“Social Hygge” and Chronic Low-Grade Inflammation in Children and Adolescents

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ABSTRACT

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There is robust evidence of the health-enhancing benefits of social relationships and support, especially for inflammatory processes. Most research is limited to adults. In children and adolescents, the social support literature focuses on individual sources of support (i.e., mother). An encompassing, comprehensive measure of support spanning a child's entire social network may help to unify findings across developmental areas. The thesis aims were twofold: Part 1 explored a novel multidimensional conceptualization of social support named "social hygge", and Part 2 tested the relation between social hygge and chronic low-grade inflammation in children and adolescents. Data from the population-based Quebec Child and Adolescent Health and Social (QCAHS) survey were analyzed. Youth aged 9, 13, and 16 years (N = 3613) and their parents answered questions about their social relationships and support. A subsample (n = 2204) provided a fasting blood draw that was assayed for C-reactive protein (CRP). Part 1 explored the psychometrics of three quantitative approaches: traditional, data-driven, and social hygge to derive principal components. Part 2 tested the relation between these derived components with CRP, adjusting for age, sex, body mass index and smoking. All multidimensional social hygge scores were associated with lower CRP in adolescents (η^2_p = .003-.005); no association was found for children. Effect sizes were comparable to those previously reported in adults. Findings support a possible latent construct that more broadly encompasses social support, warmth, and feeling valued in children and adolescents. Recommendations for replication and future research are provided.

Keywords: social relationships, social support, psychometric, multidimensional, chronic inflammation, child, adolescent

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CONTRIBUTION OF AUTHORS

Eloïse Fairbank developed the research question, conducted the literature review, cleaned and synthesized data, undertook the statistical analyses, interpreted the results, and wrote and revised the thesis. As Eloïse Fairbank's research supervisor, Dr. Jennifer J. McGrath co-developed the research question, oversaw research data management, supervised the statistical analyses and results interpretation, and revised the thesis.

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Overview

Social support has emerged as a robust predictor of health and well-being across disciplines spanning evolutionary psychology, sociology, epidemiology, and behavioural medicine (Cacioppo & Cacioppo, 2014; Cohen, 2004; Taylor & Gonzaga, 2006; Umberson & Montez, 2010). Our understanding of the complex mechanisms between social support and health is emerging. However, there has been limited development in the traditional ways social support is measured, particularly in children. Furthermore, less is known about how social support influences immune functioning and inflammation during childhood (Uchino, 2006; Uchino et al., 2012).

In the background sections below, current conceptualizations of social relationships and support are discussed and gaps in the assessment of social support in children are outlined. Next, the existing measurement of social support is critically examined and the utility of an encompassing, multidimensional conceptualization of social support is posited. Finally, the influence of social support on health and inflammation is highlighted and the extension of this work in pediatric samples is reviewed. The aims of this thesis were twofold: (1) to explore a novel multidimensional approach to quantifying social support in children, and (2) to test the relation between social support and children's immune functioning, specifically, chronic low-grade inflammation, through the lens of this proposed multidimensional conceptualization of social support. The thesis was organized into Part 1 and Part 2 in parallel with these aims.

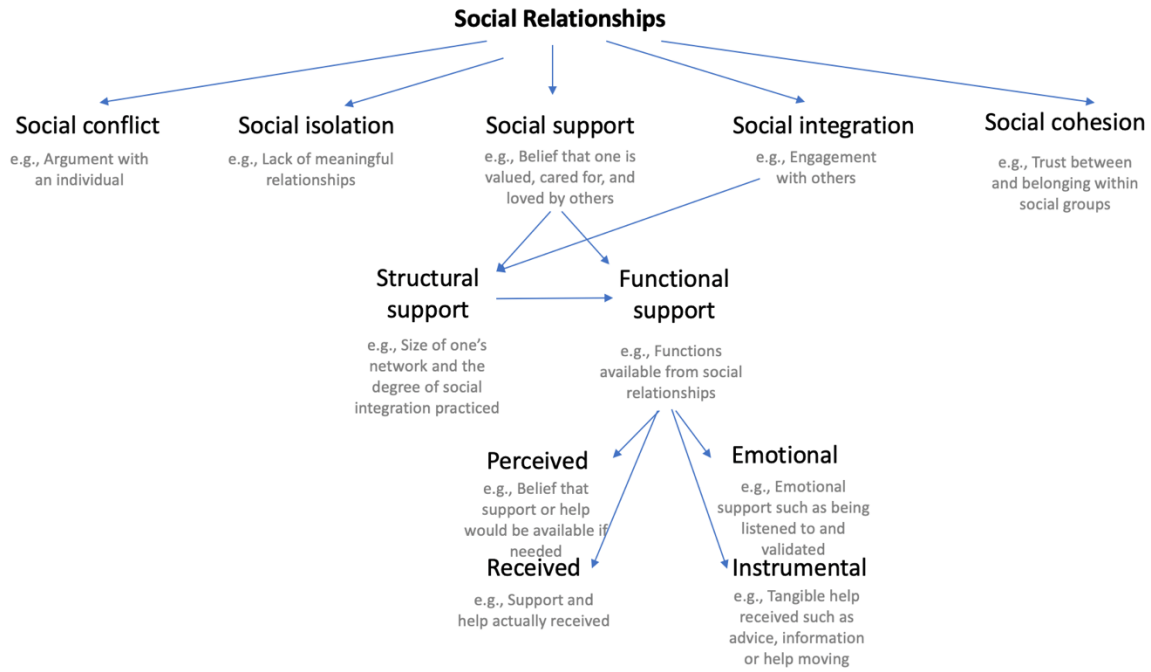
Background Literature Review

Part 1: Social Relationships and Social Support

Social relationships encompass numerous subconstructs of social experiences within one's network, both negative and positive (August & Rook, 2013; Cohen, 2004; See Figure 1).

Figure 1

Conceptual Mapping of Social Relationship Subconstructs



Note. Illustration of social relationship constructs and subconstructs.

Social conflict and isolation can be described as negative social experiences. Social or interpersonal conflict is characterized by negative emotional reactions in response to an argument or confrontational interaction between individuals (Barki & Hartwick, 2004). Social isolation is characterized by a lack of meaningful social connections within one's network (Majka & Cacioppo, 2013). Social support, social integration, and social cohesion can be described as positive social experiences. Social support is the "belief that one is valued, cared for, and loved by others in a social network" (Ruiz et al., 2013). Social integration is the level of social engagement one practices within their network (Ruiz et al., 2013). Social cohesion is typically conceptualized at a contextual or societal level and refers to the degree of trust and respect between different individuals or groups (Gidron, 2013). These social experiences are

related to health: negative social experiences are linked to adverse consequences for health and well-being, whereas positive social experiences have been found to be protective and beneficial for health over time (Rook, 1998). The presence of negative social support does not necessarily indicate the absence of positive social support (or vice-versa). In other words, negative and positive social support are not reciprocal; social conflict/isolation and social support co-exist on different continuums and can influence one another. This point is important for the conceptualization and measurement of social support.

Types of Social Support

Social support has been identified as a key characteristic of social relationships with important links to health outcomes (Uchino, 2004). Indeed, social support has been found to be protective against cardiovascular disease, cancer, infectious disease, depression, and early mortality (Uchino, 2006). However, research has pointed consistently to important distinctions between the *structural* and *functional* characteristics of these supports (See Figure 1 above; Holt-Lunstad et al., 2010; Taylor, 2011). Structural characteristics include the size of one's social network and the degree of social integration one experiences (i.e., number of individuals within one's social network, living arrangement, marital status). Functional characteristics include the support processes that these networks serve, which can be further divided into two functional processes: *received* and *perceived* support (Cohen et al., 1985s). Received support (i.e., what support one "gets") captures interactions that are actually experienced such as help or advice during a crisis; these interactions often emerge in the context of conflicts and tend to be highly situational. Perceived support (i.e., support one "perceives" as available) captures beliefs and perceptions of help and support availability that one believes they can acquire from their network if necessary (Gallo et al., 2015). Self-reported received and perceived support are moderately

correlated (r = 0.35; Haber et al., 2007). Further, functional social support has also been categorized into emotional (i.e., empathy, trust and caring) and instrumental support (i.e., information, tangible help, advice; House, 1981; Wills, 1991); these categories are not exclusive as there is emotional meaning in instrumental support (Semmer et al., 2008). Together, these functional social support subconstructs (i.e., perceived, received, emotional, instrumental) may overlap such that support during a crisis may be both received and emotional support. Notably, perceived and emotional support have been more strongly linked to healthier outcomes, than received and instrumental support (Uchino, 2009; Lyyra & Heikkinen, 2006). Structural and functional support are correlated (r = .28, Gallo et al., 2015), yet, results are inconclusive as to whether one is a better predictor of health than the other, with evidence for both (Uchino et al., 2018; Gallo et al., 2015; Holt-Lunstad et al., 2010).

The constructs of social support and social relationships are almost solely quantified using these labels (e.g., structural, functional, perceived, received, emotional, instrumental) in adults. However, in children and adolescents, functional social support is traditionally parsed by source based on particular people within the child's social network (e.g., mother, teacher, peers). Although emotional and instrumental social support are considered in children, these are conceptually organized within each source rather than identified as separate constructs. Structural social support is less commonly assessed in children. It is important to note that the conceptualization of social support in children and adolescents has some overlap with other salient support constructs, including attachment, parental monitoring, and harsh family environment, which contribute to feelings of warmth, safety, and being valued during one's childhood.

Measures of Social Support

Most measures of social support in adults focus on the structural or functional characteristics of support, and can be used in tandem to complement one another, while other tools specifically target the emotional or instrumental aspects of functional support. In comparison, measures of social support in children are traditionally organized by the *source* of support in parallel with the childhood conceptualization described above. For example, the Student Social Support Scale (Malecki & Elliott, 1999), the Child and Adolescent Social Support Survey (CASSS; Malecki & Demaray, 2002), the Social Support Scale for Children (SSSC; Harter, 2012), the Multidimensional Scale of Perceived Support (Zimet et al., 1988) and the Social Support Questionnaire for Children (SSQC; Gordon-Hollingsworth et al., 2016) all categorize social support from parents, teachers, peers, and other sources. Upon closer inspection of the questionnaires' items, one can find that assessment of emotional and instrumental support is embedded within the language of the item wording (e.g., emotional: say nice things, make me feel better; instrumental: help me when I need it, helps me solve problems). Aubin and colleagues (2002) suggested that source-specific support may be more important and descriptive in children (Aubin et al., 2002), because types of functional support such as emotional and instrumental are less well-defined and instead cluster by source. For instance, the people in a child's network are largely consistent over time (i.e., parents are primary sources of support, peer support increases across development), while their roles and the type of support experienced by the child likely evolve across development. Indeed, as the majority of these traditional measures use a source-centric approach, with each source considered uniquely and independently (i.e., within a vacuum), they fail to consider cumulative social support available across *all* sources. To

the best of my knowledge, no social support measure for children has considered a more global perception of support across one's social network.

Researchers have thoroughly studied other aspects of social relationships related to children's social support. Experiencing social support means feeling a sense of closeness, warmth, and safety. Within the child literature, these are constructs more commonly nested within conceptualizations of attachment, parental monitoring, and early family environment. Bowlby (1989) suggested that children rely on their closest relationships (e.g., primary caregivers) for feelings of comfort and security, especially during stressful times. Ainsworth's Strange Situation (1978) is commonly used to measure attachment style of a child's relationship with their parent (usually mother). Parental monitoring includes behaviors to provide a child with a safe environment, which directly overlap with the latent essence of social support. For example, items on the Alabama Parenting Questionnaire (Essau et al., 2006) assess positivity (e.g., compliment achievements), involvement (e.g., do fun things with parent), availability (e.g., parents are too busy), and control/monitoring (e.g., inconsistent discipline). Clearly, the importance of warmth and safety is shared across social support and family relationships; these constructs are salient to optimal childhood development. Evidence suggests there are important and intricate links between social support, attachment, and parenting (Green et al., 2007; Kafetsios & Sideridis, 2006). For example, children with early supportive family environments (e.g. parental social support, less social conflict) develop higher perceived social support during adulthood, which in turn, is associated with better health outcomes via healthy coping and health behaviours (Uchino, 2009). Indeed, it is plausible that a latent, unifying construct of social support that includes closeness, warmth, and safety could explain the observed associations between attachment, parenting, and well-being, as previously posited by Uchino (2009). This

underscores the need for a more comprehensive, encompassing conceptualization of children's social support and a mirrored measurement approach that assesses children's experience of warmth, safety, and "social coziness" that are aligned with the idea that social support means believing you are *valued, cared for,* and *loved* by *someone*. Fundamentally, the significance of feeling close to others and having a network to rely on are the core elements of what makes one *feel supported* and these underlying characteristics are presumed to be the same across the lifespan. During the transition of adolescence, children's sources of social support begin to broaden across their emerging social networks (Furman & Buhrmester, 1992; Levitt et al., 1993); this raises the question of whether their levels of perceived social support or overall "social coziness" would change developmentally (i.e., consistent perception of social support, but source changes).

Multidimensional Approach to Social Support. A seminal meta-analysis by Holt-Lunstad and colleagues (2010) found that adults with stronger social support had a 50% greater likelihood of survival, regardless of age, sex, initial health status, cause of death, or length of follow-up period. Importantly, how features of social relationships were defined and measured mattered: studies with multidimensional measures of social integration (e.g., network-based inventories) yielded higher odds of survival (91%) versus those with narrow measures (e.g., living alone) which yielded lower odds (19%; Holt-Lunstad et al., 2010). Similarly, Kumar and colleagues found that the association between social support and self-reported health was consistent across income categories and geographic locations in over 100 countries (Kumar et al., 2012). Intriguingly, only a single question was used to measure social support in Kumar's study that asked simply, "If you were in trouble, do you have friends and relatives you can count on to help you whenever you need them, or not?" This single item managed to encapsulate

perceived support across one's entire social network. The encompassing measures of social support used in both the Holt-Lunstad and Kumar studies (regardless of whether assessed through several items or a single item) seem to have better captured the multidimensional effects that social relationships have on health. In other words, identifying whether there is *someone* available for support may be a more robust predictor of health than approaches that uniquely consider only a single source. Notably, these studies were exclusively conducted in adults; there has yet to be a shift to adopt a more comprehensive lens to the conceptualization of social support in children and adolescents.

Existing Gaps in the Literature. In summary, there are various aspects of social relationships that play a role in one's health and well-being, particularly social support. Social support has been ardently categorized and defined, reflected in its rigorous measurement approach in adults. However, in children, social support measurement has traditionally relied on a source-centric approach. Holt-Lunstad (2010) and Kumar's (2012) use of multidimensional measures of social support across one's network demonstrated that a more encompassing conceptualization was a more robust predictor of mortality and self-reported health. The use of singular source-centric social support rather than a multidimensional approach makes it difficult to draw relative conclusions in children and adolescent samples (Chu et al., 2010; Heerde & Hemphill, 2018). Importantly, this source-centric approach that is traditional for the measurement of social support during childhood and adolescence may fail to capture an underlying, latent construct of social support and feeling valued in one's daily life. Further, rather than considering social support based on the relationship source, an alternative conceptualization raises the possibility of separate subdimensions of social support related to feeling valued, warmth, and secure. Findings about the relation between social support and

health in children and adolescents are limited by the current source-centric methodology. Few studies compare social support across age groups, and thus, lack a developmental perspective. Given the prominent evidence linking social support's role for health in adults, there are unanswered questions about how social support relates to health and well-being in pediatric populations and whether this association exists earlier in the lifecourse.

Part 2: Linking Social Support and Health

Aspects of social relationships important for health include social support (and integration) and negative social interactions (Cohen, 2004). Emerging evidence suggests the influence of social relationships on the immune system is one key contributor for multiple health outcomes, given the role of inflammation across different pathologies (Fagundes & Way, 2014). The scope of this thesis is focused on the link between social support and inflammatory processes. In the following background sections, general theoretical models of the mechanisms linking social support and health are briefly reviewed. Then, the immune and inflammatory processes are discussed in depth and their role as mechanisms for health are presented.

Theoretical Models

Social support is thought to exert its influence on health through bi-directional and nested mechanisms via psychological (i.e., positive and negative emotion, self-efficacy), physiological (i.e., endocrine, cardiovascular, immune system), and behavioural processes (i.e., physical activity, smoking; August, & Rook, 2013). Two general theoretical models propose how social support influences health: (i) the main effects hypothesis (a.k.a., direct effects hypothesis), stating that social support is generally beneficial to mental and physical health, and (ii) the stress buffering hypothesis, stating that social support is primarily beneficial during stressful times as a resource and promoter of adaptive behaviours and neuroendocrine responses (Cohen et al.,

2000). As previously described, social conflict and social support can occur simultaneously, and social support may mitigate the effects of interpersonal stress. More specific to the immune system, two theories have been put forth to explain the neurophysiological and behavioural pathways between social support and inflammation. First, social stressors activate brain regions associated with cytokine release, which become repeatedly sensitized over time (*social signal transaction theory*; Slavich & Irwin, 2014). Separately, sickness-induced inflammation can lead to increases (*sickness behaviour theory*; Muscatell et al., 2016) or decreases (Miller & Raison, 2016) in social support. For example, chronic cytokine exposure can produce withdrawal, energy conservation, anxiety and/or hypervigilance behaviours (Miller & Raison, 2016). Overall, negative social experiences (i.e., conflict, isolation) can increase inflammatory responses while suppressing antiviral immunity, whereas positive social experiences (i.e., social support) can decrease inflammation and strengthen antiviral responses (Leschak & Eisenberger, 2019).

Immune and Inflammatory Processes

Immune functioning (i.e., inflammation) has been posited as a mediator linking social relationships and numerous health outcomes due to the role of inflammatory cytokines and acute phase reactants in a variety of diseases (Uchino, 2006). Inflammation is a natural immune response to threats (e.g., invading pathogens or tissue damage). Acute inflammation is a strong, short-term response to injury or infection that aims to resolve the threat (Feghali & Wright, 1997). Inflammatory functions initiated and regulated by the release of cytokines (proteins or glycoproteins) serve to extinguish the immune threat and repair damage. Chronic low-grade inflammation is a weaker, long-term response to threats over time and results in elevated susceptibility to disease. Chronic low-grade inflammation is characterized by increasing levels

of mediators (cytokines, proteins) that contribute to chronic inflammation (Rohleder & Wolf, 2013).

The major inflammatory cytokines include interleukin (IL)-1, IL-4, IL-6, C-reactive protein (CRP), and tumor necrosis factor-alpha (TNF-alpha). IL-1 was one of the first inflammatory cytokines discovered; it activates IL-6 gene expression and other pro-inflammatory mechanisms (Rohleder, 2013a). IL-4 is a cytokine known for regulating helper T-cells during infection (Gadani et al., 2012). IL-6 is an endocrine cytokine secreted from immune cells in addition to adipocytes and endothelial cells, which triggers the production of CRP (Rohleder, 2013a). CRP is an acute phase reactant which is secreted in response to both acute and chronic inflammation by IL-6 (or IL-1, TNF-alpha, and glucocorticoids). Although CRP initially works to restore the body after infection or injury, high circulating levels of CRP reflecting chronic low-grade inflammation have been associated with adverse health outcomes (van Zanten, 2013). Finally, TNF-alpha is a cytokine characterized by signaling programmed cell death and/or triggering pro-inflammatory effects (Rohleder, 2013b). Natural killer cells and helper T-cells are important for targeting infections and chronic conditions and are involved in the release of cytokines such as TNF-alpha and IL-4 (Uchino, 2006). Chronic low-grade inflammation can be assessed with high-sensitivity assays of these inflammatory biomarkers in blood samples (van Zanten, 2013). Higher levels of these circulating inflammatory markers have been associated with osteoporosis, certain cancers, cardiovascular disorders, type 2 diabetes, rheumatoid arthritis, Alzheimer's disease, frailty and disability (Maggio et al., 2006) and increased risk of all-cause of mortality (Harris et al., 1999).

