017/2018 HBSC that were used in this thesis. All items are included exactly as they appear on both the grades 6-8 and the grades 9-10 versions of the surveys. Additionally, **Table B.1**. shows how the bullying subtype questions were classified into the bullying victimization subtypes.

## General Bullying Victimization (Exposure):

Here are some questions about bullying. We say a person is **BEING BULLIED** when another person, or a group of people, repeatedly say or do unwanted nasty and unpleasant things to him or her. It also is bullying when a person is teased in a way he or she does not like or when he or she is left out of things on purpose. The person that bullies has more power than the person being bullied and wants to cause harm to him or her. It is <u>not</u> bullying when two people of about the same strength or power argue or fight.

**55. How often have you been bullied at school in the past couple of months?**

1☐ I have not been bullied at school in the past couple of months
2☐ It has happened once or twice
3☐ 2 or 3 times a month
4☐ About once a week
5☐ Several times a week

## Subtypes of Bullying Victimization (Exposure):

**56. How often have you been bullied at school in the past couple of months in the ways listed below?**
*(Please mark one box for each line)*

| | *I have not been bullied in this way in the past couple of months* | *Once or twice* | *2 or 3 times a month* | *About once a week* | *Several times a week* |
|---|---|---|---|---|---|
| a. I was called mean names, was made fun of, or teased in a hurtful way. | 1☐ | 2☐ | 3☐ | 4☐ | 5☐ |
| b. Other students left me out of things on purpose, excluded me from their group of friends, or completely ignored me. | 1☐ | 2☐ | 3☐ | 4☐ | 5☐ |
| c. I was hit, kicked, pushed, shoved around, or locked indoors. | 1☐ | 2☐ | 3☐ | 4☐ | 5☐ |
| d. Other students told lies or spread false rumours about me and tried to make others dislike me. | 1☐ | 2☐ | 3☐ | 4☐ | 5☐ |
| e. Other students made fun of me because of my body weight. | 1☐ | 2☐ | 3☐ | 4☐ | 5☐ |
| f. Other students made sexual jokes, comments, or gestures to me. | 1☐ | 2☐ | 3☐ | 4☐ | 5☐ |

**57. In the past couple of months, how often have you been cyberbullied?**

1☐ I have not been cyberbullied in the past couple of months
2☐ Once or twice
3☐ 2 or 3 times a month
4☐ About once a week
5☐ Several times a week

## Spiritual Health Domain Questions (Effect Modifiers):

**86. How important is it for you to … ?** *(Please mark one box for each line)*

| | | *Not at all important* | | | | *Very important* |
|---|---|---|---|---|---|---|
| a. | Be kind to other people. | 1☐ | 2☐ | 3☐ | 4☐ | 5☐ |
| b. | Be forgiving of others. | 1☐ | 2☐ | 3☐ | 4☐ | 5☐ |
| c. | Show respect for other people. | 1☐ | 2☐ | 3☐ | 4☐ | 5☐ |
| d. | Feel that your life has meaning or purpose. | 1☐ | 2☐ | 3☐ | 4☐ | 5☐ |
| e. | Experience joy in life. | 1☐ | 2☐ | 3☐ | 4☐ | 5☐ |
| f. | Feel connected to nature or wilderness. | 1☐ | 2☐ | 3☐ | 4☐ | 5☐ |
| g. | Care for the natural world. | 1☐ | 2☐ | 3☐ | 4☐ | 5☐ |
| h. | Meditate or pray. | 1☐ | 2☐ | 3☐ | 4☐ | 5☐ |
| i. | Feel a connection to a higher spiritual power. | 1☐ | 2☐ | 3☐ | 4☐ | 5☐ |
| j. | Feel a sense of belonging to something greater than yourself. | 1☐ | 2☐ | 3☐ | 4☐ | 5☐ |