Social Support and Inflammation: Adults

Reviews of social support and inflammation report consistent evidence of an association linking social support to lower levels of chronic low-grade inflammation (Kiecolt-Glaser et al., 2010; Uchino et al., 2012; Uchino et al., 2018). For example, a population-based study in the United States found that higher levels of social support and lower levels of social conflict from one's social network predicted lower levels of inflammatory markers throughout adulthood (Yang et al., 2014). In a recent meta-analysis of 47 studies by Uchino and colleagues (2018), social support was significantly related to lower levels of inflammatory markers (r = -.073; note the original Fisher's Z' value reported was transformed into r to facilitate comparison and interpretation). Specifically, social support across source (e.g., family, caregiver, friends, neighbours, supervisors/co-workers, family) was associated to inflammatory markers (i.e., CRP) in clinical and non-clinical samples (c.f., Lutgendorf et al., 2005; Nakata et al., 2013; McHugh Power et al., 2019; See Uchino et al., 2018 for complete list). Further, Uchino and colleagues found that this association was maintained across social support subconstruct (structural, perceived, received), cytokine (fibrinogen, IL-6, CRP), and methodological design (e.g., sample: non-clinical vs. clinical; study design: cross-sectional vs. prospective). The largest effect was for social integration (structural support, r = -.076, n = 22), followed by perceived support (r = -.054, n = 24) and received support (r = -.040, n = 6). Finally, almost all studies in this meta-analysis had samples of adults or older populations, and effect sizes were based on social support measures restricted to received or perceived support; other subconstructs of social support (e.g., emotional, instrumental subcomponents) were not considered, nor were multidimensional measures. Overall, evidence supports that higher social support is robustly associated with lower inflammation in adults.

Social Support and Inflammation: Children and Adolescents

Less research has been conducted examining the effects of social support on low-grade chronic inflammation in children and adolescents. Questions remain about the effect on social support on the pathogenesis of inflammation and generalization across childhood development. Within the past decade, research has started to examine the relation between social relationships and chronic low-grade inflammation in youth. As discussed earlier in the conceptualization of social support, the child and adolescent literature has a rich density of findings linking key elements of social support to health; however, these are rarely referred to as "social support". Instead, constructs with considerable overlap are largely considered within conceptual silos. For example, parent support, harsh family climate, and even attachment could be reconstrued as emotional and instrumental social support. Evidence has shown the entwined nature of these constructs (e.g., Uchino, 2009). Further, most findings are presented as a source-centric approach, focusing singularly on parents or peers or teachers. The lack of continuity in the construct of social support across the lifespan, combined with the emphasis on single sources of social support during childhood and adolescence has limited its contribution to a cumulative science about social support and inflammation. For example, parent support has moderated the link between adolescents' depressive symptoms and CRP (b = -.20, Guan et al., 2016), has been associated with decreased levels of IL-4 (Chen et al., 2007), and has been found to moderate the link between sympathetic activity and CRP (Nelson et al., 2017). In a sample of older adolescent females, warmer family climate (i.e., more emotional support, less conflict, less harsh) predicted IL-6 production trajectories over 18 months; and, having a less harsh family climate was a buffer when experiencing a major life event, leading to lower IL-6 production (Miller & Chen, 2010). Closer inspection of these studies reveal that items used to assess parent support and harsh

family climate actually could be relabeled as emotional social support, instrumental social support, social conflict, and social cohesion if viewed through a broader, multidimensional lens of the conceptualization of social support. It is commonplace for studies with children and adolescents to use an insular approach when assessing social support, focusing solely on singular sources of support. In addition to the need to consider the scope of support across sources, the *quality* of the support is also relevant. Adolescents who had more engaging and fulfilling cumulative social support *across* sources (i.e., peers, family, school) had lower CRP values, even after adjusting for the amount of support received ($\beta = .28$; Fuligni et al., 2009).

Negative aspects of social relationships closely related to emotional social support and warmth have also been examined (Uchino, 2009). For example, insecure and disorganized attachment during infancy (e.g., insecurity, distance) predicted higher inflammatory markers (Measelle & Ablow, 2018) and higher CRP in early childhood (Bernard et al., 2019). Poor parental monitoring (e.g., lack of time or interest in teen's activity) and negative parental behaviours (e.g., conflictual aggression) were associated with higher CRP during adolescence (Byrne et al., 2017a; Byrne et al., 2017b). Less warm, supportive relationships predicted greater pro- and anti-inflammatory response in adolescents (Miller et al., 2009). These negative emotional aspects (i.e., conflict, distance) foster support that is less warm and less supportive, which have been associated with inflammatory markers in children and adolescents.

Safety has also been associated with inflammation. Safety is a construct that partly overlaps with perceived and instrumental support (i.e., resources), and is usually characterized within one's contextual environment. More dangerous neighbourhoods and unsafe physical home environments have been associated with higher levels of CRP in children and adolescents (Broyles et al., 2012; Schmeer & Yoon, 2016b). Curiously, while school environment (e.g.,

teachers, classmates) has been related to positive mental health outcomes and reduced health risk behaviours (Vaz et al, 2014; McNeely & Falci, 2004), no studies to date have explored its relation to inflammation.

The importance of understanding the pathophysiology of inflammation from a young age is timely and has lasting implications for overall health. There is evidence for a longitudinal association between social support and inflammation across the lifecourse. Emotional and instrumental support in childhood have been retrospectively associated to greater allostatic load scores in adulthood for inflammation and metabolic-lipids (Slopen et al., 2016). Indeed, aspects of social relationships in childhood such as attachment and social isolation are linked to higher levels of inflammation in adulthood nearly 40 years later (Fagundes et al., 2011; Lacey et al., 2014). It is unclear whether this is due to long-term effects of social support during critical developmental periods, or whether social support or inflammation levels track into adulthood. These findings underscore the importance of better understanding the relation between social support and inflammation early in life, and they suggest that social support may play a crucial role in regulating chronic low-grade inflammation in children and adolescents.

Existing Gaps in the Literature. Overall, there is robust evidence for the relation between social support and health in adults, specifically chronic low-grade inflammation. Within the literature, some studies suggest that a multidimensional approach aggregating social support across sources and across types yields stronger associations with inflammatory markers. However, most of the literature with children and adolescents targets negative and positive social relationships using a singular source approach and few use formal social support measures. This traditional approach considers sources of social support independently, when instead there are likely common underlying aspects about closeness, warmth, and safety. The source-centric

approach introduces a gap because it undermines the importance of having *anyone* within one's social network who can contribute to feeling valued and supported. Most child and adolescent studies only capture one component of a more encompassing, multidimensional conceptualization of social support, thereby precluding the discovery of other dimensions of social support that may be instrumental in regulating levels of chronic inflammation.

Social support likely plays an important role balancing associations for healthier outcomes across numerous biophysiological systems. Consider the construct of allostatic load that captures cumulative exposure to a defined set of risk factors (McEwen, 2000). The conceptualization of allostatic load has led to significant advances in knowledge and the field of psychosomatic medicine. Allostatic load unified disparate lines of research to collectively provide evidence for a cumulative causal risk factor. This encompassing approach used with allostatic load raises a parallel question for the social support literature: is there a unifying, latent social support construct that may better reflect the salient aspects of social support, and in turn, more robustly explain its relation to health and well-being across the lifespan? I postulate that using a more comprehensive conceptualization and quantification of social support in children would be a more integrative way to examine support across the child's entire social network.

Thesis Rationale and Objectives

At the population level, countries and cultures with close social networks and stronger social cohesion, such as Scandinavia, consistently outperform other OECD countries in their rankings of happiness, overall wellbeing, and lower levels of depression among adults (OECD, 2015; Sachs et al., 2018), and for multiple psychosocial outcomes, emotional wellbeing, and life satisfaction among children (UNICEF dimensions of child well-being; Adamson, 2013). The differences in prevalence rates of depression and mortality observed across countries is not fully

explained by access to healthcare, economic resources, material deprivation, or income inequality. Instead, there is an increasing recognition of the role of social relationships, support, and warmth that may fundamentally shape well-being and promote health. For example, the World Health Organization regards social engagement / integration as a critical contributor to better health and well-being of children and adolescents (WHO, 2017). Curiously, *hygge* is a concept that embodies Danish culture and implies "coziness" and feelings of warmth and security among one's home, family, and community (Wiking, 2016).

Reiterating the Danish concepts of hygge mentioned above, I propose "social hygge", or social coziness, as the integrated construct that may more fully capture social support and warmth across levels of children's social environments (i.e., family, school/peers, community). This is posited as a unifying theoretical concept to more broadly represent the latent facets and nuances of social support. Social hygge emphasizes a child's feelings of warmth and being valued and cared for in their social environment, and echoes the definition of social support. Social hygge is intended to target the gap in multidimensional assessment of social support in children and adolescents. For my thesis, I contended that social hygge, as an enhanced conceptualization of social support, would better predict health in children and adolescents.

Two studies were proposed to test these assertions. In Part 1, I explored the quantification of social support and social hygge and their psychometric qualities using three approaches: traditional, data-driven, and social hygge. For the Traditional Approach: I created source-specific measures of social support aligned with the traditional method for quantifying social support in children. For example, social support was be grouped by source, including mother, father, parents, peers, school, and neighbourhood. For the Data-Driven Approach: I created measures of social support that held together quantitatively and reflected the covariance among aspects of

social support, independent of source. This approach allowed me to see how types of social support from various sources may converge naturally. For example, social support may be grouped by quality or characteristic, such as close parents, emotional support from mothers, or perceptions of safety. For the Social Hygge Approach: I created social hygge measures of social support guided by the proposed unifying reconceptualization that social hygge is an encompassing, latent construct that spans all social supports across a child's network, and that social hygge can be separated into underlying subdimensions (e.g., warmth, safety). Social hygge measures were divided into both multidimensional measures (e.g., latent component) and underlying subcomponents guided by data and pre-existing theory of social support.

Hypotheses

The overarching aim of this thesis was to explore the proposed concept of social hygge as a predictor of chronic inflammation. In Part 1, I conducted a psychometric evaluation of three social support conceptualizations: (i) traditional, (ii) data-driven and (iii) social hygge (multidimensional and subdimensional). In Part 2, I tested whether this proposed social hygge conceptualization was associated to chronic inflammation (i.e., CRP), and whether it better predicted inflammation compared to traditional measures of social support in children. Two hypotheses were tested: (1) Consistent with previous findings, I hypothesized that there would be a negative association between all social support conceptualizations and inflammation. Specifically, higher levels of social hygge were predicted to be linked with lower levels of CRP. (2) I hypothesized that the social hygge construct would be more strongly associated with CRP than the traditional (source-specific) or data-driven, singular components.

Methods

Procedure and Sample

This thesis used the dataset from the Quebec Child and Adolescent Health and Social Survey (QCAHS) collected between January 1999 and May 1999 for secondary analyses. The complete survey design and methods are reported in detail elsewhere (Paradis et al., 2003; Aubin et al., 2002). QCAHS used stratified, cluster sampling of schools to recruit three samples of youth aged 9 (*n*=1520, range 8-10 yrs), 13 (*n*=1498, range 12-14 yrs), and 16 years old (*n*=1495, range 15-17 yrs). The original sampling frame was drawn to be population-representative of Quebec and stratified by administrative region based on language of instruction, school status (private vs public), and geography. Schools were randomly selected for each age group (age 9 *n*=69, age 13 *n*=52, age 16 *n*=61), with 25 students randomly selected from each school. The sample was selected to be representative of 97% of the Quebec population of 9-, 13-, and 16-year-olds, of whom 79.6% were French Canadian, when sampling weights were applied.

The Quebec Child and Adolescent Health and Social Survey was approved by the Ethics Review Board of Direction Santé Québec, Institut de la Statistique du Québec, and CHU Sainte-Justine. Written informed consent was obtained from the legal guardians of participants (Paradis et al., 2003). Concordia University Ethics Committee approved secondary use of this dataset (UH2006-068).

Prior to the school visit, parents provided consent and completed a parental questionnaire mailed to the researchers in a preaddressed, stamped return envelope. The parent who "knew the child best" was instructed to complete the questionnaire. On the day of the school visit, trained and certified staff collected measures during a single morning session. Measures included a fasting blood draw, blood pressure, anthropometrics (height, weight, waist circumference), and a youth questionnaire. Questionnaires were administered in French or English (according to school language) and were allocated 45 to 60 minutes for completion.

Part 1 of this thesis used the total sample of eligible youth who completed the questionnaire for measurement development and quantification of the social hygge construct (age 9 *n*=1267, age 13 *n*=1186, age 16 *n*=1212); 52 participants were excluded due to crucial data missingness. Part 2 used the subset of youth who completed the fasting blood draw and had assays for plasma-levels of C-reactive protein (age 9 *n*=697, age 13 *n*=715, age 16 *n*=792). As previously reported, while the lower completion rates for the blood draw suggested possible selection bias, only language spoken at home (age 9 only) and physical activity levels (age 16 only) were significantly different between those who did and did not complete the blood draw (Paradis et al., 2003). Specifically, blood draws were completed for 53% of anglophones versus 67% of francophones among 9-year-olds; and, blood draws were completed for 72% of those physically active versus 81% of those least active among 16-year-olds. Furthermore, there were no statistically significant differences for blood draw completion for sex, pubertal status, smoking, weight status, parental smoking, parent education, household income, or school setting (rural or urban; Paradis et al., 2003).

Measures

Sociodemographics

Youth reported their age and birthdate. Age was stratified into three categories (age 9, range 8-10yrs; age 13, range 12-14yrs; age 16, range 15-17yrs). Youth endorsed they were a boy or a girl. (Note, insufficient information was collected to discern biological sex assigned at birth versus identified gender; response options only included boy or girl. Thus, for the purpose of this thesis, sex is the assumed construct measured and consistent with prior QCAHS publications.)

Parents answered questions about their socioeconomic status including items about parental education and household income. Highest level of education completed was assessed on

a 7-point Likert scale (*No formal schooling or nursery school* = 1; *University* = 7; *Do not know* was response option) for the parent completing the questionnaire and their spouse/partner. Total household income (1998, before taxes and deductions), including everyone residing at the same residence as the child who shared expenses, was assessed on a 9-point Likert scale *(<$10,000* = 1; *≥$80,000* = 9). Income category brackets were converted into the median income and used as a scale variable in analyses (e.g., *$15,000 to $19,999* = 17.5K $CAN).

Anthropometrics

Body Mass Index (BMI) was calculated from measured height and weight [weight (kg)/height^2(m^2)]. BMI was then converted into age- and sex-specific Z-scores based on the Centers for Disease Control and Prevention (CDC) standardized curves to derive percentiles (CDC, 2018). Height was recorded to the nearest millimetre during maximal inspiration without shoes using a standard measuring tape. Weight was recorded to the nearest 0.2kg without heavy clothing using a spring scale. For protocol fidelity and data quality, measurements were repeated a third time if they differed by more than 0.5cm for height or 0.2kg for weight (average of two closest measures used; Paradis et al., 2003).

Smoking Behaviour

Questions were based on the 1994 Canadian Youth Smoking Survey (Stephens & Morin, 1996). Current smoking was defined using items as previously described by Lambert and colleagues (2004). Youth answered one of two questions (9-year-olds: "*Have you ever smoked a whole cigarette?*"; 13- and 16-year-olds "*During the past 30 days, did you smoke cigarettes, even just a few puffs?"*). Response options were binary categorical (yes/no).

Social Hygge Items

Questions included in the QCAHS were previously validated or used in prior population-based surveys in Canada or Quebec (e.g., Canadian National Longitudinal Study of Children and Youth, Quebec Enquete Sociale et de Santé). Social hygge item selection was decided by three raters (two independent and myself) who were asked to identify questions that measured social support and/or social relationships. Raters identified potentially relevant items in the child or parent questionnaires; 38 items were identified for children, 44 items were identified for adolescents. Raters had strong agreement for items chosen before a focus group discussion (kappa (κ)=.923, p=.001). Item selection was finalized after differences in opinion and rationale were discussed during the focus group. Items with lower concordance were those related to school and neighbourhood; ultimately, the raters agreed to included these items to reflect the broad conceptualization of social support and social hygge for this exploratory study. Social support items were selected that measured perceived social support, confiding habits, received social support, parental support, school environment, and neighbourhood social cohesion.

Perceived Social Support. Youth answered seven questions about perceived availability of (emotional) social support, adapted from the Social Support Rating Scale (Cauce et al., 1994). Questions assessed the perceived functional aspect of social support; in other words, that support resources (e.g., help, emotional support, companionship, information) would be available from one's social network if needed. Items included '*Do you have someone who can help you in case of a problem?*' (yes/no categorical variable) and '*Do you think the following people would really listen to you and help you feel better if you really needed it?*" answered for father, mother, sibling, friend, teacher, and someone else (3-point Likert scale: *Not at all / NA* = 0, *A little* = 1, *A lot* = 2; Aubin et al., 2002). Original responses were reverse coded into these scores to facilitate

data harmonization across variables; higher scores reflect higher perceived social support. (See Table A1, Appendix A for complete questionnaire item list.)

Confiding Habits. Youth answered two questions about their confiding habits. Items included whether they confided in someone over the past six months (‘*During the past 6 months, have you ever told someone something that was bothering you or was very important to you?*’; yes/no categorical variable) and one question about their frequency of confiding with others (‘*When you feel sad or very happy, do you talk to someone about it, share it with someone?*’; 3-point Likert scale: *Never* = 0, *Sometimes* = 1, *Often* = 2). Responses were coded into these scores to facilitate data harmonization across variables; higher scores reflect higher frequency of confiding. (See Appendix A.)

Received Social Support. Adolescents (13 and 16 years only) answered one question about the received functional aspects of social support, quantifying supportive behaviors received by an individual. The item asked ‘*Did you feel satisfied with the listening/help received if you confided in someone over the past 6 months?*’ (3-point Likert scale: *Unsatisfied* = -1, *More or Less Satisfied* = 0, *Satisfied* = 1; item scored as missing if youth did not endorse confiding). Original responses were recoded into these scores to facilitate data harmonization across variables; higher scores reflect more satisfaction with support received. (See Appendix A.)

Parental Support. Youth answered 18 questions about the frequency of emotional support and controlling behaviours, from their mother and father over the last month (adapted from Styles de vie des jeunes du secondaire en Outaouais study, Deschesnes & Schaefer, 1997). Wording of items included flexibility for diverse family structures: father or father-figure; mother or mother-figure. Items included positive interactions (8 questions e.g., *‘Does he/she compliment you for good things you do?’*) and negative interactions (10 questions e.g., *‘Does*

he/she say things that hurt you or make you feel bad'). Children (9 years) answered using a 3-point Likert scale (*Never* = 0, *Sometimes* = 1, *Often* = 2); adolescents (13 and 16 years) used a 5-point Likert scale (*Never* = 0, *Rarely* = 0.5, *Sometimes* = 1, *Often* = 2, *Very Often* = 3; Aubin et al., 2002). Negative items were recoded so lower scores reflected lower support (e.g., *Never* = 0, *Rarely* = -0.5, *Sometimes* = -1, *Often* = -2, *Very Often* = -3). Original responses were recoded into these scores to facilitate data harmonization across variables to capture both positive and negative support. (See Appendix A.)

School Environment. Adolescents (13 and 16 years only) answered five questions about their school environment (adapted from the Ado, Familles et Milieu de vie study, Cloutier et al., 1994). Items included *'I feel comfortable at my school'* and *'Some of my teachers will listen to what I have to say when I need to talk about my problems'* (4-point Likert scale: *Completely Disagree* = -2 to *Completely Agree* = 2; Aubin et al., 2002). Original responses were reverse coded into these scores to facilitate data harmonization across variables; higher scores reflect warmer, more supportive school environments. (See Appendix A.)

Neighbourhood Social Cohesion. Parents agreed or disagreed with 11 statements about their neighbourhood social cohesion and safety. Statements included *'Neighbours help each other'* and *'There is criminal activity (break-ins, violence)'* (3- and 5-point Likert scales depending on item: *Completely Disagree* = -2, *Disagree* = -1, *Don't know* = 0, *Agree* = 1, *Completely Agree* = 2). Original responses were recoded into these scores to facilitate data harmonization across variables; higher scores reflect greater neighbourhood social cohesion. (See Appendix A.)

C-Reactive Protein

More than half of the sample completed an overnight (10 hour) fasting blood draw (n = 2475). Of the 2475 blood samples, 226 were excluded due to parent refusal for assays other than lipids (n = 107), and sample quality or quantity (n = 119) of these sample. Of the remaining 2249 samples, an additional 45 samples were excluded from analyses as CRP levels were ≥10.0 mg/L; this traditional cut-point indicates active infection or chronic inflammatory disease (age 9 = 2%, age 13 = 1.1%, age 16 = 2.6%). Thus, the total number of samples used in analyses was 2204 (age 9, n = 697; age 13, n = 715; age 16, n = 792). Blood was obtained by venipuncture by a pediatric nurse in a 1 g/L EDTA collection tube (Lambert et al., 2004). High-sensitivity C-reactive protein (CRP) concentrations were assessed with the IMMAGE® immunochemistry system (Beckman Coulter), with a lower detection limit of 0.20 mg/L per assay. Assays values below the lower detection limit were conservatively assigned a value of 0.20 mg/L (age 9= 47.7%, age 13 = 51.1%, age 16 = 31.5% of valid cases). Coefficients of variability for controls were 4.2% at 0.84 mg/L and 2.5% at 13.8 mg/L (Lambert et al., 2004, p. 1763). Medication use for possible infections or inflammatory conditions (antibiotics, pain/fever, cold/allergies, respiratory problems) in the 2 weeks prior to the blood draw was assessed (Lambert et al., 2004). Risk levels for CRP are defined as low risk <1mg/L, moderate risk 1 - <3mg/L, high risk 3 - <10mg/L, and acute risk or current infection for ≥10mg/L (Pearson et al., 2003). CRP concentrations were $\log_e$-transformed to adjust for non-normality and positive skew (Tabachnick & Fidell, 2013).

Data Integrity and Missingness

Analyses were performed using SPSS version 26. Data were inspected for assumptions of linearity, normality, absence of outliers, and missingness, which are relevant for both Principal Components Analysis (Part 1; Tabachnick & Fidell, 2013) and multivariate, linear regression

(Part 2; Tabachnick & Fidell, 2013). As stated above, CRP was $\log_e$ transformed to correct for skew. Univariate outliers were retained in the sample when values were clinically plausible (e.g., BMI-Z score). Data were missing at random (full sample MCAR $\chi^2 = 50.404$, $df = 19$, $p = .000$) and observed for both the child subsample (age 9: 10.1% total missingness) and adolescent subsample (age 13 and 16: 13.3% total missingness). To address missingness, multiple imputation was conducted using the Regression procedure, which allows for estimation of continuous values for missing data (Tabachnick & Fidell, 2013). Demographics and social support variables (e.g., adolescent-reported mental health items, parent-reported mental health of children items, parent social support items) were used to inform the imputation. Five imputed datasets were created using default specifications for SPSS (maximum parameter draws = 500). Analyses results were averaged across the five imputed datasets, either automatically by SPSS (e.g., regression) or manually (e.g., averaged factor loadings). Imputed data were also inspected for multivariate outliers ($n = 4$ outliers; Tabachnick & Fidell, 2013). Analyses were conducted with the imputed and non-imputed datasets. Results were largely identical; thus, only imputed results are presented for parsimony.

Statistical Analyses Plan

Analytic Plan: Part 1. Quantifying Social Hygge

As explained in the Introduction, I proposed social hygge as an enhanced conceptualization of social support that could be quantified in two ways: (i) multidimensional social hygge latent construct, and (ii) can be separated into underlying dimensions (i.e., social hygge subconstructs: warmth, safety). Using a large population-based survey with parent and child questionnaires, broad social support items were selected by three independent raters. Raters were instructed to identify items that measured social support (e.g., structural, functional,

emotional, instrumental) and/or social relationships using specified operational definitions described above. Items could reflect either positive and negative social interactions as both were incorporated within the multidimensional social hygge construct and subconstructs. Rater agreement was compared and disagreements were discussed; item selection was finalized after discussion of rationale among raters (excellent agreement, kappa $\kappa = .886$). After generating the item pool, data reduction techniques were conducted to quantify social hygge. Three sets of Principal Components Analyses were conducted to correspond with three approaches: (a) traditional social support measures, (b) data-driven and informed by optimal psychometric principles, and (c) social hygge that integrated data-driven with my proposed conceptualization and guiding theories about social support. Part 1 was conducted using the entire sample (N = 3613); some items were only answered by adolescents (e.g., satisfaction, school). When necessary, components were adjusted accordingly to yield factor scores that were centered separately for children and adolescents (i.e., initial factor loading was weighted and sum was divided by number of items to calculate standardized score).

Traditional Approach

Traditional source-centric components (e.g., mother, father, teacher) were derived that aligned with the typical approach used for social support measures for children and adolescents. Raters identified six sources of social support: mother, father, parents, siblings/peers, school, and neighbourhood (See Figure 2). When conducting the Principal Components Analysis, items specific to each source were entered to create a unique component. For example, all father items were entered into a Principal Component Analysis and the solution was constrained to one father component.

Figure 2

List of Derived Components Across Approaches

Traditional		Mother
		Father
		Parents
		Sibling/Peer
		School (Adolescent)
		Neighbourhood
Data-Driven		Availability
		Close Parents
		Distant Mother
		Distant Father
		Busy Parents
		Bossy Parents
		Sibling
		Teacher
		School (Adolescent)
		Neighbourhood Safety
		Neighbourhood Danger
		Neighbourhood Services
Social Hygge	Multidimensional	Latent Component
		Cumulative Sum
		Latent Sum
		Latent Positive
		Latent Negative
	Subdimensional	Perceived Support
		Time Terse
		Parental Warmth
		Safety
		Confiding

Note. Names of components for three analytical approaches, for reference.

Data-Driven Approach

The data-driven approach was grounded in psychometric theory to optimize and explore the quantification of social hygge. Principal Components Analysis (SPSS: Exploratory Factor Analysis using principal axis factoring) with varimax rotation was first conducted using the entire item pool to derive the data-driven components. No constraints were made so that items could be grouped into components based entirely on the covariance matrix. After this initial exploratory analysis, only items with loadings ≥.250 were retained to optimize the components; analyses were conducted again to yield the final loadings. Note that item scoring was already harmonized by reverse scoring relevant items to reflect higher and lower levels of social hygge (see Measures). This data-driven approach yielded 12 components: availability, close parents, distant mother, distant father, busy parents, bossy parents, siblings, teacher, school, neighbourhood safety, neighbourhood danger, and neighbourhood services (See Figure 2).

Social Hygge Approach

Components were derived for an overall social hygge component and for subdimensions of social hygge (subconstructs) using two separate analyses. The overall multidimensional social hygge component was a single, latent component derived from all items. Principal Components Analysis was conducted using the entire item pool and constrained to yield one component. For comparison purposes, four additional cumulative scores were calculated: (i) cumulative sum (calculated as sum of all item responses); (ii) latent sum (item response multiplied by component loading, then calculated sum for all items and divided by number of items), and (iii) latent positive (average of positive items weighted by component loading), and (iv) latent negative (average of negative items weighted by component loading; See Figure 2). These five scores were purposely calculated to compare the construct as latent versus cumulative (e.g., latent component vs. cumulative sum), to compare component scores versus raw scores (e.g., latent component vs. latent sum), and to compare single versus bivariate planes (e.g., latent sum vs. latent positive and negative scores).

The dimensions of social hygge were conceptualized as subconstructs using themes identified qualitatively by three independent raters during a focus group discussion. These themes were also informed by the components that emerged from the data-driven approach and from prior conceptualizations of social support within the literature. Five themes were identified for the dimensions: perceived support, time terse, warmth, safety, and confiding (See Figure 2). Items deemed relevant to each dimension by the raters were entered into a Principal Components Analysis and the solution was constrained to a single component. The *perceived support* dimension component was based on items of perceived availability in a child's network for people to "listen" and "help" when discussing problems. The *time terse* dimension component

was based on items of lack of time and/or interest from others. The *warmth* dimension component was based on items of positive behaviours that promote emotional closeness. The *safety* dimension component was based on items of feeling safe and a sense of belonging in one's surroundings. The *confiding* dimension component was based on items of one's tendency to disclose to others.

Analytic Plan: Part 2. Social Hygge Constructs and CRP

Assumptions of multiple regression were met (Tabachnick & Fidell, 2013). Linear regression models were used to test the hypothesized relation between social support and CRP. Analyses were limited to the subsample of participants who had completed a fasted blood draw with values of CRP below 10.0mg/L (n = 2204). The modeling strategy was conducted in four sequential steps: First, base models included known covariates (age, sex, BMI Z-score) tested to predict continuous levels of CRP (Dowd et al., 2010). Second, additional covariates (current smoking status, household income, parental education) were added to the base model. Results from these models determined which statistically significant covariates would be retained for the models. Third, each social hygge component was tested while adjusting for the base model. Finally, models were stratified by age (child, adolescent) and sex (girl, boy) to explore results and inform the interpretation.

Results

Sample Description

The sample consisted of children and adolescents from the QCAHS survey. Analyses were stratified by age subsamples: children (n = 1267, M_{age} = 8.95 years, SD = 0.44) and adolescents (n = 2346, M_{age} = 14.41 years, SD = 1.55), to reflect questionnaire differences and developmental stage. There were two samples used: the entire QCAHS sample which consisted

of all children and adolescents (N = 3613), and the subsample who consented to complete the fasting blood draws (n = 2204) used to derive CRP. In Part 1, the entire QCHAS sample was used to best inform the quantification of social hygge. In Part 2, the results were limited to the subsample with CRP values.

Overall, the entire QCAHS sample consisted of an equal percentage of boys and girls, with most children and adolescents of normal weight, who were non-smokers and from middle-class families, and who had a college-educated parent. Descriptive statistics are reported in Table 2. Some group differences were observed: Adolescents and girls had slightly higher BMIs and were more likely to smoke than children and boys. Adolescents also belonged to wealthier families in comparison to children.

Part 1. Quantifying Social Hygge

Part 1 consisted of data reduction analyses based on three conceptual approaches: (i) traditional, (ii) data-driven, and (iii) social hygge. Each approach used principal components analysis. Items included for each approach, their respective component loadings, and the internal consistency and variance accounted for by each component are presented in Table 1. A correlation matrix was constructed to examine the association between components within and between the three approaches, presented in Table B1, Appendix B. Components were also compared by age and sex groups.

Traditional Approach

The traditional approach, derived from 39 items, yielded six source-driven components: mother, father, parents, sibling/peer, school, and neighbourhood (See Table 1). Components were based on a range of items from 2 (sibling/peer component) to 20 (parent component, which included 10 identical items for mother and father). The complete items and loadings are

presented in Table 1. Across components, items loadings were moderately strong (average loading = .552). The component with the strongest loading was sibling/peer (average loading = .768); other components had average loadings between .505 and .593. Only one item had a loading <.250 on the neighbourhood component (.084). On average, the traditional components had good internal consistency (Cronbach α_{avg} = .684). Components with more items had stronger internal consistency; the parents component had the strongest internal consistency (α = .846), while the sibling/peer component has the lowest (α = .297). Items on the parent component (e.g., mother/father have good times with you, hurt you) had loadings between .317 and .621; while the items on the sibling/peer component (e.g., sibling/friend can help) had higher loadings of .768 (for both items). On average, the six traditional components accounted for 37.53% of variance of the entered items (range = 27% to 59%); the parent component accounted for the least variance (27.08%) and the sibling/peer component accounted for the greatest variance (59.03%). It is important to note that the variance accounted for is based on the number of entered items; components with fewer items accounted for more variance.

Upon review of the correlation matrix (see Table B1, Appendix B), mother and father components were found to be strongly associated to each other (r_{avg} = .516) and to the parents component (r_{avg} = .870). The sibling/peer component was only modestly associated to other source-driven components (r_{range} = .102 to .221, excluding the neighbourhood component); similar modest correlations were observed for the school component (r_{range} = .070 to .281, in adolescents). The neighbourhood component had weak or no correlation with all other source-driven components (r_{range} = .065-.077).

Differences were observed in comparisons of the component scores across age and sex. As a reminder, component scores have a mean of 0, standard deviation of 1, and were coded to

facilitate interpretation (e.g., higher score indicates higher level of social hygge or more positive interactions). Group comparisons are presented in Table C1, Appendix C. Compared to children, adolescents reported lower support from fathers (t = 8.70) and parents (t = 6.17), higher support from their sibling/peer (t = -6.32) and their parents reported a better neighbourhood environment (t = -3.32). Compared to boys, girls reported higher support from mothers (t = -2.46), school (t = -2.73), and their sibling/peer (t = -10.61).

Data-Driven Approach

The data-driven approach, derived from 44 items, yielded 12 components: availability, close parents, distant mother, distant father, busy parents, bossy parents, sibling, teacher, school, neighbourhood safety, neighbourhood danger, and neighbourhood services (See Table 1). Make note: *negatively* worded components were coded so that a higher component score indicated more social support (e.g., a higher distant mother component score means a *less* distant mother). On average, item loadings across components were moderately strong (average loading = .655). The components with the strongest loadings were neighbourhood danger and close parents (average loading = .745 and .691, respectively). The components with the weakest loadings were distant father and neighbourhood services (average loading = .411 and .417, respectively). Overall, the data-driven components had good internal consistency (Cronbach α_{avg} = .669): the components with the strongest internal consistency were named close parents and distant father (α = .841 and .844, respectively); those components with the weakest internal consistency were named neighbourhood services and busy parents (α = .417 and .486, respectively). Components with fewer items accounted for the most variance of those items (e.g., busy parents, variance = 66.34%; bossy parents, variance = 72.45%; neighbourhood danger, variance = 66.24%), while

those with more items accounted for the least variance (e.g., availability = 36.75%; neighbourhood safety = 39.81%; school = 40.81%).

Comparison of the correlations among components revealed that the availability component was weakly correlated to other data-driven components (r_{range} = .045 to .137; See Appendix B). Components that were related to parents had the strongest inter-correlations, when compared across components. For example, close parents, distant mother, distant father, busy parents, and bossy parents components had low to moderate correlations (r_{range} = .104 to .464). The sibling component had weak to no correlation with all other data-driven components (r_{range} = .062 to .187). The school component was the most strongly correlated component with the teacher component, albeit a low correlation (r = .419, adolescents). Components that were related to neighbourhood were the most weakly correlated to all other data-driven components (rs < .100), although the neighbourhood danger and safety components were moderately correlated with one another (r_{avg} = .412; See Appendix B).

Comparison of the data-driven components revealed differences across age groups and sex (See Table C1, Appendix C). Adolescents reported closer parents (t = -7.23), more negative parenting (distant mother t = 12.34, distant father t = 10.05, bossy parents t = 13.04), and much less teacher support (t = 30.92) than children, and their parents reported safer neighbourhoods (t = -4.46). Girls reported much higher availability (t = -17.35), less bossy parents (t = -6.65), and greater school support (t = -2.75; Appendix C), compared to boys.

Social Hygge Approach

Social hygge was quantified as both a multidimensional construct and its underlying subdimensions. The multidimensional approach yielded five scores: (i) the latent component, (ii) cumulative sum, (iii) latent sum, (iv) latent positive, and (v) latent negative scores (See Table 1).

The latent component, cumulative sum, and latent sum included the entire item pool (adolescents 44 items, children 38 items). The latent positive and negative scores included items categorized as either positive (adolescents 28 items, children 22 items) or negative (both 16 items). Item loadings for the latent component were acceptable (average loading = .313), ranging from -.014 to .638; all items were retained regardless of loading to represent the proposed latent construct. Items with loadings <.250 were about neighbourhood, having people available to help (someone, sibling, friend, someone else), disclosure (disclosure, sharing habits, satisfaction), and school belonging.

On average, these five multidimensional scores had good internal consistency (α_{avg} = .791). The multidimensional social hygge scores with the strongest internal consistency are those that included the most items (latent component, cumulative sum, latent sum, α_{avg} = .817). The latent positive and negative scores had slightly lower internal consistency (α = .760 and .746, respectively). The latent component accounted for 13.18% variance in items in children, and 14.53% in adolescents. All multidimensional scores were highly correlated to each other, with the latent component, cumulative sum, and latent sum most closely related (r_{range} = .859 to .992; See Appendix B). Of note, the latent positive and negative scores were moderately correlated to one another (r = .357). Comparisons of the multidimensional social hygge scores across age and sex groups revealed. Compared to children, adolescents scored higher for cumulative sum (t = -10.216), but lower for latent sum (t = -6.681), latent positive (t = 14.513), and latent negative scores (t = 13.713). Compared to boys, girls scored higher on all multidimensional social hygge scores (t_{range} = -2.039 to -.6379), except the latent negative score (Table C1, Appendix C).

The subdimensional approach to social hygge subconstructs yielded five components: perceived support, time terse, parental warmth, safety, and confiding (See Table 1). Item

loadings across components were moderately strong (average loading = .623). The parental warmth (e.g., mother/father compliment you) and confiding components (e.g., disclosure) had items with the strongest loadings (average loading = .750 and 763, respectively); the perceived support component had items with the weakest loadings (average loading = .498). Overall, the social hygge subdimensional components had good internal consistency (Cronbach α_{avg} = .590); the parental warmth component had the strongest internal consistency (α = .843), while the confiding component had the weakest (α = .253). On average, the components accounted for 45.27% of variance of the entered items (range = 27.16 to 58.19%); the confiding component accounted for the greatest variance (59.03%), while the perceived support component accounted for the least (27.16%).

Subdimensional components were weakly to modestly associated to each other *(*r_{range} = .046 to .425; Appendix B). The perceived support and parental warmth components were most strongly correlated to other components (r_{range} = .395 to .425), followed by time terse (rs < .300), confiding (rs < .200) and safety components (rs < .100). Further, all multidimensional scores were most strongly associated to the subdimensional component of parental warmth (r_{range} =.634 to .933) except for the latent negative score which was most strongly associated to time terse (r_{avg} =.719). Multidimensional scores were most weakly associated to the subdimensional social hygge confiding component (r_{range} =.030 to .285). Comparisons of the subdimensions of social hygge across age and sex groups revealed significant differences. Compared to children, adolescents reported more time terse (t = 9.07) and higher parental warmth (t = -10.22), safety (t = -2.57) and confiding (t = -3.57), compared to children. Compared to boys, girls reported higher levels of all hygge subdimensions (t_{range} = -2.15 to -16.80; less time terse), except safety (Table C1, Appendix C).

Three Approach Comparison

Components derived using the three different approaches were compared qualitatively (See Table 1). As expected, many of the components had overlapping items. The social hygge subdimensions used similar items to several data-driven components: perceived support (3 of 7 items from availability), time terse (combined items from busy and bossy parents), parental warmth (6 of 7 items from close parents), safety (5 of 6 items from neighbourhood safety), and confiding (2 of 7 items from availability). The subdimensions of parental warmth and safety only differed by one item compared to the data-driven components of close parents and neighbourhood safety. The social hygge components (parental warmth, safety) had just noticeably higher item loadings and variance accounted for, compared to the data-driven components ($loading_{avg}$ = .733 *vs* .679, α_{avg} = .745 *vs* .754, $variance_{avg}$ = 48.93% *vs* 45.55%). The latent positive and latent negative scores (social hygge approach) included the same items as the close and distant components (data-driven approach) spanning across a number of sources. For example, the latent positive scores included items from the close parents, school, neighbourhood safety and neighbourhood services component and the latent negative score included items from the distant mother/father and neighbourhood danger components. Internal consistency between the latent positive score, school, and neighbourhood safety were more homogenous (α_{range} = .740 to .760), compared to close parents, which was higher (α = .841) and neighbourhood services, which was lower (α = .417). Internal consistency between the latent negative score and negative danger were also homogenous (α = .745 and 746), in contrast to the busy parents and bossy parents components which were more dissimilar (α_{range} =.481 to .617).