## Subjective Health Complaints (Outcome):

**46. In the last 6 months, how often have you had the following?** *(Please mark one box for each line)*

| | | *About every day* | *More than once a week* | *About every week* | *About every month* | *Rarely or never* |
|---|---|---|---|---|---|---|
| a. | Headache | 1☐ | 2☐ | 3☐ | 4☐ | 5☐ |
| b. | Stomachache | 1☐ | 2☐ | 3☐ | 4☐ | 5☐ |
| c. | Backache | 1☐ | 2☐ | 3☐ | 4☐ | 5☐ |
| d. | Feeling low (depressed) | 1☐ | 2☐ | 3☐ | 4☐ | 5☐ |
| e. | Irritability or bad temper | 1☐ | 2☐ | 3☐ | 4☐ | 5☐ |
| f. | Feeling nervous | 1☐ | 2☐ | 3☐ | 4☐ | 5☐ |
| g. | Difficulties in getting to sleep | 1☐ | 2☐ | 3☐ | 4☐ | 5☐ |
| h. | Feeling dizzy | 1☐ | 2☐ | 3☐ | 4☐ | 5☐ |
| i. | Sore mouth or toothache | 1☐ | 2☐ | 3☐ | 4☐ | 5☐ |

**Table B.1.** 2017/18 Health Behaviour in School-aged Children Questionnaire items for the classification of bullying victimization subtypes.

| Questionnaire Item | Bullying Victimization Subtype |
|---|---|
| "I was called mean names, was made fun of, or teased in a hurtful way." | Direct Bullying Victimization |
| "I was hit, kicked, pushed, shoved around, or locked indoors." | Direct Bullying Victimization |
| "Other students made sexual jokes, comments, or gestures to me." | Direct Bullying Victimization |
| "Other students left me out of things on purpose, excluded me from their group of friends, or completely ignored me." | Indirect Bullying Victimization |
| "Other students told lies or spread false rumours about me and tried to make others dislike me." | Indirect Bullying Victimization |
| "In the past couple of months, how often have you been cyberbullied?" | Cyberbullying Victimization |

## Appendix C. Minimum detectable difference calculations

This appendix details the parameters used and calculations performed to determine the minimal detectable differences that could be identified for our primary effect modifications of interest. In this study, the minimum detectable difference for effect modification represents the smallest detectable multiplicative effect that any of the spiritual health domains could have on our associations of interest (relative risk ratio (RRR)=$RR_{\text{high spiritual health}}$ / $RR_{\text{low spiritual health}}$). For example, if among students with high spiritual health those also exposed to bullying had a 25% increased risk of subjective health complaints ($RR_{\text{high spiritual health}}$=1.25), and among students with low spiritual health those also exposed to bullying had a 75% increased risk of subjective health complaints ($RR_{\text{high spiritual health}}$=1.75), then we would say that the multiplicative effect of the spiritual health domain would be RRR=0.71.

A simulation analysis was conducted to estimate the minimum detectable multiplicative effects of spiritual health after accounting for clustering (design effect of 1.2).[1] First, and *a priori*, I determined the minimum detectable multiplicative effect of spiritual health within each gender strata based on the achieved sample size for the 2017/18 HBSC sample. Second, an *a posteriori* analysis was also conducted to determine the minimum detectable differences following the removal of incomplete cases. This was done for sample sizes within specific socio-demographic groups as a conservative estimate of the available power.

**Minimal Detectable Difference for Primary Interaction Effect (*a priori*):**

Effective sample size calculations:
Actual Sample size n=19493 (9325 boys and 10168 girls)
Design Effect = (Actual Sample Size)/(Effective Sample size )
= 1.2 = (Actual Sample Size)/(Effective Sample size )
Effective sample size=19493/1.2 = 16 244 (7770 boys and 8474 girls)

**Parameter Estimates:**

**Prevalence of Bullying Victimization:**[2] Based on estimates from the 2014 HBSC Canadian survey, girls in grades 6 to 10 reported an average prevalence of bullying victimization (measured as bullied more than once or twice in the last two months) of 25%. Boys in this age range had an average prevalence of victimization of 19%. The overall reported prevalence of bullying victimization was 22%.

**Prevalence of Psychosomatic symptoms:**[2] The 2014 HBSC Canadian survey found that 32.3% of students reported high psychosomatic symptoms. Girls in grades 6 to 10 had an average prevalence of 40.2%, while boys had an average of 21.8%.

**Relative Risk Effect Size:** The relative risk effect size that will be examined is based on an odds ratio estimate from a meta-analysis of 24 cross-sectional studies:[3] OR = 2.17, 95% CI: 1.91 to 2.46. Because an odds ratio will overestimate relative risk when the outcome is not rare, the lower bound of the confidence interval was used as a more conservative estimate of relative risk (RR=1.91).