Correlations across components from the three approaches were also examined (Table B1, Appendix B). Components based on the traditional approach were correlated with other

source-based components across the other two approaches. For example, the traditional mother component was highly correlated to the data-driven distant mother component (r_{avg} = .897) and close parents component (r_{avg} = .619), and moderately correlated to the bossy and busy parents components (r_{avg} = .449 and 313, respectively). Similar associations were found for the traditional father component (distant father, close parents, bossy parents, busy parents) and the traditional parents component (distant mother, distant father, close parents, bossy parents, busy parents;(See Appendix B). The mother, father and parents components (from traditional) were strongly associated to multidimensional scores (from social hygge; *r*s > .590); the strongest and most consistent associations between the traditional and social hygge components lay with the latent component (with all traditional components *r*s > .850) and the parents component (with all social hygge scores; *r*s > .770). Between the social hygge and data-driven components, the latent positive score was most strongly associated to the close parents component (r_{avg} = .939) and the latents negative score most strongly associated to the distant mother (r_{avg} =.796) and distant father components (r_{avg} = .780).

Part 2. Social Hygge Constructs and CRP

Descriptive Statistics

Overall, the subsample of children and adolescents who completed fasting blood draws for CRP were an equal percentage of boys / girls, had normal weight status and were non-smokers, who were from middle-class families with a college-educated parent, and had low-risk levels of CRP (< 1mg/L). Descriptive statistics are presented in Table C2 (Appendix C). Within the fasting blood draw subsample, age and sex differences were observed: adolescents were slightly heavier (t = 2.998, p = .003), came from wealthier households (t = -2.360, p = .018), and were more likely to smoke (χ^2 = 190.83, p = .000), compared to children. Adolescents also had

significantly higher levels of CRP (t = -3.073, p < .01), as did girls (t = -3.100, p < .01; See Table C2). Compared to the entire QCAHS sample, the subsample who completed the fasting blood draws did not differ in sex, BMI, current smoking status, household income, or parental education; but, adolescents were slightly older (t = -3.073; See Table 2 and Appendix B). Differences between the entire QCAHS sample and the fasting blood draw subsample were also observed for the social support / social hygge component scores established in Part 1. Specifically, subsample children had higher scores on the teacher component (t = -2.05) and adolescents had higher scores on the cumulative sum (t = -3.34), latent sum (t = -2.39), and latent positive scores (t = -4.37), and lower scores on latent negative (t = 2.50), compared to their counterparts in the entire sample.

Hypothesis Testing

The aim of Part 2 was to compare the relation between social support and chronic low-grade inflammation. First, it was hypothesized that (i) higher social support would be associated with lower CRP, irrespective of which conceptual approach for social support was used (from Part 1). Second, it was hypothesized that the multidimensional social hygge component would account for more variance in the association with CRP, compared to the traditional (source-specific) or data-driven components. To test these hypotheses, we conducted regression analyses using the General Linear Model (GLM). In the base models, age, sex and BMI Z-score were significantly associated with CRP in children and adolescents (see Table 3). Household income and parental education were not significantly associated with CRP in either age group; these variables were not retained in tested models. Current smoking status was significantly associated with lower CRP in children. Thus, four covariates were retained as the base model for all regression analyses. The base models accounted for approximately 10% of the variance in CRP

(child R^2_{adj} = .104, adolescent R^2_{adj} = .108; see Table 3). Next, each social support component derived from Part 1 (traditional, data-driven, social hygge components) were entered singularly into the regression model, adjusting for the base model, to predict CRP. (see Discussion for comments about multiple comparisons and Type II error).

Traditional Components

Six traditional approach components were tested to predict CRP: mother, father, parents, sibling/peer, school and neighbourhood. In children, none of the traditional components predicted CRP. In adolescents, higher father and parents components scores were associated with lower CRP (See Table 3). In boys, higher mother and parents components scores were associated with lower CRP; while, in girls, higher father component score was associated with lower CRP (See Appendix D). These small effect sizes were comparable across age and sex (η^2_p = .004 - .005). No other traditional components were significantly associated to CRP. This demonstrated that components based on parents were more likely associated with CRP, compared to other traditional source-driven components.

Data-Driven Components

Twelve data-driven approach components were tested to predict CRP: availability, close parents, distant mother, distant father, busy parents, bossy parents, siblings, teacher, school, neighbourhood safety, neighbourhood danger, and neighbourhood services. In children, none of the components significantly predicted CRP; however, there was a trend toward more neighbourhood services (e.g., parks and services) being associated with higher CRP (p = .056, η^2_p = .006). In adolescents, a higher close parent component score and a lower distant father component score were associated with lower CRP (η^2_p = .003; See Table 3). Sex stratification revealed that among girls, a higher close parents component score was associated with lower

CRP accounting for 1% of the variance in CRP (See Appendix D); there were no other sex differences. The effect sizes were small; on average, the data-driven components accounted for less than 0.2% of the variance in CRP (See Table 3).

Social Hygge Components

The social hygge components were organized into the multidimensional components and the subdimension components. Five multidimensional scores were tested to predict CRP: latent component, cumulative sum, latent sum, latent positive, and latent negative scores. In children, none of the multidimensional components significantly predicted CRP ($\eta^2_{p\ avg} = .000$). In adolescents, all multidimensional measures were significantly associated with CRP. Higher social hygge multidimensional scores were associated with lower CRP (See Table 3). The multidimensional scores accounted for 0.3 to 0.5% of the variance, yielding a small effect size. Analyses stratified by sex revealed that a higher latent component score was associated with lower CRP in boys and girls; additionally, the latent sum score was associated with lower CRP in boys and the cumulative sum score was associated with lower CRP in girls (Appendix D).

Five subdimension components of social hygge were tested to predict CRP: perceived support, time terse, parental warmth, safety, and confiding. In children, none of the subdimension components significantly predicted CRP. In adolescents, as parental warmth increased, CRP decreased (See Table 3). This effect was also observed in girls; there were no other sex differences (Appendix D). There was a trend toward higher time terse component score (e.g., parents too busy, bossy) associated with higher CRP in boys ($p = .053$, $\eta^2_p = .004$). On average, the social hygge subdimension components accounted for 0.4% of the variance in CRP in adolescents (e.g., latent sum score = 0.5%, latent negative score = 0.3%).

Hypothesis 2: Component Comparison

The second hypothesis compared the magnitude of the association between social support and inflammation across all three approaches to quantifying social support from Part 1. As a reminder, it was hypothesized that the multidimensional social hygge component would account for more variance in the association with CRP. Across traditional, data-driven, and social hygge components, none were associated to CRP in children ($p > .05$). Instead, the relation was present only in adolescents. Partially supporting the hypothesis, the multidimensional social support measures were the most robust predictors of CRP among adolescents ($\eta^2_p = .003\text{-}.005$).

Discussion

The objectives of this thesis were twofold: (i) to explore three approaches to quantifying social support, including the proposed social hygge construct as a unifying, multidimensional construct of social support, and (ii) to test the relation between social support and low-grade chronic inflammation in a population-based sample of children and adolescents, using these three approaches.

Part 1: Findings

Part 1 proposed the construct of social hygge, as an alternative, more encompassing perspective for the construct of social support. Three approaches to quantifying social support were explored: traditional, data-driven, and social hygge.

First, the components derived using the traditional approach clearly identified sources of support in a child's network, including mother, father, parents, sibling/peer, school and neighbourhood. Here, items loaded robustly onto each source (average loading per component from .512 to .768), with high internal consistency suggesting that the items were measuring aspects unique to each source. There was evidence of strong internal consistency among the parent, school, and neighbourhood components, which also included the most items.

Components with more items had higher internal consistency and lower variance accounted for, which was distinct from the item loading strength; this observation was not unexpected given basic principles of psychometric measurement theory (Anastasi, 1985). The traditional components were intentionally created as a parallel to the sources used in formal social support measures (e.g., SSQC; Gordon-Hollingsworth et al., 2016). Examination of the items that loaded on the traditional components suggest certain characteristics of social support contribute more than other characteristics. For example, "had good times with you" loaded most strongly onto the mother, father, and parents components, while "telling the child what to do" (bossy items) loaded the least. This pattern was observed across the six traditional components derived, suggesting that a source-centric approach may not be an ideal fit to the entire social support item pool.

Second, the quantitative data-driven approach was used, yielding more specific components. Components were found to be a hybrid based on source and theme. The mother and father components, previously derived in the source-centric approach, separated into five different components when using the data-driven approach: close parents, distant mother, distant father, busy parents, and bossy parents. Items about closeness or distance in relationships emerged as their own components within sources, namely distant mothers and distant fathers. In fact, the parent closeness component did not include all four emotional support items as grouped within the original questionnaire; instead, only those items about warmth were retained (excluded: too busy to talk about things that are important), in addition to perceived support from fathers. This finding points to the importance of warmth with the quantitative data-driven approach. Bossy items for mothers and for fathers (described above) merged and were the basis of their own component named bossy parents. Items related to safety and danger branched into separate components for neighbourhood characteristics, suggesting that these are also separate

facets of one's contextual social support. Curiously, perceived support from a sibling and teacher emerged as two single-item components. These single items suggest the nature of support from siblings and teachers varies qualitatively from that of parents and the social context.

The internal consistency of the data-driven components was comparable to the traditional components. Altogether, the data-driven approach yielded the most components compared to the other approaches. Components emerged that were primarily based on both the source and nature of the social support quality (e.g., closeness, distant). A real strength of this approach is that it was purely driven by the data, which was valuable for the exploratory objective of Part 1. It was interesting how many components emerged; this approach provided evidence that there is more to social support that simply the source. The distinctions within sources that merged to yield new components suggests that the fundamental aspects of type of social support are also unique. This is especially intriguing because several of these new components are better aligned with the conceptualization of social support that is found within the adult literature, such as emotional support (close parents) and perceived support (availability).

Third, the social hygge approach explored alternative encompassing constructs, including a more holistic, multidimensional construct and several dimensional subconstructs about the nature and quality of the support, rather than the source. Five scores were created to capture the multidimensional social hygge construct and to explore its optimal quantification and related conceptualization (i.e., latent component, cumulative sum, latent sum, latent positive, latent negative). The multidimensional scores included all items and they were correlated with all components derived from the traditional and data-driven approaches. This finding is not unexpected given the overlap of items. Each multidimensional score was calculated for a specific purpose: (i) to test the construct as a latent versus cumulative variable (e.g., latent component vs.

cumulative sum), (ii) to compare component scores versus raw scores (e.g., latent component vs. latent sum), and (iii) to compare single versus bivariate planes (e.g., latent sum vs. latent positive/negative scores). A review of the psychometric findings from the principal components analyses suggests the evidence is inconclusive regarding whether social support is better conceptualized as a latent component or a cumulative sum; they have similar internal consistency. However, the findings indicate that parents remain an important source of support as the parent-related items had higher loadings and converged to yield distinct components with strong psychometrics across the three approaches. Next, there was inconclusive evidence regarding whether component scores or raw scores (based on original values) are better; they have equal internal consistency and the same pattern across sexes (as expected). Lastly, there was inconclusive evidence regarding whether there is a single or bivariate plane of social support. Calculating latent positive and negative scores separately permitted a child to have positive and/or high negative support, independent of one another; these scores would have cancelled one another out in the latent sum. The moderate correlation between latent positive and latent negative scores suggests these are distinct, while the positive experiences do not equate to a lack of negative experiences (bivariate plane). This partly supports previous conceptualizations of social relationships in that positive and negative aspects of relationships are separate (Cohen, 2004). On the other hand, the scores did not seem to have cancelled each other out given the psychometric integrity of the latent sum (single plane). Replication is needed to untangle these effects; it may be that single and bivariate planes are present (i.e., main hypothesis and stress buffering hypothesis). Further, the utility of the scores provide additional evidence to help sort out these comparisons; I will return to this point in Part 2.

Next, subdimensions for social hygge were created using a hybrid of the data-driven approach and my proposed re-conceptualization of social support informed by findings in the literature. Of the five components derived (i.e., perceived support, time terse, parental warmth, safety, confiding), perceived support, time terse, parental warmth and safety dimensions were particularly robust, with higher internal consistency. These dimensions of social hygge overlapped to some extent with components identified in the data-driven approach. For example, parental warmth was most similar to close parents (overlap on 6 of 7 items), safety was most similar to neighbourhood safety (overlap on 5 of 6 items), and time terse included items from the busy and bossy parents components (include 2/2 items from busy parents and 2/2 items from bossy parents). The items dropped were those with little theoretical value for social support (e.g, dangerous traffic for safety). The social hygge subdimension components created yielded higher items loadings for parental warmth and safety, similar items loadings for confiding, and lower item loadings for perceived support and time terse compared to each related data-driven components mentioned above (close parents, availability and busy/bossy parents, respectively).

Comparison of the component scores for all three approaches by age and sex groups revealed possible developmental differences for social support among children and adolescents. The same items for both children and adolescents were intentionally entered into the principal components analyses to compare how the component scores varied during childhood and adolescence. Alternatively, the principal components analyses could have been conducted separately within children and adolescents to see if items loaded on to components in a similar pattern. Differences by sex were less robust. Replication is needed to determine if similar components or age/sex differences would emerge in another sample considering the methodological decisions made.

Part 1: Comparison to Past Research

In comparison to past research, several components derived shared item content that overlap with other constructs that could be construed as "proxies" of social support, such as parental monitoring, attachment, harsh family environment, and neighbourhood cohesion. For example, the distant mother/father components included items about supervision and control that overlap with parental monitoring as measured by the Alabama Parenting Questionnaire (Essau et al., 2006); and, the parental warmth component included items about affection that overlap with secure attachment. In comparison to the conceptual organization of social support common in the adult literature, only perceived social support was mirrored in the components derived. Perceived support, and more specifically perceived emotional support (e.g., "really listen to you and help you feel better if you really needed it") were items that were included in the parental warmth component. Structural, instrumental and received support components did not emerge, which is likely attributable to the items included in the QCAHS. (I will return to this issue in more detail below.) Interestingly, availability was the only component with items that were negatively loaded on the multidimensional social hygge latent component. Namely, the items about disclosure and sharing habits were inversely related to social hygge, and they seem to capture the social support construct known as received support. This findings is actually consistent with research evidence that individuals who ask for (or receive) social support often fare worse than those who do not; in other words, asking for help means that it was needed in the first place.

Finally, observations of age and sex differences in the scores on the social support components echo findings in developmental research. For example, adolescents reported less support from parents and teachers and more support from their peers. Indeed, adolescence is a time when individuals become more independent and develop their own identity separate from

their parents (Colarossi, 2001). Age differences were also observed for neighbourhood safety (as reported by parents). It is plausible that parents perceive neighbourhood safety and danger differently based on the age of their child, presumably because vulnerability would differ by age (i.e., younger children would be more in danger/vulnerable). Girls generally reported higher support across social support components, compared to boys. Unfortunately, gender was not assessed in the QCAHS. The observed sex differences parallel gender differences in femininity and higher seeking/receiving emotional support (especially from other women) reported by others (Reevy & Maslach, 2001).

Taken together, the proposed social hygge approach applies a novel lens through which to reconsider how we conceptualize social support. The multidimensional component scores illustrate a practical method to work with existing questionnaires that examine source-driven social support in children and adolescents to derive a single score. Aggregating content across sources to distill a latent score yields a more unifying indicator of social support. Further, the results suggest the field may need to revisit the development of social support questionnaires. Instead of organizing questions by source, it may be more valid to examine the quality and nature of the support itself. Future research should also explore the possible hierarchical nature of social support or social hygge as a latent construct, with a higher order level that captures feelings of being valued and cared for by others, combined with lower order levels that represent the fundamental sources of support and underlying subdimensions of the quality of the support.

Part 1: Strengths, Limitations, and Future Directions

There are seven matters that merit attention. First, an important strength of this study is the richness and quality of the sample dataset. The QCAHS survey is a large, population-based dataset that included information about children's social support combined with biological

samples (for Part 2). The entire dataset was used to inform the creation of the components and quantification of social hygge. Further, data missingness (10-13%) was addressed by using multiple imputation that permitted a more informed analysis. Thus, this large representative sample has added value of increasing the generalizability of the findings.

Second, an assumption was made that the nature of social support has not changed over the past two decades. The QCAHS study was conducted in 1999; however, the relation tested between variables would not necessarily be expected to change over time. When exploring theories and mechanisms about social support, time or cohort effects should not matter. Advances in technology and the omnipresent influence of social media have changed rapidly since 1999. Social media presents increased opportunities for social relationships and social support experiences. This is a recognized potential limitation of the study, which may impact the generalizability of findings. To the best of my knowledge, no work has considered the medium by which social support is received; it is unknown if whether one feels valued differs by whether the *someone* is live in-person, on the phone, via text messages or online posts, or may have never met in person. Future research should consider how to best incorporate social media and online platforms into the assessment of social support in modern samples.

Third, I have proposed social hygge as an encompassing, latent construct that characterizes social support, warmth, coziness, and feeling valued across the *lifespan*. It is thought that while the *someone* or source of support, or even the nature of the social support may evolve across development, there is still a fundamental underlying core construct. (Relatedly, this is precisely why a latent variable, rather than a sum-of-the-parts aggregation variable was proposed.) This rationale informed the measurement approach to include the same items for children and adolescents in the principal components analyses and to use the same loadings to derive the

component scores. One limitation of the QCAHS was that a few items were only answered by adolescents and not children (e.g., satisfaction, school) despite being relevant for both age groups. This was in part dealt with by calculating weighted averages based on the number of items to provide the most accurate scores. To harmonize research and advance the field, additional conceptual work should consider whether social hygge is a latent construct across development and investigate measurement equivalence of this construct across childhood, adolescence, and adulthood.

Fourth, one issue that arises for all measurement work with children and adolescents is who is the most accurate informant to report on the child's experiences or beliefs. The use of multiple informants is common (e.g., child, parent, teacher), and scores often vary widely by reporter. The most objective informant would likely depend upon the construct being measured. For perceived social support and subjective feelings of being valued, the most ideal reporter is likely the child themself. (This does assume the child is sufficiently developmentally advanced to have theory of mind and is a reliable reporter.) Items from the QCAHS included questions asked to the child and their parent. This introduced a possible measurement artifact because certain questions were only answered by parents. For example, only parents answered questions about their neighbourhood. This may explain why the neighbourhood items possibly loaded more weakly onto the latent component of social hygge; it may be that responses were inherently biased by being asked of a separate informant and not the child. (On the other hand, it may be that neighbourhood is truly not associated to social hygge at an individual level.) This issue raises the question of whether there would be value of having multiple informants reporting on a child's social network. One could argue that multiple informants would provide a more *objective* way of quantifying a child's experience, but concordance has proved to be low between parents

and children for social engagement, likely because parents are often not privy to their child's daily social experiences (Schneider & Byrne, 1989). It is important to keep in mind that one's perceived support, which is inherently subjective, is more important for health (Uchino et al., 2012). A parallel can be drawn to the socioeconomic status and health literature, where objective measures (income, education) are less predictive of health than perceived social status (Singh-Manoux et al., 2005). While adolescents are likely their own best informants, research should continue to investigate who (or how many) informants are best suited to report on social support in children.

Fifth, I conceptualized social hygge as a multidimensional latent construct but I recognized there may be a bivariate plane. Meaning, negative and positive social support were not thought to be reciprocal. Instead, it was thought that these could co-exist. This coaxial representation informed the decisions regarding item re-coding and data harmonization. For the multidimensional social hygge components that yielded a single score, coding allowed items to reflect either the presence (positive score) or absence (negative score) of the characteristic. As such, social support items were coded positively (0 to 5) with higher numbers reflecting higher social hygge, and social conflict items were coded negatively (0 to -5) with lower numbers reflecting lower social hygge; zero was set as neutral for both. This introduced a possible measurement artifact when the responses were tallied for the cumulative sum score, because the responses could cancel each other out (i.e., social support +5 and social conflict -5 = 0). To circumvent this issue, separate latent positive and negative scores were calculated. The social support and social conflict items were used to create separate scores so that one could have high social support and high social conflict. Although the five multidimensional scores were

calculated to examine the psychometric nuances of social hygge, they would be ideally compared to a criterion measure of social support. However, I will return to their utility in Part 2.