**Simulation Analysis**: One hundred potential effect sizes for effect modification (range 0.995 – 0.5) were examined, with 1000 data sets generated for each effect size. Each data set contained 16,244 records (for the total sample size analysis; n=7 770 or n=8 474 were used for gender-specific simulations) and each subject was randomly assigned exposure status using a probability-weighted 22% exposure prevalence. Each subject was also randomly assigned a different level of a binary spiritual health effect modifier variable (an even distribution of the two levels, high or low, was assumed). Binary outcomes (yes/no high subjective health complaints) were generated using a baseline risk of 0.323 (risk of health complaints if unexposed).

If exposed, subjects had an outcome probability of:

P(outcome) = (baseline risk*RR of outcome if exposed* RR of interaction effect).

A Modified Poisson regression model was used to analyze each simulated data set. Power for the interaction effect in each scenario was calculated as the average number of tests that rejected the null hypothesis at alpha=0.05. 80% power was achieved through an interaction effect of approximately RRR=0.89 for the total sample, RRR=0.83 for boys and RRR=0.58 for girls **(Figure C.1)**. Simulation analyses were conducted on R software (R Core Team, 2019).

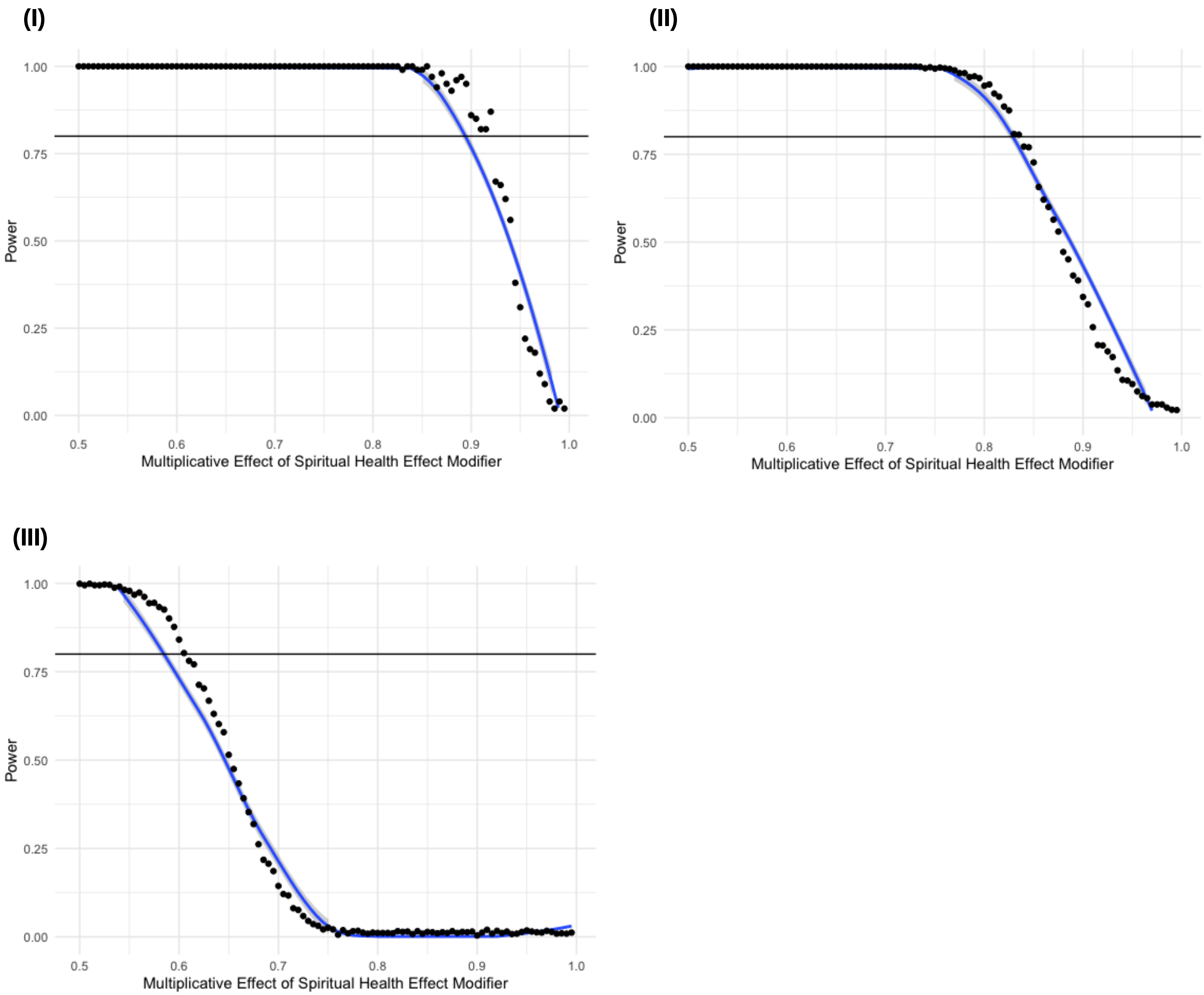


**Figure C.1 – I) Total sample II) Boys III) Girls.** The estimated power available (calculated *a priori*) to detect a significant (p<.05) multiplicative effect of spiritual health (Spiritual Health*Bullying Victimization). A loess curve was fit to the data. The black horizontal line is drawn at 80% power to show what effect size can be detected at 80% power.

**Minimal Detectable Difference for Primary Interaction Effect (*a posteriori* for final analytical Sample)**

**Table C.1**. Actual and effective sample sizes for each age/gender category used to calculate *a posteriori* minimal detectable difference.

| Category | Actual Sample Size | Effective Sample Size[a] |
|---|---|---|
| Younger Boys (Grades 6 – 8) | 3374 | 2812 |
| Older Boys (Grades 9 – 10) | 2436 | 2030 |
| Younger Girls (Grades 6 – 8) | 3823 | 3186 |
| Older Girls (Grades 9 – 10) | 2960 | 2467 |

[a]Based on design effect of 1.2.

A significant portion of the sample was unable to be used in the analytic sample due to missing data. To determine the approximate minimum detectable difference that we would have been able to find with the reduced sample, a second simulation analysis was conducted *a posteriori*. The same simulation strategy that was described above was used, but with the effective sample sizes calculated for a stratified sample by gender (boys and girls), as well as by grade (grades 6 to 8 and 9 to 10). Using 80% power and we found a minimum detectable interaction effect of RRR=0.74 for boys in grades 6 to 8, RRR=0.70 for boys in 9 to 10, RRR=0.52 for girls in grades 6 to 8 and RRR=0.46 for girls in grades 9 to 10 **(Figure C.2)**.