Sixth, several issues could be raised about the content validity of Part 1. Questionnaires included in the QCAHS were chosen from assorted population-level studies to facilitate comparisons across cohorts; however, no "gold-standard" pre-existing social support measures were included. This precluded my ability to have a criterion by which to compare the components derived from the three approaches. Items within the QCAHS questionnaire included content about warmth, comfort, conflict, and resources of the child's social network (e.g., family, school, neighbourhood); this allowed for a more comprehensive understanding of social support in the child's surrounding environment. To ensure that all potentially relevant items were included, three independent raters were asked to identify items about social support and social relations. A focus-group discussed the items and careful attention was given to the wording of each item and its intended meaning and associated connotations. Overall, rater agreement was excellent. There was general agreement for most items identified as measuring social support (e.g., perceived, parents, school environment). Controversial items included those about neighbourhood, bullying, and remedial help at school. Nevertheless, the content validity is a weakness of Part 1 because of QCAHS items were limited in scope and diversity considering the wide array of social support questions that exist. Certain aspects of social support were not adequately covered by the items in the QCAHS questionnaires. For example, there were few questions about siblings and peers (one question each, referring to availability of help) and most questions centered around experiences of parenting. Items about friendships, trust, and belonging for both peers and siblings were also extremely limited. Relatedly, there were few social support items that were representative of how social support is considered within the adult literature.

Remember, types of social support conceptualized in the adult literature include structural (size of network, degree of integration) versus functional (processes, function of relationships); received (actual support received) versus perceived (what is perceived as available if needed); and emotional (support, comfort) versus instrumental (tangible help, information). In the QCAHS dataset, there were no items that assessed the child's structural supports (e.g., number of friends or social groups). Functional support items were also limited; only one question asked adolescents about the quality of support received (satisfaction), the remaining questions asked about perceived support (across sources). Few items were worded to clearly distinguish instrumental support. Items about support from parents could be classified as emotional support (how they make you feel) and the only item that asked about neighbors helping each other could be classified as instrumental support. Aubin and colleagues (2002) note that emotional support is more influential than instrumental support for children, which was the basis for the decisions about items to include in the original QCAHS study. However, more emotional support items may inadvertently lead to a sex/gender bias as girls report higher emotional support (Aubin et al., 2002). It is important to recognize that nearly all existing "gold-standard" measures of social support for children and adolescents are limited in their conceptualization because they too approached measurement development from a source-centric framework. Future research should incorporate broader items to fully capture support, warmth, trust, belonging, and cohesion among one's social network, rather than only focusing on sources of support with limited information. To advance social hygge as a potential unifying, latent construct, it will be important to conduct additional psychometric work and to replicate the findings with other large scales studies that include multiple items from the potential universe of items that capture social support.

Seventh, the analytic choices for the principal component may have influenced the results of Part 1. Specifically, the varimax rotation was chosen to initially identify components within the data-driven approach, which is an orthogonal rotation that yields lower correlations among components. Had an oblique rotation been selected (e.g., direct oblimin), components would have been free to correlate with one another. Nevertheless, while a different rotation strategy would alter the loadings, the items would be similarly grouped by component. These nuanced methodological decisions should be thoughtfully considered for future psychometric work as they are intricately linked with the conceptualization of the social hygge construct and possible subdimensions.

In summary, Part 1 was conducted with a population-based sample with several items about social support and relationships. This psychometric work needs to be replicated in other samples and with additional items of social support and overlapping constructs. Items should be envisioned as sampling from the entire universe of questions that tap at the underlying latent construct of social support, or social hygge. The questionnaires used in the QCAHS study are only a limited set of items. If social hygge were found to be a valid and reliable latent construct, it is plausible that a revised measurement approach could be flexibly applied to other studies that included items about social support, warmth, and closeness to yield a latent variable. Alternatively, it is possible that a single, broader question could be an easier way to capture the fundamental content that social hygge is striving to represent. The single question used by Kumar (2012) that asks about perceived support from friends or family could be compared to the multidimensional social hygge score. Finally, it is important to investigate the utility of social hygge in the context of predicting health outcomes.

Part 2: Findings

The objective of Part 2 was to examine the relation between social support, using the proposed multidimensional social hygge construct, with low-grade chronic inflammation (CRP) in children and adolescents. The first hypothesis was that higher social hygge would be associated with lower CRP. The second hypothesis was that a broader conceptualization of social hygge across one's network would be more strongly associated to CRP than other social support components (e.g, traditional source-centric approach). Both hypotheses were partially supported. For the first hypothesis, none of the social support components were associated with CRP among children. Among adolescents, several of the social support constructs (including all of the social hygge components) were associated with CRP. Thus, the first hypothesis was partially supported, but only among adolescents. This finding may be attributable to slightly lower mean levels of CRP in children than adolescents (discussed in more detail below). For the second hypothesis, all of the multidimensional social hygge components were associated with CRP among adolescents, compared to only a few others from the traditional and data-driven approaches (e.g., parent, father components). These findings provide preliminary support for the proposed conceptualization of social hygge as a unifying, latent variable of social support. For every additional higher rating for any support item (latent sum), CRP was .263 units lower (log-transformed). These findings support the hypothesis that a more unifying conceptualization that represents social support across sources, settings, and quality of support may be a more robust predictor of inflammation.

In comparison, two traditional components (father, parents), two data-driven components (close parents, distant father), and two social hygge subdimension components (parental warmth, time terse) were associated with CRP in adolescents. The magnitudes of the effect sizes were largely comparable to each other for adolescents (range .03 to .05% of variance in CRP), and not

noticeably different than the social hygge components. The largest effect size was observed for girls, where close parents and parental warmth accounted for ~1% of the variance in CRP. These findings imply that there is still something important captured within the source perspective, and that fathers and parents play a critical role in social support early in development. This is not unexpected as parents are the primary means of all tangible/instrumental support and children are dependent upon them (Bronfenbrenner, 1992). This finding also relates back to the conceptualization in Part 1, as children's reliance on parents is a fundamental distinction when making comparisons to social support in adults, who have outgrown this dependency.

Although just a trend, it is worth noting that one finding observed in children was opposite that expected; higher neighbourhood services (data-driven component) were associated with higher CRP (p = .056), with an effect size comparable to those above (0.6% of variance). It is plausible that children at risk for higher CRP also live in neighbourhoods that offer more services for at-risk populations. Household income and parental education were tested as covariates, and unexpectedly, were not found to be associated with CRP. However, the interactions of socioeconomic status with social support and/or neighbourhood level indicators of poverty may have been important to investigate.

It was interesting to observe that *all* of the multidimensional, social hygge components were associated to inflammation in adolescents. This provides some follow-up to the question raised in Part 1 about the conceptualization of social hygge. As you will recall, different scores were purposely calculated to isolate unique aspects of the construct (i.e., latent/cumulative, component score/raw value, univariate/bivariate). All of these scores were associated to CRP in adolescents, yet, the comparable effect sizes (percent variance accounted for in CRP) did not provide any additional insight into the conceptualization of social hygge for the three

comparisons mentioned above. Of note, the latent component was the only score which was associated to CRP in adolescents and across both boys and girl, emerging as the most consistent multidimensional measure associated to inflammation. Given that all of the multidimensional social hygge scores were associated with CRP in adolescents, one question raised is whether the parent and father items in these scores are predominantly driving this association, since these items load strongly on the social hygge latent component. However, if this were the case, one would not expect the cumulative sum score to have a similar effect size because the parent and father items are unweighted. Thus, it does not seem that these sources account for the association; instead, the evidence supports the value of an encompassing social support construct.

Part 2: Comparison to Past Literature

Findings about social hygge and CRP can be compared to previous research and considered within the context of the larger social support and inflammation literature. First, the effects sizes observed are nearly identical to those previously reported in the adult literature linking social support and inflammation (Uchino et al., 2018; $R^2 = .005$). While small, these effect sizes are consistent across studies and imply a robust association between social support and inflammation across development. The small effect size is not unexpected given that inflammation is only one of the many pathways linking social support to health; the multiplicity of inflammatory processes and their unmeasured biological influences encumber the effects. Additionally, the complexity of social support conceptualizations may further attenuate the measured effect (Uchino et al., 2018). Given the comparable effect size of that within adults, findings from this study are promising for the pediatric literature.

The results can also be compared to past research investigating children's chronic low-grade inflammation. Parent support and behaviors (positive, negative) have been found previously to be related to CRP in adolescents (Guan et al., 2016, Nelson et al., 2017). The findings from the traditional approach mirrored this previous finding: parents (source and close parents) and fathers (source and distant father) were associated to CRP in adolescents. Parent monitoring has also been previously associated with CRP (Byrne et al., 2017a; Byrne et al., 2017b). The findings from the data-driven and social hygge approaches yielded parallel findings: time terse was meaningfully related to CRP in adolescents and boys (though not statistically significant). Harsh family environments have also been linked to inflammation in youth (e.g., Miller et al., 2009; Miller & Chen, 2010). The findings from the social hygge approach was aligned with these past findings: parental warmth was associated to CRP in adolescents. Further, the parental warmth component included items about social support which are consistent with findings in the attachment literature (Measelle & Ablow, 2018; Bernard et al., 2019) and underscore the importance of emotional support for health (Reblin & Uchino, 2008). Finally, the social hygge subdimensional safety component was not associated with CRP, which differs from previous findings in children and adolescents (Broyles et al., 2012; Schmeer & Yoon, 2016b).

Analyses were stratified by age and sex and different patterns emerged for social support and its association with inflammation. Age group differences suggest biological risk (culmination of CRP over time) or developmental stage are two important lenses through which to view the relation between social hygge and CRP, as associations were found only in adolescents. Biological risk also varies by age; children may have not yet had enough accumulation of inflammation. CRP is low during childhood and increases throughout adolescence and adulthood (Ferrucci et al., 2005). Inflammatory markers not assessed in this

study may have been more sensitive (i.e., IL-4, IL-6). Additionally, hormonal variations (which increase with age) can influence levels of CRP (Bupp, 2015). Developmental differences in social support may also account for the differences observed between children and adolescents. The transition between childhood to adolescence marks a key developmental period when relationships are formed outside the immediate family context (e.g., increased reliance on peers) and may be important for health. Future research should consider earlier precursors for inflammation that may be prevalent at younger ages, as well as examining the relation between social support and other health outcomes.

Differences by sex may be attributed to both biological (sex) and social (gender) differences. Biologically, boys and girls have varying levels of pubertal maturation over time, which affects the CRP trajectory (Shanahan et al., 2013). Socially, there is evidence that the importance of different relationships may vary by gender. For example, mother-son relationships for boys and father-daughter relationships for girls have been previously reported to be distinct (Russell & Saebel, 1997). This echoes findings from Part 2. Future research should aim to assess both sex and gender and related covariates (pubertal status, dyadic relationships) to disentangle their particular effects.

Questions remain about the pathways linking social support and CRP (behaviours, physiological pathways). For example, possible mediators may include health behaviours, such as physical activity and/or nutrition (which can be affected by gender; Timslet et al., 1995). Mechanisms should also be considered within the larger physiological context, as social support has been linked to inflammation, which is a risk factor for adverse cardiovascular functioning. Chin and Cohen's review of the adult literature (2020) found that social support was linked to cardiovascular precursors, but the effects varied by sex; there was a social support gradient for

men, and both a gradient and threshold (social isolation) for women. These findings reinforce the need to examine cumulative exposures of one's social network (i.e., social roles and social isolation) and to consider sex and gender differences.

Finally, covariates in this study were limited to age, sex, BMI Z-score and current smoking status. Several covariates known to be associated with CRP were not found to be significant. Unexpectedly, current smoking status was negatively associated to CRP in children only, which is the opposite direction than usually observed (O'Loughlin et al., 2008). Namely, children who endorsed smoking a whole cigarette had lower CRP. Socioeconomic status indicators (household income, parental education) were also not associated to CRP. Prior research has examined diet, physical activity, ethnicity, smoking exposure, socioeconomic status (perceived social status) and stress (perceived or interpersonal stress) and their relation to CRP (Dowd et al., 2010; Freeman et al, 2016; Fuligni et al., 2009; Schmeer and Yoon, 2016a). Future work should consider these variables as possible covariates or mediators in the association between social hygge and CRP.

Part 2: Strengths and Limitations

The main strength for Part 2 was the large population-based sample of children and adolescents who completed fasting blood draws and had CRP values. It is rare to have biological data on such a large number of participants, especially in a pediatric sample. This dataset presented a unique opportunity to examine the cross-sectional relation between social support and objective measures of chronic inflammation with generalizability to the larger population of children and adolescents in Quebec.

CRP levels in this sample were comparable to those previously reported in pediatric studies (most < 3mg/L; Rödöö et al., 2013). Chronic inflammation is relatively stable over

several days (half-life ~19 hours), excluding acute inflammation in response to injury or infection (Markanday, 2015); therefore, one sample of CRP was sufficient to assess circulating inflammation. The lack of variability in the CRP levels may have contributed to the null findings in children. Children have generally much lower CRP levels than adults. Values of CRP that were below the detectable limit (0.20mg/L; age 9 = 26.8%, age 13 = 31.2%, age 16 = 21.2%) were conservatively set to 0.20mg/L. This may have influenced results in reducing variability further for low-level inflammation. An alternative approach would have been to use censored data analytic techniques (e.g., PROC LEFT REG) or to use imputation to assign values below the 0.20mg/L threshold (e.g., randomly assign value between 0 and 0.20). Individuals with CRP values greater than 10mg/L were not included in the analyses. Individuals with chronic illness (e.g., diabetes) were included as long as their CRP values were within the acceptable range; sensitivity analyses should be conducted to compare the results with and without these children. Everyone did not agree to complete the fasting blood draw. Using non-invasive saliva sampling or finger prick dried blood spots to assess CRP may have greater acceptance and increase sample size. Indeed, saliva samples have been shown to be have higher sensitivity to CRP and other inflammatory markers in adolescents (Byrne et al., 2013). Future work should also consider assessing other early inflammatory markers (i.e., IL-4, IL-6, TNF-alpha) as these may contribute additional information about the relation between social support and inflammatory pathways.

Finally, there were 112 regression models conducted in Part 2. Although the models were all specified a priori, the sheer number of models introduced greater likelihood for Type II errors. Although a Bonferroni correction could have been applied given the number of multiple comparisons, this would have yielded an ultra conservative *p* value of .00045. Given the exploratory nature of this thesis, the consistency in the pattern of results (i.e., all

multidimensional social hygge scores) and the concordance with past research (i.e., social support accounts for ~.5% variance of CRP) provide preliminary support for the proposed construct of social hygge.

Future Directions

This thesis has met its objectives of introducing and quantifying the novel construct of social hygge in children and adolescents, in relation to low-grade chronic inflammation. The findings also raise new questions and underline avenues for future work. Specific suggestions for future directions were made in Part 1 and Part 2 above. Altogether, there are some key recommendations to advance work on the construct of social hygge and to elucidate these findings. First, this study should be replicated in other samples. Replications should include a large pool of social support items, especially those that capture social relationships via social media. Replications should also consider sex and gender to examine their different roles for social support and health. Second, future research should examine the relation between social support and CRP longitudinally. These data were cross-sectional and no causality can be inferred from our findings. Prospective studies would provide valuable data to investigate the causal nature of the relation and information about the predictive utility of social hygge. Relatedly, the pathogenic mechanisms linking social hygge and CRP should be examined in future work. Third, this study focuses on low-grade chronic inflammation within the immune system. Biomarkers pertaining to cardiovascular and endocrine systems should also be included to see how these parallel physiological systems may also be affected by social hygge, as supported in the social support literature. Social hygge was posited as a unifying conceptualization of social support, inspired in name by the Scandinavian cultural phenomenon of hygge, which refers to warmth

and coziness. The thesis findings raise the question of whether social hygge might differ across cultures or contribute to social inequalities in health.

Conclusion

In summary, the conceptualization of social support differs across the adult and child literature. In adults, social support is categorized by types and subtypes (e.g., perceived, received, functional); whereas in children, social support in organized by source. For my thesis, I proposed that social support may encompass a more fundamental underlying phenomenon of feeling cared for and valued. A multidimensional conceptualization may be more unifying and better represent a latent construct that would be robust across the lifespan. It should be noted that a multidimensional perspective for social support has been suggested in recent adult work, Holt-Lunstad, 2010). It is recognized that certain sources of support differ in their importance at different life stages. Therefore, a broader lens to flexibly and robustly capture social support over the lifecourse likely has better potential to unearth its links to health. In other words, it is less about *who* is providing support, but more about having *someone* available to provide quality support that shapes protective and risk factors for health. Part 1 provided preliminary psychometric support for a multidimensional conceptualization of "social hygge" across sources in a child's network. Replication and further work is necessary to disentangle evidence for a latent versus cumulative conceptualization of social hygge.

Social support predicts multiple health outcomes in adults, including those related to inflammation and immune functioning. There is less evidence for this relation in children and adolescents. In Part 2, higher multidimensional social hygge scores were associated with lower low-grade chronic inflammation in adolescents only. Remarkably, the magnitude of effect was similar to that previously observed among adults. These findings contribute to the current state of

knowledge about the relation between social support and inflammation and have implications for improving our understanding of the pathophysiology of systemic inflammation and susceptibility to disease. Future research should continue to investigate the mechanisms and evaluate the predictive utility of social hygge for assorted health outcomes.

References

Adamson, P. (2013). Child well-being in rich countries: A comparative overview. *Innocenti Report Card*. Retrieved July 20, 2020, from https://files.eric.ed.gov/fulltext/ED595633.pdf

Ainsworth, M. D. S., Blehar, M. C., Waters, E. & Wall, S. (1978). *Patterns of Attachment: A Psychological Study of the Strange Situation*. Hillsdale, Lawrence Erlbaum Associates.

Anastasi, A. (1985). *Psychological testing: Basic concepts and common misconceptions.* In A. M. Rogers & C. J. Scheirer (Eds.), *The G. Stanley Hall Lecture Series. The G. Stanley Hall lecture series, 5*, 87–120. https://doi.org/10.1037/10052-003

Aubin, J., Lavallée, C., Camirand, J., Audet, N…. Berthiaume, P. (2002). *Enquête sociale et de santé auprès des enfants et des adolescents québécois 1999*. Québec: Institut de la statistique du Québec.

August K.J., Rook K.S. (2013). *Social Relationships*. In Gellman M.D., & Turner J.R. (Eds.) *Encyclopedia of Behavioral Medicine*. Springer, New York, NY.

Barki, H., & Hartwick, J. (2004). Conceptualizing the construct of interpersonal conflict. *International Journal of Conflict Management*, *15*(3). doi:10.1108/eb022913

Bernard, K., Hostinar, C. E., & Dozier, M. (2019). Longitudinal associations between attachment quality in infancy, C-reactive protein in early childhood, and BMI in middle childhood: preliminary evidence from a CPS-referred sample. *Attachment & Human Development, 21*(1), 5-22. https://doi.org/10.1080/14616734.2018.1541513

Bowlby, J. (1988). *A secure base: Parent-child attachment and healthy human development*. London: Basic Books.

Bronfenbrenner, U. (1992). *Ecological systems theory*. Jessica Kingsley Publishers.

Broyles, S. T., Staiano, A. E., Drazba, K. T., Gupta, A. K., Sothern, M., & Katzmarzyk, P. T. (2012). Elevated C-reactive protein in children from risky neighbourhoods: evidence for a stress pathway linking neighbourhoods and inflammation in children. *PLoS One, 7*(9). https://doi.org/10.1371/journal.pone.0045419

Bupp, M. R. G. (2015). Sex, the aging immune system, and chronic disease. *Cellular Immunology, 294(*2), 102-110. https://doi.org/10.1016/j.cellimm.2015.02.002

Byrne, M. L., Badcock, P. B., Simmons, J. G., Whittle, S., Pettitt, A., Olsson, C. A., . . . Allen, N. B. (2017a). Self-reported parenting style is associated with children's inflammation and immune activation. *Journal of Family Psychology, 31*(3), 374-380. https://doi.org/10.1037/fam0000254

Byrne, M. L., Horne, S., O'Brien-Simpson, N. M., Walsh, K. A., Reynolds, E. C., Schwartz, O. S., . . . Allen, N. B. (2017b). Associations between observed parenting behavior and adolescent inflammation two and a half years later in a community sample. *Health Psychology, 36*(7), 641-651. https://doi.org/10.1037/hea0000502

Byrne, M. L., O'Brien-Simpson, N. M., Reynolds, E. C., Walsh, K. A., Laughton, K., Waloszek, J. M., ... & Allen, N. B. (2013). Acute phase protein and cytokine levels in serum and saliva: a comparison of detectable levels and correlations in a depressed and healthy adolescent sample. *Brain, Behavior, and Immunity, 34*, 164-175. https://doi.org/10.1016/j.bbi.2013.08.010

Cacioppo, J. T., & Cacioppo, S. (2014). Social relationships and health: The toxic effects of perceived social isolation. *Social and Personality Psychology Compass, 8*(2), 58-72. https://doi.org/10.1111/spc3.12087

Cauce, A. M., Mason, C., Gonzales, N., Hiraga, Y., & Lia, G. (1994). Social support during adolescence: Methodological and theoretical considerations. In Nestmann, F. & Klaus Hurrelmann, K. (Eds.) *Social Networks and Social Support in Childhood and Adolescence,* 89-108.

Center for Disease Control (CDC). (2018, July 3). *BMI for children and teens.* Retrieved July 20, 2020, from https://www.cdc.gov/obesity/childhood/defining.html

Chen, E., Chim, L. S., Strunk, R. C., & Miller, G. E. (2007). The role of the social environment in children and adolescents with asthma. *American Journal of Respiratory and Critical Care Medicine*, *176*(7), 644-649. https://doi.org/10.1164/rccm.200610-1473OC

Chin, B., & Cohen, S. (2020). Review of the Association Between Number of Social Roles and Cardiovascular Disease: Graded or Threshold Effect?. *Psychosomatic Medicine, 82*(5), 471-486. doi:10.1097/PSY.0000000000000809

Chu, P. S., Saucier, D. A., & Hafner, E. (2010). Meta-analysis of the relationships between social support and well-being in children and adolescents. *Journal of Social and Clinical Psychology*, *29*(6), 624-645. https://doi.org/10.1521/jscp.2010.29.6.624

Cloutier, R., L. Champoux & C. Jacques (1994). *Enquête ados, familles et milieu de vie : la parole aux ados!,* Québec, Université Laval, Centre de recherche sur les services communautaires, 124.

Cohen, S. (2004). Social relationships and health*. American Psychologist, 59*(8), 676.

Cohen, S., Mermelstein, R., Kamarck, T., & Hoberman, H. M. (1985). *Measuring the functional components of social support.* In *Social support: Theory, research and applications*, 73-94. Springer, Dordrecht.

Cohen, S., Underwood, L. G., & Gottlieb, B. H. (Eds.). (2000). *Social support measurement and intervention: A guide for health and social scientists*. Oxford University Press.

Colarossi, L. G. (2001). Adolescent gender differences in social support: Structure, function, and provider type. *Social Work Research*, *25*(4), 233-241. https://doi.org/10.1093/swr/25.4.233

Deschesnes, M., & Schaefer, C. (1997). *Styles de vie des jeunes du secondaire en Outaouais: Secteur général*. Régie régionale de la santé et des services sociaux de l'Outaouais, Direction de la santé publique.

Dowd, J. B., Zajacova, A., & Aiello, A. E. (2010). Predictors of inflammation in US children aged 3-16 years. *American Journal of Preventive Medicine, 39*(4), 314-320. https://doi.org/10.1016/j.amepre.2010.05.014

Essau, C.A., Sasagawa, S., & Frick, P.J. (2006). Psychometric properties of the Alabama Parenting Questionnaire. *Journal of Child and Family Studies*, 15, 597-616. doi:10.1007/s10826-006-9036-y

Fagundes, C. P., & Way, B. (2014). Early-life stress and adult inflammation. *Current Directions in Psychological Science, 23*(4), 277-283. https://doi.org/10.1177/0963721414535603

Fagundes, C. P., Bennett, J. M., Derry, H. M., & Kiecolt-Glaser, J. K. (2011). Relationships and inflammation across the lifespan: Social developmental pathways to disease. *Social and Personality Psychology Compass, 5*(11), 891-903. https://doi.org/10.1111/j.1751-9004.2011.00392.x

Feghali, C. A., & Wright, T. M. (1997). Cytokines in acute and chronic inflammation. *Frontiers in Bioscience, 2*(1), d12-d26. Retrieved July 20, 2020 from https://www.researchgate.net/profile/Carol_Feghali-

Bostwick/publication/14059816_Cytokines_acute_and_chronic_inflammation/links/54a1786b0cf256bf8baf722e/Cytokines-acute-and-chronic-inflammation.pdf

Ferrucci, L., Corsi, A., Lauretani, F., Bandinelli, S., Bartali, B., Taub, D. D., ... & Longo, D. L. (2005). The origins of age-related proinflammatory state. *Blood, 105*(6), 2294-2299. https://doi.org/10.1182/blood-2004-07-2599

Freeman, J. A., Bauldry, S., Volpe, V. V., Shanahan, M. J., & Shanahan, L. (2016). Sex differences in associations between subjective social status and C-reactive protein in young adults. *Psychosomatic Medicine, 78*(5), 542. doi:10.1097/PSY.0000000000000309

Fuligni, A. J., Telzer, E. H., Bower, J., Cole, S. W., Kiang, L., & Irwin, M. R. (2009). A preliminary study of daily interpersonal stress and C-reactive protein levels among adolescents from Latin American and European backgrounds. *Psychosomatic Medicine, 71*(3), 329. doi:10.1097/PSY.0b013e3181921b1f

Furman, W., & Buhrmester, D. (1992). Age and sex differences in perceptions of networks of personal relationships. *Child Development*, *63*(1), 103-115. https://doi.org/10.1111/j.1467-8624.1992.tb03599.x

Gadani, S. P., Cronk, J. C., Norris, G. T., & Kipnis, J. (2012). IL-4 in the brain: a cytokine to remember. *Journal of Immunology*, *189*(9), 4213–4219. https://doi.org/10.4049/jimmunol.1202246

Gallo, L. C., Fortmann, A. L., McCurley, J. L., Isasi, C. R., Penedo, F. J., Daviglus, M. L., Roesch, S. C., Talavera, G. A., Gouskova, N., Gonzalez, F., 2nd, Schneiderman, N., & Carnethon, M. R. (2015). Associations of structural and functional social support with diabetes prevalence in U.S. Hispanics/Latinos: results from the HCHS/SOL Sociocultural

Ancillary Study. *Journal of Behavioral Medicine, 38*(1), 160–170. https://doi.org/10.1007/s10865-014-9588-z

Gidron, Y. (2013). *Social Cohesion*. In Gellman M.D., & Turner J.R. (Eds.) *Encyclopedia of Behavioral Medicine*. Springer, New York, NY.

Gordon-Hollingsworth, A. T., Thompson, J. E., Geary, M. A., Schexnaildre, M. A., Lai, B. S., & Kelley, M. L. (2016). Social support questionnaire for children: Development and initial validation. *Measurement and Evaluation in Counseling and Development, 49*(2), 122-144. https://doi.org/10.1177/0748175615596780

Green, B. L., Furrer, C., & McAllister, C. (2007). How do relationships support parenting? Effects of attachment style and social support on parenting behavior in an at-risk population. *American Journal of Community Psychology*, *40*(1-2), 96-108. doi:10.1007/s10464-007-9127-y

Guan, S.-S. A., Bower, J. E., Almeida, D. M., Cole, S. W., Dahl, R. E., Irwin, M. R., … Fuligni, A. J. (2016). Parental support buffers the association of depressive symptoms with cortisol and C-reactive protein during adolescence. *Brain, Behavior & Immunity*, *57*, 134–143. https://doi.org/10.1016/j.bbi.2016.03.007

Haber, M. G., Cohen, J. L., Lucas, T., & Baltes, B. B. (2007). The relationship between self-reported received and perceived social support: A meta-analytic review. *American Journal of Community Psychology, 39*(1-2), 133-144. https://doi.org/10.1007/s10464-007-9100-9

Harris, T. B., Ferrucci, L., Tracy, R. P., Corti, M. C., Wacholder, S., Ettinger Jr, W. H., ... & Wallace, R. (1999). Associations of elevated interleukin-6 and C-reactive protein levels with mortality in the elderly. *The American Journal of Medicine*, *106*(5), 506-512. https://doi.org/10.1016/S0002-9343(99)00066-2

Harter, S. (2012). *Social support scale for children: Manual and questionnaires*. Denver, CO: University of Denver.

Heerde, J. A., & Hemphill, S. A. (2018). Examination of associations between informal help-seeking behavior, social support, and adolescent psychosocial outcomes: A meta-analysis. *Developmental Review*, *47*, 44-62. https://doi.org/10.1016/j.dr.2017.10.001

Holt-Lunstad, J., Smith, T. B., & Layton, J. B. (2010). Social relationships and mortality risk: a meta-analytic review. *PLoS Medicine*, *7*(7), e1000316. https://doi.org/10.1371/journal.pmed.1000316

House, J. S. 1981. *Work stress and social support*. Reading, Mass: Addison-Wesley Pub. Co.

Kafetsios, K., & Sideridis, G. D. (2006). Attachment, social support and well-being in young and older adults. *Journal of Health Psychology*, *11*(6), 863-875. https://doi.org/10.1177/1359105306069084

Kiecolt-Glaser, J. K., Gouin, J. P., & Hantsoo, L. (2010). Close relationships, inflammation, and health. *Neuroscience and Biobehavioral Reviews*, *35*(1), 33-38. https://doi.org/10.1016/j.neubiorev.2009.09.003

Kumar, S., Calvo, R., Avendano, M., Sivaramakrishnan, K., & Berkman, L. F. (2012). Social support, volunteering and health around the world: Cross-national evidence from 139 countries. *Social Science and Medicine, 74*(5), 696-706. https://doi.org/10.1016/j.socscimed.2011.11.017

Lacey, R. E., Kumari, M., & Bartley, M. (2014). Social isolation in childhood and adult inflammation: Evidence from the National Child Development Study. *Psychoneuroendocrinology, 50*, 85-94. https://doi.org/10.1016/j.psyneuen.2014.08.007

Lambert, M., Delvin, E. E., Paradis, G., O'Loughlin, J., Hanley, J. A., & Levy, E. (2004). C-reactive protein and features of the metabolic syndrome in a population-based sample of children and adolescents. *Clinical Chemistry*, *50*(10), 1762-1768. https://doi.org/10.1373/clinchem.2004.036418

Landis, J. R., Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics, 33*, 159-174. doi:10.2307/2529310

Leschak, C. J., & Eisenberger, N. I. (2019). Two distinct immune pathways linking social relationships with health: inflammatory and antiviral processes. *Psychosomatic Medicine, 81*(8), 711-719. doi:10.1097/PSY.0000000000000685

Levitt, M. J., Guacci-Franco, N., & Levitt, J. L. (1993). Convoys of social support in childhood and early adolescence: Structure and function. *Developmental Psychology, 29*(5), 811–818. https://doi.org/10.1037/0012-1649.29.5.811

Lutgendorf, S. K., Sood, A. K., Anderson, B., McGinn, S., Maiseri, H., Dao, M., Sorosky, J. I., Geest, K. D., Ritchie, J., and Lubaroff, D. M. (2005). Social support, psychological distress, and natural killer cell activity in ovarian cancer. *Journal of Clinical Oncology. 23*, 7105–7113. doi: 10.1200/JCO.2005.10.015

Lyyra, T. M., & Heikkinen, R. L. (2006). Perceived social support and mortality in older people. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 61*(3), S147-S152. https://doi.org/10.1093/geronb/61.3.S147

Maggio, M., Guralnik, J. M., Longo, D. L., & Ferrucci, L. (2006). Interleukin-6 in aging and chronic disease: a magnificent pathway. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, *61*(6), 575-584. https://doi.org/10.1093/gerona/61.6.575

Majka E.A., Cacioppo J.T. (2013). *Loneliness*. In Gellman M.D., & Turner J.R. (Eds.) *Encyclopedia of Behavioral Medicine*. Springer, New York, NY.

Malecki, C. K., & Demaray, M. K. (2002). Measuring perceived social support: Development of the child and adolescent social support scale (CASSS). *Psychology in the Schools*, *39*(1), 1-18. https://doi.org/10.1002/pits.10004

Malecki, C. K., & Elliott, S. N. (1999). Adolescents' ratings of perceived social support and its importance: Validation of the Student Social Support Scale. *Psychology in the Schools, 36*(6), 473-483. https://doi.org/10.1002/(SICI)1520-6807(199911)36:6<473::AID-PITS3>3.0.CO;2-0

Markanday, A. (2015). Acute phase reactants in infections: evidence-based review and a guide for clinicians. *Open Forum Infectious Diseases, 2*(3), 1-7. https://doi.org/10.1093/ofid/ofv098

McEwen, B. S. (2000). Allostasis and allostatic load: implications for neuropsychopharmacology. *Neuropsychopharmacology, 22*(2), 108. https://doi.org/10.1016/S0893-133X(99)00129-3

McHugh Power, J., Carney, S., Hannigan, C., Brennan, S., Wolfe, H., Lynch, M., ... & Lawlor, B. (2019). Systemic inflammatory markers and sources of social support among older adults in the Memory Research Unit cohort. *Journal of Health Psychology, 24*(3), 397-406. https://doi.org/10.1177/1359105316676331

McNeely, C., & Falci, C. (2004). School connectedness and the transition into and out of health-risk behavior among adolescents: A comparison of social belonging and teacher support. *Journal of School Health*, *74*(7), 284-292. https://doi.org/10.1111/j.1746-1561.2004.tb08285.x

Measelle, J. R., & Ablow, J. C. (2018). Contributions of early adversity to pro-inflammatory phenotype in infancy: the buffer provided by attachment security. *Attachment & Human Development, 20*(1), 1-23. https://doi.org/10.1080/14616734.2017.1362657

Miller, A. H., & Raison, C. L. (2016). The role of inflammation in depression: from evolutionary imperative to modern treatment target. *Nature Reviews Immunology*, *16*(1), 22. https://doi.org/10.1038/nri.2015.5

Miller, G. E., & Chen, E. (2010). Harsh family climate in early life presages the emergence of a proinflammatory phenotype in adolescence. *Psychological Science*, *21*(6), 848-856. https://doi.org/10.1177/0956797610370161

Miller, G., Rohleder, N., & Cole, S. (2009). Chronic interpersonal stress predicts activation of pro-and anti-inflammatory signaling pathways 6 months later. *Psychosomatic Medicine*, *71*(1), 57. doi:10.1097/PSY.0b013e318190d7de.

Muscatell, K. A., Eisenberger, N. I., Dutcher, J. M., Cole, S. W., & Bower, J. E. (2016). Links between inflammation, amygdala reactivity, and social support in breast cancer survivors. *Brain, Behavior, and Immunity*, *53*, 34-38. https://doi.org/10.1016/j.bbi.2015.09.008

Nakata, A., Irie, M., & Takahashi, M. (2013). Source-specific social support and circulating inflammatory markers among white-collar employees. *Annals of Behavioral Medicine, 47*(3), 335-346. https://doi.org/10.1007/s12160-013-9555-x

Nelson, B. W., Byrne, M. L., Simmons, J. G., Whittle, S., Schwartz, O. S., Reynolds, E. C., O'Brien-Simpson, N. M., Sheeber, L., & Allen, N. B. (2017). Adolescent sympathetic activity and salivary C-reactive protein: The effects of parental behavior. *Health Psychology, 36*(10), 955–965. https://doi.org/10.1037/hea0000516

O'Loughlin, J., Lambert, M., Karp, I., McGrath, J., Gray-Donald, K., Barnett, T. A., ... & Paradis, G. (2008). Association between cigarette smoking and C-reactive protein in a representative, population-based sample of adolescents. *Nicotine & Tobacco Research, 10*(3), 525-532. https://doi.org/10.1080/14622200801901997

OECD. (2015). *How's Life? 2015: Measuring Well-being.* Paris: OECD Publishing. Retrieved July 20, 2020, from http://dx.doi.org/10.1787/how_life-2015-en

Paradis, G., Lambert, M., O'Loughlin, J., Lavallée, C., Aubin, J., Berthiaume, P., et al. (2003). The Quebec Child and Adolescent Health and Social Survey: design and methods of a cardiovascular risk factor survey for youth. *Canadian Journal of Cardiology, 19*(5). Retrieved July 20, 2020, from http://www.med.mcgill.ca/epidemiology/Hanley/bios601/Surveys/QCHASDesignMethodsParadis2003.pdf

Pearson, T. A., Mensah, G. A., Alexander, R. W., Anderson, J. L., Cannon III, R. O., Criqui, M., ... & Rifai, N. (2003). Markers of inflammation and cardiovascular disease: application to clinical and public health practice: a statement for healthcare professionals from the Centers for Disease Control and Prevention and the American Heart Association. *Circulation, 107*(3), 499-511. https://doi.org/10.1161/01.CIR.0000052939.59093.45

Reblin, M., & Uchino, B. N. (2008). Social and emotional support and its implication for health. *Current Opinion in Psychiatry, 21*(2), 201. doi:10.1097/YCO.0b013e3282f3ad89.

Reevy, G. M., & Maslach, C. (2001). Use of social support: Gender and personality differences. *Sex Roles*, *44*(7-8), 437-459. https://doi.org/10.1023/A:1011930128829

Rödöö, P., Ridefelt, P., Aldrimer, M., Niklasson, F., Gustafsson, J., & Hellberg, D. (2013). Population-based pediatric reference intervals for HbA1c, bilirubin, albumin, CRP,

myoglobin and serum enzymes. *Scandinavian Journal of Clinical and Laboratory Investigation, 73*(5), 361-367. https://doi.org/10.3109/00365513.2013.783931

Rohleder N. (2013a). *Interleukins, -1 (IL-1), -6 (IL-6), -18 (IL-18)*. In Gellman M.D., & Turner J.R. (Eds.) *Encyclopedia of Behavioral Medicine*. Springer, New York, NY.

Rohleder N. (2013b). *Tumor Necrosis Factor-Alpha (TNF-Alpha)*. In Gellman M.D., & Turner J.R. (Eds.) *Encyclopedia of Behavioral Medicine*. Springer, New York, NY.

Rohleder N., Wolf J.M. (2013). *Inflammation*. In Gellman M.D., & Turner J.R. (Eds.) *Encyclopedia of Behavioral Medicine*. Springer, New York, NY.

Rook, K. S. (1998). *Investigating the positive and negative sides of personal relationships: Through a lens darkly*? In B. H. Spitzberg & W. R. Cupach (Eds.), *The dark side of close relationships* (pp. 369–393). Mahwah, NJ: Lawrence Erlbaum.

Ruiz J., Prather C.C., Kauffman E.E. (2013). *Social Support*. In Gellman M.D., & Turner J.R. (Eds.) *Encyclopedia of Behavioral Medicine*. Springer, New York, NY.