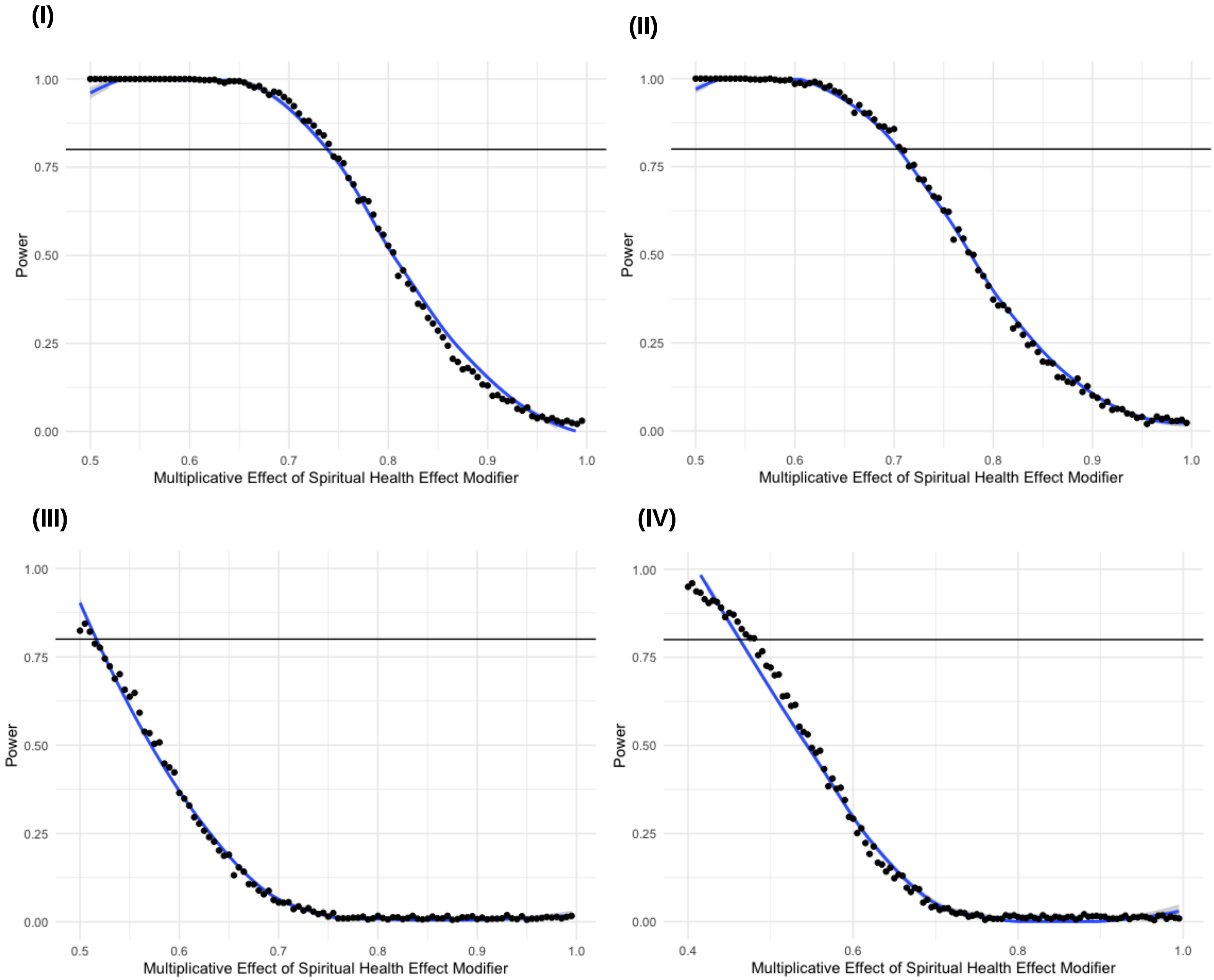


**Figure C.2 – I) Boys in grades 6 to 8, II) Boys in grades 9 to 10, III) Girls in grades 6 to 8, IV) Girls in grades 9 to 10.** The estimated power available (calculated *a posteriori*) to detect a significant ($p<.05$) multiplicative effect of spiritual health (Spiritual Health*Bullying Victimization). A loess curve was fit to the data. The black horizontal line is drawn at 80% power to show what effect size can be detected at 80% power.

## Appendix D. Model Information

The purpose of Appendix D is to provide a justification for my choice of a generalized linear regression model. A summary of the model building process and selection of confounders is provided. Additionally, the results of an analysis to determine the effects of various confounders on my associations of interest are described. Finally, the fit of my final analytical model is evaluated.

**Model Rationale**. Multivariable regression analysis was performed using a Modified Poisson regression model with robust error variance estimation, selected for the ability to estimate relative risk. Relative risk is a measure of association that is more intuitive and may be meaningful to policy-makers and educators when disseminating the results of this thesis. It also addresses problems with the rare disease assumption that may be needed for other types of link functions (e.g. a logit-based model). A generalized estimating equation (GEE) method with an exchangeable correlation type was used to account for the nested nature of the HBSC data.

A GEE approach is a marginal (population-averaged) method that uses a quasi-likelihood approach for modeling correlated responses.[4] Exchangeable correlation assumes that the level of correlation between observations is equal across clusters.[4] School identifiers were used in the REPEATED statement to account for within-school correlation or clustering. Although a hierarchical regression (multi-level) modelling approach was considered, the GEE approach was selected for ease of applicability and because we were not specifically trying to estimate school effects, but merely control for clustering. GEE models require fewer distribution assumptions than mixed models and have been shown to be robust to incorrect specification of the covariance structure.[5]

**Model Building and Confounder Effects**. A backwards elimination approach using a liberal p-value was used to create a parsimonious model. All confounders were found to be significantly ($p<0.05$) related to the subjective health complaint outcome besides "peer support" which was excluded from our analytical model. Significant 2-way interactions between gender and age and other covariates were also included in the model, to control for potential confounding effects that were differential by age or gender. To determine which confounders played a strong role in confounding the observed relationships, a sensitivity analysis was performed using a change-in-estimate method (**Table D.1**). Social support variables had the strongest effects on the associations of interest for all genders and grades.