Russell, A., & Saebel, J. (1997). Mother–son, mother–daughter, father–son, and father–daughter: Are they distinct relationships?. *Developmental Review, 17*(2), 111-147. https://doi.org/10.1006/drev.1996.0431

Sachs, J. D., Layard, R., & Helliwell, J. F. (2018). World Happiness Report 2018 (No. id:12761). Retrieved July 20, 2020, from http://www.esocialsciences.org/Download/repecDownload.aspx?fname=A201854103855_57.pdf&fcategory=Articles&AId=12761&fref=repec

Schmeer, K. K., & Yoon, A. (2016a). Socioeconomic status inequalities in low-grade inflammation during childhood. *Archives of Disease in Childhood, 101*(11), 1043-1047. http://dx.doi.org/10.1136/archdischild-2016-310837

Schmeer, K. K., & Yoon, A. J. (2016b). Home sweet home? Home physical environment and inflammation in children. *Social Science Research, 60*, 236-248. https://doi.org/10.1016/j.ssresearch.2016.04.001

Schneider, B. H., & Byrne, B. M. (1989). Parents rating children's social behavior: How focused the lens?. *Journal of Clinical Child Psychology, 18*(3), 237-241. https://doi.org/10.1207/s15374424jccp1803_6

Semmer, N. K., Elfering, A., Jacobshagen, N., Perrot, T., Beehr, T. A., & Boos, N. (2008). The emotional meaning of instrumental social support. *International Journal of Stress Management*, *15*(3), 235. https://doi.org/10.1037/1072-5245.15.3.235

Shanahan, L., Copeland, W. E., Worthman, C. M., Erkanli, A., Angold, A., & Costello, E. J. (2013). Sex-differentiated changes in C-reactive protein from ages 9 to 21: The contributions of BMI and physical/sexual maturation. *Psychoneuroendocrinology, 38*(10), 2209-2217. https://doi.org/10.1016/j.psyneuen.2013.04.010

Singh-Manoux, A., Marmot, M. G., & Adler, N. E. (2005). Does subjective social status predict health and change in health status better than objective status?. *Psychosomatic Medicine*, *67*(6), 855-861. doi:10.1097/01.psy.0000188434.52941.a0

Slavich, G. M., & Irwin, M. R. (2014). From stress to inflammation and major depressive disorder: a social signal transduction theory of depression. *Psychological Bulletin, 140*(3), 774. doi:10.1037/a0035302.

Slopen, N., Chen, Y., Priest, N., Albert, M. A., & Williams, D. R. (2016). Emotional and instrumental support during childhood and biological dysregulation in midlife. *Preventive Medicine*, *84*, 90-96. https://doi.org/10.1016/j.ypmed.2015.12.003

Stephens, T., & Morin .M. (1996). *Youth Smoking Survey, 1994: Technical Report*. Ottawa (ON): Minister of Supply and Services Canada.

Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics (6th ed.).* Boston: Pearson.

Taylor, S. E. (2011). *Social support: A review.* In H. S. Friedman (Ed.), *Oxford library of psychology. The Oxford handbook of health psychology* (p. 189–214). Oxford University Press.

Taylor, S., & Gonzaga, G. (2006). Evolution, relationships, and health: The social shaping hypothesis. *Evolution and Social Psychology*, 211-236. Retrieved July 20, 2020, from https://pdfs.semanticscholar.org/824a/da88f4e0f84a1c91c8805688c90482754c37.pdf

Uchino, B. N. (2004). *Social support and physical health: Understanding the health consequences of relationships*. Yale University Press.

Uchino, B. N. (2006). Social support and health: a review of physiological processes potentially underlying links to disease outcomes. *Journal of Behavioral Medicine*, *29*(4), 377-387. doi:10.1007/s10865-006-9056-5

Uchino, B. N. (2009). Understanding the links between social support and physical health: A life-span perspective with emphasis on the separability of perceived and received support. *Perspectives on Psychological Science, 4(*3), 236-255. https://doi.org/10.1111/j.1745-6924.2009.01122.x

Uchino, B. N., Trettevik, R., Kent de Grey, R. G., Cronan, S., Hogan, J., & Baucom, B. R. W. (2018). Social support, social integration, and inflammatory cytokines: A meta-analysis. *Health Psychology, 37*(5), 462-471. https://doi.org/10.1037/hea0000594

Uchino, B. N., Vaughn, A. A., Carlisle, M., & Birmingham, W. (2012). *Social support and immunity*. In S. C. Segerstrom (Ed.), *Oxford library of psychology. The Oxford handbook of psychoneuroimmunology* (p. 214–233). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780195394399.013.0012

Umberson, D., & Karas Montez, J. (2010). Social relationships and health: A flashpoint for health policy. *Journal of Health and Social Behavior, 51*(1_suppl), S54-S66. https://doi.org/10.1177/0022146510383501

van Zanten J.V. (2013). *C-Reactive Protein (CRP).* In Gellman M.D., & Turner J.R. (Eds.) *Encyclopedia of Behavioral Medicine*. Springer, New York, NY.

Wiking, M. (2016). *The little book of hygge: The Danish way to live well.* Penguin UK.

Wills, T. A. (1991). *Social support and interpersonal relationships.* In M. S. Clark (Ed.), *Review of personality and social psychology, Vol. 12. Prosocial behavior* (p. 265–289). Sage Publications, Inc.

World Health Organization (WHO). (2017). An evidence map of social, behavioural and community engagement interventions for reproductive, maternal, newborn and child health (No. 9789240697263). *World Health Organization*. Retrieved July 20, 2020, from https://apps.who.int/iris/bitstream/handle/10665/259399/9789240697263-eng.pdf

Yang, Y. C., Schorpp, K., & Harris, K. M. (2014). Social support, social strain and inflammation: Evidence from a national longitudinal study of US adults. *Social Science & Medicine*, *107*, 124-135. https://doi.org/10.1016/j.socscimed.2014.02.013

Zimet, G. D., Dahlem, N. W., Zimet, S. G., & Farley, G. K. (1988). The multidimensional scale of perceived social support. *Journal of Personality Assessment, 52*(1), 30-41. https://doi.org/10.1207/s15327752jpa5201_2

Table 1

Components and Item Loadings

	Traditional Approach						Data-Driven Approach										Social Hygge									
																	Multidimensional					Subdimensional				
	Mother	Father	Parents	Sibling/Peer	School (Adolescent)	Neighbourhood	Availability*	Close Parents	Distant Mother	Distant Father	Busy Parents	Bossy Parents	Sibling	Teacher	School (Adolescent)	Neighbourhood Safety	Neighbourhood Danger	Neighbourhood Services	Latent Component*	Cumulative Sum*	Latent Sum*	Latent Positive *	Latent Negative	Perceived Support*	Time Terse	Parental Warmth	Safety	Confiding
Someone to listen and help							.392												.195	.	.	.		.295				
Father would help		.644	.480					.540											.536	.	.	.		.547				
Mother would help	.565		.548						.502										.472	.	.	.		.528				
Sibling would help				.768									.						.230	.	.	.		.305				
Friend would help				.768			.570												.077	.	.	.		.262				
Teacher would help					.672									.					.294	.	.	.		.752				
Someone else would help							.449												.154	.	.	.		.441				
Disclosure in past 6 months							.782												-.116	.	.	.						.763
Sharing habits							.534												.230	.	.	.						.763
Satisfaction*							.791												.021	.	.	.						
Mother compliments you	.605		.516					.680											.605	.	.	.				.717		
Mother is affectionate	.643		.539					.697											.583	.	.	.				.734		
Mother has good times with you	.647		.580					.728											.614	.	.	.				.756		
Mother is too busy to talk	.486		.407								.814								.449	.	.		.		.575			
Mother is bossy	.377		.317									.850							.303	.	.		.		.701			
Mother searches your things	.587		.496						.69										.489	.	.		.					
Mother annoys you	.668		.591						.756										.612	.	.		.					
Mother ridicules you	.594		.501						.742										.497	.	.		.					
Mother hurts you	.673		.575						.770										.551	.	.		.					
Father compliments you		.687	.614					.797											.623	.	.	.				.776		
Father is affectionate		.683	.621					.786											.621	.	.	.				.765		
Father has good times with you		.699	.621					.762											.638	.	.	.				.749		
Father is too busy to talk		.522	.451								.814								.462	.	.		.		.604			
Father is bossy		.381	.329									.850							.323	.	.		.		.725			
Father searches your things		.386	.371							.316									.379	.	.		.					
Father annoys you		.683	.582							.467									.573	.	.		.					
Father ridicules you		.566	.518							.400									.506	.	.		.					
Father hurts you		.671	.589							.459									.567	.	.		.					
Safe to bring up children						.675										.727			.136	.	.	.					.758	
Safe to play						.618										.715			.098	.	.	.					.734	
Safe to walk						.579										.641			.059	.	.	.					.657	
Services and stores						.084												.796	.036	.	.	.						
Parks						.272												.796	-.014	.	.	.						

	Traditional Approach						Data-Driven Approach											Social Hygge									
																		Multidimensional					Subdimensional				
	Mother	Father	Parents	Sibling/Peer	School (Adolescent)	Neighbourhood	Availability*	Close Parents	Distant Mother	Distant Father	Busy Parents	Bossy Parents	Sibling	Teacher	School (Adolescent)	Neighbourhood Safety	Neighbourhood Danger	Neighbourhood Services	Latent Component*	Cumulative Sum*	Latent Sum*	Latent Positive *	Latent Negative	Perceived Support*	Time Terse	Parental Warmth	Safety	Confiding
Neighbours are helpful						.400										.467			.151	.	.	.					.481	
Quiet area						.547										.652			.051	.	.	.					.643	
Dangerous traffic						.487										.532			.033	.	.		.					
Drugs						.557											.793		.109	.	.		.					
Criminal activity						.661											.834		.060	.	.		.					
Troubling young people						.675											.816		.110	.	.		.					
School comfort*					.364										.687				.308	.	.	.						
School belonging*					.540										.581				.331	.	.	.						
School responsibility*					.464										.715				.204	.	.	.						
Teachers listen*					.795										.815				.317	.	.	.		.675				
Teachers meet with you*					.801										.703				.285	.	.	.		.679				
Cronbach alpha	.773	.791	.846	.297	.717	.674	.610	.841	.722	.844	.486	.617	N/A	N/A	.740	.668	.745	.417	.817	.817	.817	.760	.746	.650	.555	.843	.648	.253
Variance accounted for (%)	34.81	36.61	27.08	59.03	38.84	28.80	36.75	51.29	48.94	55.03	66.34	72.45	N/A	N/A	40.81	39.81	66.24	63.19	14.53	N/A	N/A	N/A	N/A	27.16	43.16	56.09	41.77	58.19

*Items included for adolescents only, relative statistics based on adolescent sample.

Table 2

Sample Demographics

	Entire QCAHS Sample (N = 3613)				Entire QCAHS Sample		CRP Sample (N = 2204)				Entire vs. CRP Sample	
	Children (n=1267)		Adolescents (n=2346)		Age	Sex	Children (n=697)		Adolescents (n=1507)		Children	Adolescents
	M (n)	SD (%)	M (n)	SD (%)	t	t	M (n)	SD (%)	M (n)	SD (%)	t	t
Age (years)	8.95	0.44	14.41	1.55	.	-0.70	8.93	1.55	14.51	1.55	1.27	**-4.12****
Sex (girl)	(640)	(50.5)	(1220)	(50.9)	-0.21	.	(358)	(51.4)	(777)	(51.6)	-0.67	-0.87
BMI-Z Score	0.11	1.18	0.23	1.03	**-3.04****	**2.19***	0.09	1.14	0.24	1.02	0.76	-0.60
BMI Underweight[a]	(94)	(7.5.)	(86)	(3.7)	**28.46****	7.54	(48)	(6.926)	(53)	(3.52)	4.60	0.35
Normal weight	(860)	(68.40)	(1724)	(73.90)	.	.	(489)	(70.56)	(1113)	(74.00)	.	.
Overweight	(177)	(14.10)	(321)	(13.80)	.	.	(96)	(13.85)	(206)	(13.70)	.	.
Obese	(126)	(10.0)	(203)	(8.70)	.	.	(60)	(8.66)	(132)	(8.78)	.	.
Current Smoker[b]	(25)	(2.0)	(641)	(26.70)	**341.71****	**11.75****	(15)	(2.15)	(407)	(27.01)	0.26	0.16
Household Income ($K)	46.36	22.27	49.35	22.64	**-3.40****	0.10	46.66	22.42	49.29	22.57	0.48	0.16
Parental Education[c]	6.21	1.16	6.49	1.18	-0.38	-0.64	6.18	1.12	6.38	1.20	-0.05	-0.08
CRP[d] (mg/L)	0.78	1.30	0.93	1.39	**-3.55****	**-4.24****	.	.	.	.	.	.

[a] denotes chi-squared test.
[b] denotes chi-squared test, nominal category (Yes/No).
[c] denotes chi-squared test, nominal category (No formal schooling or nursery school = 1; University = 7).
[d] based on log-transformed CRP values post re-coding.
*p < .05 level; **p < .01 level.

Table 3

Social Hygge and CRP by Age Group

		Children (n= 697)						Adolescents (n=1507)					
		Unstd. *B*	Unstd. *SE*	*t*	*p*	η^2_p	Adj. R^2	Unstd. *B*	Unstd. *SE*	*t*	*p*	η^2_p	Adj. R^2
Base Models	Sex	0.107	.031	3.492	.000**	**.017**		0.067	.022	3.024	.002**	**.006**	
	Age	-0.090	.044	-2.065	.039*	**.007**		0.055	.007	7.536	.000**	**.038**	
	BMI-Z	0.111	.013	8.266	.000**	**.090**	.104	0.117	.011	10.742	.000**	**.071**	.108
	Current smoking status	-0.227	.112	-2.024	.043*	**.007**		-0.014	.028	-0.497	.619	.000	
	Household income	0.000	.001	-0.35	.727	.001		-0.001	.001	-1.684	.092	.002	
	Parental education	0.005	.029	0.179	.862	.003	.099	-0.021	.011	-1.954	.051	.003	.117
Traditional	Mother	-0.010	.022	-0.468	0.64	0.000	.106	-0.014	.010	-1.405	.160	.001	.108
	Father	0.004	.022	0.174	0.862	.000	.106	-0.029	.010	-2.807	.005**	**.005**	.112
	Parents	-0.003	.022	-0.131	0.896	.000	.106	-0.025	.010	-2.455	.014*	**.004**	.111
	Sibling/Peer	0.009	.015	0.569	0.569	.001	.106	-0.003	.012	-0.29	.772	.000	.107
	School (Adolescent)	.	.	.	.	.	.	-0.014	.011	-1.203	.229	.001	.108
	Neighbourhood	0.020	.015	1.299	0.194	.002	.108	-0.010	.012	-0.821	.412	.001	.108
Data-Driven	Availability[a]	-0.026	.015	-1.709	0.087	.004	.110	0.003	.013	0.257	.797	.000	.107
	Close Parents	-0.011	.025	-0.416	0.678	.000	.106	-0.023	.010	-2.252	.024*	**.003**	.110
	(Less) Distant Mother[b]	-0.003	.019	-0.174	0.862	.000	.106	-0.008	.011	-0.794	.427	.000	.107
	(Less) Distant Father[b]	0.021	.021	0.989	0.324	.002	.114	-0.022	.010	-2.076	.038*	**.003**	.113
	(Less) Busy Parents[b]	-0.014	.016	-0.885	0.376	.001	.107	-0.014	.011	-1.243	.214	.001	.108
	(Less) Bossy Parents[b]	-0.009	.019	-0.496	0.62	.000	.106	-0.019	.011	-1.776	.076	.002	.109
	Sibling	0.020	.019	1.033	0.301	.002	.107	-0.002	.014	-0.129	.897	.000	.107
	Teacher	-0.015	.026	-0.593	0.553	.000	.106	-0.013	.016	-0.813	.416	.001	.107
	School (Adolescent)	.	.	.	.	.	.	-0.014	.011	-1.205	.228	.001	.108
	Neighbourhood Safety	0.014	.016	0.93	0.352	.001	.107	-0.006	.012	-0.495	.621	.000	.107
	(Less) Neighbourhood Danger[b]	0.015	.015	0.969	0.332	.001	.107	-0.011	.012	-0.902	.368	.001	.108
	Neighbourhood Services	0.031	.016	1.916	0.056	.006	.111	-0.008	.013	-0.635	.528	.000	.108
Social Hygge – Multi.	Latent Component[a]	0.001	.016	0.048	0.962	.000	.106	-0.015	.006	-2.546	.011*	**.004**	.111
	Cumulative Sum[a]	0.001	.002	0.605	0.545	.001	.106	-0.002	.001	-2.492	.013*	**.004**	.111
	Latent Sum[a]	0.010	.203	0.048	0.962	.000	.106	-0.263	.100	-2.633	.008**	**.005**	.111
	Latent Positive[a]	0.055	.186	0.293	0.769	.000	.106	-0.212	.089	-2.386	.017*	**.004**	.110
	Latent Negative	-0.037	.151	-0.248	0.804	.000	.106	-0.160	.080	-2.001	.045*	**.003**	.109
Social Hygge – Sub.	Perceived Support[a]	0.011	.016	0.66	0.51	.001	.106	-0.011	.011	-0.945	.345	.001	.108
	(Less) Time Terse[b]	-0.015	.017	-0.878	0.38	.001	.107	-0.021	.011	-1.915	.056	.003	.109
	Parental Warmth	-0.011	.027	-0.398	0.691	.000	.106	-0.021	.01	-2.098	.036*	**.003**	.110
	Safety	0.020	.015	1.294	0.196	.002	.108	-0.006	.012	-0.532	.594	.000	.107
	Confiding	-0.011	.016	-0.669	0.504	.001	.106	-0.006	.012	-0.527	.598	.000	.107

Note. All models adjusted for sex, age, BMI Z-score and current smoking status; Cases bolded for emphasis.

[a] Component includes additional items for adolescents;

[b] Component includes negatively worded items where higher score indicates *greater* social support;

*p < .05 level; **p < .01 level.