**Model Fit**. An examination of model fit was undertaken to understand how the final analytical model fit the data. Many of the indices usually applied to assess and compare model fit do not apply to GEE models, since GEE is not a likelihood-based estimation method. Instead, model fit was examined using quasi-likelihood criteria statistics for the null and final model. The quasi-likelihood under the independence model criterion (QIC) is a modification of the Akaike information criterion for use in comparing fit of GEE models.[6] The adjusted QIC (QICu) is a related statistic that takes into account model parsimony by adding a penalty to the quasi-likelihood with any additional model parameters. Lower QIC and QICu values represent models that better depict relationships.[6] Additionally, QICu approximate QIC when the GEE model is correctly specified. **Table D.2** uses QIC to compare the fit of empty, adjusted and our final models. These results indicate that my final analytical model that includes all interactions and that is adjusted for selected covariates seems to provide the best fit for modelling relationships between bullying victimization, spiritual health and subjective health complaints.

**Table D.1**. Change-in-estimate analysis to show the effect of final analytic model confounders on relative risk[a] estimates for the effect of any bullying victimization on frequent subjective health complaints.

| Covariate Removed | Socioeconomic status | Body Mass Index | Physical Activity | Race/ Ethnicity | Immigration | Social Support[b] | Screen time | Exceptionalities |
|---|---|---|---|---|---|---|---|---|
| **<u>Percent Change in relative risk for younger boys (grades 6 – 8)</u>** | | | | | | | | |
| Low spiritual health | 1 | 0 | 0 | 0 | 1 | 10 | -2 | 0 |
| High self | 2 | 2 | 0 | 0 | 1 | 4 | -1 | 1 |
| High others | 2 | -1 | 0 | 0 | 1 | 6 | 1 | 0 |
| High nature | -2 | 0 | 0 | -1 | 1 | 13 | -3 | 0 |
| High transcendent | 2 | 1 | 0 | 0 | 1 | 8 | -3 | 1 |
| **<u>Percent Change in relative risk for older boys (grades 9 – 10)</u>** | | | | | | | | |
| Low spiritual health | 0 | 1 | 0 | -1 | 1 | 6 | 1 | -1 |
| High self | 0 | 0 | 1 | 0 | 0 | -1 | -1 | 1 |
| High others | 1 | 1 | 0 | 0 | 1 | 8 | 2 | -1 |
| High nature | 2 | 1 | 0 | -1 | 3 | 8 | 1 | 1 |
| High transcendent | 1 | 2 | -1 | 0 | 1 | 8 | 2 | -2 |
| **<u>Percent Change in relative risk for younger girls (grades 6 – 8)</u>** | | | | | | | | |
| Low spiritual health | 0 | 1 | 0 | 0 | 0 | 11 | 3 | 1 |
| High self | 1 | -1 | 1 | 1 | 0 | 10 | 2 | 0 |
| High others | 0 | 2 | -1 | 1 | 1 | 14 | 4 | 1 |
| High nature | 1 | 1 | 0 | 0 | 0 | 12 | 3 | 2 |
| High transcendent | 0 | 1 | 0 | 1 | 1 | 13 | 3 | 1 |
| **<u>Percent Change in relative risk for older girls (grades 9 – 10)</u>** | | | | | | | | |
| Low spiritual health | 1 | 2 | 0 | 2 | 1 | 11 | 0 | 2 |
| High self | 3 | 1 | -1 | 2 | -1 | 9 | 0 | 0 |
| High others | -1 | 2 | 0 | 0 | 0 | 13 | 1 | 1 |
| High nature | 1 | 1 | 0 | 2 | 1 | 17 | 0 | 4 |
| High transcendent | 1 | 0 | 0 | 3 | 0 | 8 | 0 | 1 |

*Note*. The percent change (%) was calculated by calculating the percent change in each parameter estimate between the full model with all covariates included and a reduced model with the covariate listed in the column removed.
[a]Relative risk estimates are for the association between "any" bullying victimization and high subjective health, estimated separately by level of spiritual health, gender and grade.
[b]Social Support variables were examined as a group.

**Table D.2.** Model fit statistics comparing empty, adjusted and final full models used to estimate the association between bullying victimization and subjective health complaints.

| Model | QIC[a] | QICu[b] |
|---|---|---|
| Intercept only | 25703 | 25699 |
| Adjusted Model but no effect modifiers[c] | 24996 | 25007 |
| Final Model[d] | 24577 | 24600 |

[a]Quasilikelihood under the Independence model Criterion.
[b]Adjusted Quasilikelihood under the Independence model Criterion.
[c]Model fully adjusted for all selected confounders, but no effect modifiers included.
[d]Model fully adjusted for all selected confounders, and all effect modifiers (age, gender, spiritual health domains) included.

# Appendices References


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