Appendix A

Table A1

Items Included from QCAHS Questionnaire

Item	Question	Child Responses	Adolescent Responses
Someone to listen and help	**Do you have someone who can help you if you have a problem?**	No (0), Yes (1)	
Do you think the following people would really listen to you and help you feel better if you really needed it?			
Dad would help	Your father or the adult man you live with the most	N/A, or never see them (0); This person will listen to you... Not at all (0), A little (1), A lot (2)	
Mom would help	Your mother or the adult woman you live with the most	"	
Sibling would help	One of your brothers or sisters	"	
Friend would help	One of your friends	"	
Teacher would help	One of your teachers	"	
Someone else would help	Someone else	"	
Disclosure in past 6 months	During the 6 last months, have you told someone something that was bothering you or was very important to you?	No (0), Yes (1)	
Sharing habits	When you feel sad or very happy, do you talk to someone about it, share it with someone?	Never (0), Sometimes (1), Often (2)	
Satisfaction	If « yes », were you satisfied with the way they listened to you and what they said to help?	–	Unsatisfied (-1), More or less satisfied (0), Satisfied (1)
During the last month, how would you describe your relationship with your mother or the adult woman you usually live with such as your stepmother, or the wife or girlfriend of your father?			
Mother compliments you	Does she compliment you for the good things you do?	Never (0), Sometimes (1), Often (2)	Never (0), Rarely (.5), Sometimes (1), Often (2), Very Often (3)
Mother is affectionate	Is she affectionate with you? (She hugs you, smiles at you, kisses you or say nice things to you)	"	"
Mother has good times with you	Do you have good times together?	"	"
Mother is too busy to talk	Is she too busy for you to be able to talk to her about things that interest you?	Never (0), Sometimes (-1), Often(-2)	Never (0), Rarely (-.5), Sometimes (-1), Often (-2), Very Often (-3)
Mother is bossy	Does she tell you what to do, even for small, unimportant things?	"	"
Mother searches your things	Does she go through your things without your permission?	"	"
Mother annoys you	Is she on your back (on your case)?	"	"
Mother ridicules you	Does she make fun of you or ridicule you in front of others?	"	"
Mother hurts you	Does she say things that hurt you or make you feel bad?	"	"
During the last month, how would you describe your relationship with your father or the adult man you usually live with such as your stepfather, or the husband or boyfriend of your mother?			
Father compliments you	Does he compliment you for the good things you do?	Never (0), Sometimes (1), Often (2)	Never (0), Rarely (.5), Sometimes (1), Often (2), Very Often (3)
Father is affectionate	Is he affectionate with you? (He hugs you, smiles at you, kisses you or say nice things to you)	"	"
Father has good times with you	Do you have good times together?	"	"
Father is too busy to talk	Is he too busy for you to be able to talk to him about things that interest you?	Never (0), Sometimes (-1),Often (-2)	Never (0), Rarely (-.5), Sometimes (-1), Often (-2), Very Often (-3)
Father is bossy	Does he tell you what to do, even for small, unimportant things?	"	"
Father searches your things	Does he go through your things without your permission?	"	"
Father annoys you	Is he on your back (on your case)?	"	"
Father ridicules you	Does he make fun of you or ridicule you in front of others?	"	"
Father hurts you	Does he say things that hurt you or make you feel bad?	"	"
Safe to bring up children	**How would you rate your neighbourhood (town, village) as a place to bring up children?**	Very bad (-2), Somewhat bad (-1), Average (0), Don't know (0), Somewhat good (1), Excellent (2)	
Safe to play	**It is safe for children to play outside during the day?**	Completely disagree (-2), Disagree (-1), Don't know (0), Agree (1), Completely agree (2)	
Safe to walk	**It is safe to walk alone in this neighbourhood (town, village)?**	Completely disagree (-2), Disagree (-1), Don't know (0), Agree (1), Completely agree (2)	
	Indicate whether you agree or disagree with the following statements about your neighbourhood (town, village).		
Services and stores	There are enough services (daycare, clinics) and stores in the area	Disagree (-1), Don't know (0), Agree (1)	
Parks	There are enough parks, playgrounds and green spaces	"	
Neighbours are helpful	Neighbours help each other	"	
Quiet area	The area is quiet, peaceful	"	
Dangerous traffic	Traffic is dangerous	Disagree (1), Don't know (0), Agree (-1)	
Drugs	There is drug-dealing or drug use	"	
Criminal activity	There is criminal activity (break-ins, violence)	"	
Troubling young people	There are groups of young people who cause trouble	"	
School comfort	I feel comfortable at my school	–	Completely disagree (-2), Somewhat disagree (-1), Somewhat agree (1), Completely agree (2)
School belonging	At my school, they take into account the opinion of the students when making rules and regulations	–	"
School responsibility	The students have some responsibilities in organizing extracurricular school activities	–	"
Teachers listen	Some of my teachers will listen to what I have to say when I need to talk about my problems	–	"
Teachers meet with you	I can easily meet with my teachers to discuss various personal problems	–	"

Appendix B

Table B1

Correlation Matrix across Approaches and Components

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Traditional	1 Mother	–	.518**	.856**	.190**	.	.030	-.068*	.560**	.903**	.468**	.431**	.284**	.181**	.177**	.	.030	.020	.066*	.818**	.644**	.818**	.593**	.791**	.396**	.451**	.569**	.020	.083**
	2 Father	.514**	–	.885**	.196**	.	.084**	-.020	.765**	.433**	.800**	.445**	.281**	.194**	.133**	.	.083**	.050	.050	.877**	.696**	.877**	.741**	.731**	.423**	.463**	.714**	.084**	.095**
	3 Parents	.862**	.878**	–	.221**	.	.068*	-.050	.767**	.753**	.740**	.499**	.321**	.216**	.177**	.	.065*	.040	.068*	.974**	.770**	.974**	.771**	.870**	.470**	.520**	.742**	.063*	.103**
	4 Sibling/Peer	.116**	.120**	.136**	–	.	.010	.065*	.236**	.134**	.104**	.113**	.030	.758**	.265**	.	-.010	.030	.030	.306**	.360**	.306**	.367**	.133**	.601**	.089**	.217**	.000	.145**
	5 School (Adol.)	.240**	.248**	.281**	.102**	–	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	6 Neighbourhood	.068**	.065**	.077**	.040	.070**	–	.020	.104**	.020	.050	-.010	-.020	.010	-.020	.	.888**	.774**	.249**	.189**	.591**	.189**	.204**	.107**	.050	-.020	.093**	.863**	.030
Data-Driven	7 Availability[a]	.048*	.020	.040	.433**	.117**	.052*	–	.050	-.102**	-.059*	-.030	-.050	.020	.000	.	.020	.020	-.079**	-.060	.126**	-.060	.000	-.097**	.064*	-.050	.050	.030	.743**
	8 Close Parents	.678**	.762**	.830**	.141**	.254**	.063**	.086**	–	.331**	.375**	.266**	.060	.200**	.187**	.	.095**	.070*	.074*	.821**	.659**	.821**	.958**	.386**	.498**	.203**	.983**	.096**	.171**
	9 Distant Mother[b]	.891**	.441**	.758**	.070**	.187**	.054*	-.020	.406**	–	.494**	.259**	.186**	.154**	.132**	.	.010	.010	.050	.677**	.518**	.677**	.379**	.781**	.306**	.282**	.323**	.010	.020
	10 Distant Father[b]	.409**	.785**	.693**	.058**	.177**	.059*	-.020	.333**	.487**	–	.247**	.227**	.123**	.079**	.	.060	.020	.050	.667**	.522**	.667**	.377**	.765**	.220**	.303**	.355**	.060	.020
	11 Busy Parents[b]	.466**	.492**	.548**	.074**	.187**	.040	.010	.346**	.373**	.337**	–	.228**	.093**	.060	.	.000	.000	.000	.499**	.396**	.499**	.272**	.584**	.190**	.768**	.245**	-.010	.072*
	12 Bossy Parents[b]	.342**	.329**	.382**	.090**	.074**	.040	.053*	.104**	.328**	.336**	.244**	–	.040	-.010	.	-.010	-.030	.010	.314**	.281**	.314**	.060	.492**	.040	.799**	.060	-.020	-.010
	13 Sibling	.143**	.166**	.178**	.778**	.092**	.010	.112**	.186**	.099**	.082**	.090**	.062**	–	.160**	.	.000	.020	.030	.287**	.300**	.287**	.320**	.152**	.464**	.086**	.177**	.000	.085**
	14 Teacher	.182**	.179**	.207**	.197**	.408**	-.020	.137**	.208**	.134**	.081**	.094**	.093**	.149**	–	.	-.030	-.020	.030	.257**	.257**	.257**	.329**	.088**	.700**	.030	.168**	-.020	.106**
	15 School (Adol.)	.240**	.249**	.281**	.104**	1.00**	.069**	.118**	.255**	.188**	.176**	.187**	.075**	.093**	.419**	–	.	.	.	.	.	.	.	.	.	.	.	.	.
	16 N. Safety	.065**	.070**	.078**	.040	.079**	.884**	.046*	.073**	.049*	.050	.040	.040	.020	-.010	.078**	–	.409**	.141**	.171**	.525**	.171**	.209**	.070*	.030	-.010	.089**	.975**	.040
	17 N. Danger[b]	.050	.040	.050*	.030	.040	.783**	.045*	.030	.040	.048*	.030	.040	.000	-.040	.030	.415**	–	.138**	.133**	.435**	.133**	.112**	.111**	.050	-.020	.060	.395**	.020
	18 N. Services	.020	.020	.020	.000	.010	.187**	-.020	.010	.020	.040	.000	-.010	.030	.020	.010	.088**	.091**	–	.101**	.286**	.101**	.110**	.060	.065*	.010	.079*	.126**	-.040
Social Hygge Multi. Sub.	19 Latent Component[a]	.851**	.848**	.976**	.206**	.436**	.171**	.106**	.825**	.734**	.652**	.540**	.365**	.229**	.314**	.438**	.166**	.117**	.040	–	.859**	.	.859**	.817**	.568**	.515**	.796**	.169**	.144**
	20 Cumulative Sum[a]	.709**	.717**	.819**	.293**	.582**	.432**	.298**	.709**	.583**	.526**	.468**	.370**	.258**	.371**	.584**	.394**	.315**	.145**	.911**	–	.859**	.761**	.675**	.571**	.430**	.634**	.505**	.285**
	21 Latent Sum[a]	.820**	.846**	.958**	.201**	.498**	.155**	.100**	.856**	.675**	.602**	.529**	.355**	.231**	.333**	.499**	.151**	.108**	.030	.992**	.921**	–	.859**	.817**	.568**	.515**	.796**	.169**	.144**
	22 Latent Positive[a]	.676**	.727**	.808**	.229**	.556**	.134**	.150**	.930**	.434**	.343**	.359**	.126**	.255**	.389**	.558**	.151**	.066**	.020	.874**	.862**	.906**	–	.406**	.670**	.208**	.933**	.215**	.203**
	23 Latent Negative	.748**	.724**	.844**	.082**	.222**	.132**	-.020	.422**	.810**	.794**	.607**	.588**	.107**	.121**	.222**	.095**	.134**	.030	.814**	.580**	.681**	.308**	–	.258**	.685**	.370**	.061*	.030
	24 Perceived Support[a]	.387**	.381**	.441**	.420**	.647**	.043*	.335**	.433**	.300**	.197**	.214**	.135**	.325**	.738**	.653**	.056**	.010	.010	.577**	.658**	.599**	.670**	.267**	–	.144**	.425**	.040	.197**
	25 Time Terse[b]	.496**	.509**	.574**	.105**	.157**	.051*	.040	.265**	.436**	.427**	.726**	.844**	.093**	.118**	.157**	.048*	.040	-.010	.557**	.521**	.544**	.288**	.753**	.214**	–	.190**	-.020	.040
	26 Parental Warmth	.694**	.720**	.815**	.130**	.249**	.060*	.088**	.992**	.408**	.312**	.333**	.094**	.170**	.187**	.250**	.069**	.030	.000	.809**	.694**	.841**	.917**	.410**	.395**	.251**	–	.089**	.178**
	27 Safety	.070**	.075**	.084**	.040	.081**	.862**	.045*	.082**	.053*	.050	.040	.030	.030	-.010	.081**	.979**	.400**	.079**	.171**	.389**	.158**	.161**	.093**	.063**	.046*	.077**	–	.030
	28 Confiding	.020	-.020	.000	.253**	.100**	.053*	.867**	.067**	-.046*	-.054*	-.030	-.010	.069**	.058**	.100**	.040	.052*	-.010	.055*	.230**	.056**	.114**	-.056**	.179**	-.020	.076**	.040	–

Note. All models adjusted for age, BMI Z-score and current smoking status; Children in upper shaded portion, adolescents in lower unshaded portion; N. stands for Neighbourhood;

[a] Component includes additional items for adolescents;

[b] Component includes negatively worded items where higher score indicates *greater* social support;

*$p < .05$ level; **$p < .01$ level.

Appendix C

Table C1

Social Hygge Descriptives: Entire QCAHS Sample

		Entire QCAHS Sample (N = 3613)					
		Children (n=1267)		Adolescents (n=2346)		Age	Sex
		M	*SD*	*M*	*SD*	*t*	*t*
Traditional	Mother	0.04	0.71	-0.02	1.12	1.78	**-2.46***
	Father	0.18	0.73	-0.10	1.11	**8.70****	0.64
	Parents	0.13	0.72	-0.07	1.12	**6.17****	-1.03
	Sibling/Peer	-0.14	1.03	0.08	0.97	**-6.32****	**-10.61****
	School (Adolescent)	.	.	0.45	0.98	.	**-2.73****
	Neighbourhood	-0.08	1.02	0.04	0.99	**-3.32****	0.11
Data-Driven	Availability[a]	0.00	1.00	0.01	1.00	-0.18	**-17.35****
	Close Parents	-0.14	0.63	0.08	1.14	**-7.23****	-1.08
	(Less) Distant Mother[b]	0.26	0.81	-0.14	1.06	**12.34****	0.12
	(Less) Distant Father[b]	0.23	0.78	-0.12	1.08	**10.05****	0.18
	(Less) Busy Parents[b]	0.02	0.97	-0.01	1.02	0.64	-0.47
	(Less) Bossy Parents[b]	0.29	0.83	-0.15	1.05	**13.04****	**-6.65****
	Sibling	0.99	0.80	1.04	0.82	-1.86	-1.85
	Teacher	1.54	0.64	0.81	0.73	**30.92****	-1.44
	School (Adolescent)	.	.	0.44	0.99	.	**-2.75****
	Neighbourhood Safety	-0.11	1.03	0.06	0.98	**-4.46****	0.78
	(Less) Neighbourhood Danger[b]	0.00	1.00	0.00	1.00	0.16	-1.01
	Neighbourhood Services	-0.04	1.03	0.02	0.99	-1.66	0.96
Social Hygge – Multi.	Latent Component[a]	0.00	1.00	0.00	1.99	-0.00	**-2.04***
	Cumulative Sum[a^]	24.99^	7.90	27.68^	11.92	**-10.21****	**-6.38****
	Latent Sum[a^]	0.22^	0.08	0.19^	0.12	**6.68****	**-2.77****
	Latent Positive[a^]	0.47^	0.08	0.41^	0.14	**14.51****	**-2.72****
	Latent Negative^	-0.13^	0.10	-0.19^	0.14	**13.71****	-1.41
Social Hygge – Sub.	Perceived Support[a]	0.00	1.00	0.00	1.00	0	**-5.50****
	(Less) Time Terse[b]	0.21	0.88	-0.11	1.04	**9.07****	**-4.92****
	Parental Warmth	-0.21	0.60	0.11	1.14	**-10.90****	**-2.15***
	Safety	-0.08	1.04	0.04	0.98	**-2.57***	0.62
	Confiding	-0.08	0.96	0.04	1.02	**-3.57****	**-16.80****

Note. Cases bolded for emphasis.

[a] Component includes additional items for adolescents;

[b] Component includes negatively worded items where higher score indicates *greater* social support;

^ Scores based on raw values (all other scores are component scores with M=0, SD=1);

*p < .05 level; **p < .01 level.

Table C2

Social Hygge Descriptives: CRP Sample

		CRP Sample (*n* = 2204)				Entire Sample vs. CRP Sample	
		Children (*n*=697)		Adolescents (*n*=1507)		Children	Adolescents
		Z-score (*M*)	*SD*	Z-score (*M*)	*SD*	*t*	*t*
Traditional	Mother	0.05	0.72	-0.02	1.12	-0.94	-0.22
	Father	0.18	0.74	-0.11	1.12	0.48	0.55
	Parents	0.13	0.74	-0.07	1.12	-0.20	0.22
	Sibling/Peer	-0.16	1.04	0.09	0.97	0.52	-0.84
	School (Adolescent)	.	.	0.45	0.99	.	-0.38
	Neighbourhood	-0.06	1.01	0.04	0.99	-0.58	0.30
Data-Driven	Availability[a]	-0.03	1.00	0.03	0.99	1.02	1.50
	Close Parents	-0.14	0.64	0.08	1.15	-0.12	-0.32
	(Less) Distant Mother[b]	0.26	0.81	-0.14	1.06	-0.23	0.25
	(Less) Distant Father[b]	0.23	0.79	-0.15	1.09	0.60	0.98
	(Less) Busy Parents[b]	0.03	0.99	-0.01	1.04	-0.86	-0.07
	(Less) Bossy Parents[b]	0.30	0.83	-0.16	1.07	-0.52	0.33
	Sibling	0.98	0.80	1.05	0.83	0.53	-7.18
	Teacher	1.58	0.62	0.83	0.72	**-2.05***	-1.55
	School (Adolescent)	.	.	0.45	1.00	.	-0.41
	Neighbourhood Safety	-0.08	1.00	0.06	0.98	-0.36	0.61
	(Less)Neighbourhood Danger[b]	0.02	1.01	-0.02	1.01	-0.70	1.29
	Neighbourhood Services	-0.03	1.01	0.01	1.00	-0.19	0.42
Social Hygge – Multi.	Latent Component[a]	0.02	1.02	0.00	2.00	-0.57	0.03
	Cumulative Sum[a]^	25.14^	7.90	28.36^	11.98	-0.71	**-3.34****
	Latent Sum[a]^	0.22^	0.08	0.20^	0.12	-0.57	**-2.39***
	Latent Positive[a]^	0.47^	0.085	0.42^	0.13	-0.43	**-4.37****
	Latent Negative^	-0.13^	0.105	-0.19^	0.14	-0.53	**2.50***
Social Hygge – Sub.	Perceived Support[a]	0.03	0.99	0.02	1.00	-1.33	-1.10
	(Less) Time Terse[b]	0.23	0.90	-0.12	1.06	-0.85	0.19
	Parental Warmth	-0.21	0.60	0.12	1.15	-0.11	-0.41
	Safety	-0.07	1.01	0.05	0.97	-0.23	-0.31
	Confiding	-0.09	0.96	0.07	1.01	0.37	-1.74

Note. Cases bolded for emphasis.

[a] Component includes additional items for adolescents;

[b] Component includes negatively worded items where higher score indicates *greater* social support;

^ Scores based on raw values (all other scores are component scores with M=0, SD=1);

*p < .05 level; **p < .01 level.

Appendix D

Table D1

Social Hygge and CRP by Sex

		Males (*n*=1106)						Females (*n*=1135)					
		Unstd. *B*	Unstd. *SE*	*t*	*p*	η^2_p	Adj. R^2	Unstd. *B*	Unstd. *SE*	*t*	*p*	η^2_p	Adj. R^2
Base Models	Age	0.014	.004	3.265	.001**	**.010**		0.021	.004	4.727	.000**	**.020**	
	BMI-Z	0.106	.012	8.970	.000**	**.070**	.081	0.120	.012	9.758	.000**	**.078**	.096
	Current smoking status	-0.051	.039	-1.293	.196	.002		0.009	.038	0.230	.818	.000	
	Household income	-0.001	.001	-1.480	.139	.002		0.000	.001	-0.535	.593	.000	
	Parental education	0.003	.015	0.229	.820	.000	.079	-0.032	.016	-2.012	.054	.001	.109
Traditional	Mother	-0.027	.013	-2.083	.037*	**.004**	0.084	-0.013	.013	-1.024	.306	.001	.096
	Father	-0.026	.013	-1.926	.054	.004	0.084	-0.026	.013	-1.968	.049*	**.004**	.098
	Parents	-0.031	.013	-2.300	.021*	**.005**	0.085	-0.023	.013	-1.763	.078	.003	.097
	Sibling/Peer	0.004	.012	0.335	.737	.000	0.080	0.003	.015	0.213	.832	.000	.095
	School (Adolescent)	-0.025	.015	-1.618	.106	.004	0.087	-0.005	.017	-0.310	.757	.000	.114
	Neighbourhood	0.009	.013	0.701	.483	.001	0.081	-0.011	.014	-0.796	.426	.000	.095
Data-Driven	Availability[a]	-2.98^{e-05}	.013	-0.002	.998	.000	.080	-0.007	.015	-0.453	.650	.000	.095
	Close Parents	-0.022	.012	-1.792	.073	.003	.083	-0.044	.013	-3.312	.001**	**.010**	.104
	(Less) Distant Mother[b]	-0.020	.013	-1.502	.133	.002	.082	0.007	.013	0.515	.606	.000	.095
	(Less) Distant Father[b]	-0.013	.013	-0.996	.320	.001	.081	-0.008	.014	-0.551	.582	.000	.095
	(Less) Busy Parents[b]	-0.021	.013	-1.649	.100	.003	.083	-0.006	.013	-0.487	.626	.000	.095
	(Less) Bossy Parents[b]	-0.017	.012	-1.396	.163	.002	.082	-0.006	.014	-0.401	.689	.000	.095
	Sibling	0.002	.015	0.151	.880	.000	.080	0.013	.017	0.783	.434	.001	.095
	Teacher	-0.027	.017	-1.530	.126	.002	.083	0.032	.020	1.646	.100	.002	.097
	School (Adolescent)	-0.025	.015	-1.624	.104	.004	.087	-0.005	.017	-0.307	.759	.000	.114
	Neighbourhood Safety	0.008	.013	0.609	.543	.000	.081	-0.009	.013	-0.664	.507	.000	.095
	(Less) Neighbourhood Danger[b]	0.007	.013	0.545	.586	.000	.081	-0.010	.014	-0.763	.446	.001	.096
	Neighbourhood Services	0.010	.014	0.734	.464	.001	.081	-0.003	.014	-0.176	.861	.000	.095
Social Hygge – Multi.	Latent Component[a]	-0.018	.008	-2.360	.018*	**.004**	.084	-0.016	.008	-2.171	.030*	**.003**	.097
	Cumulative Sum[a]	-0.002	.001	-1.676	.094	.003	.083	-0.003	.001	-2.285	.022*	**.005**	.099
	Latent Sum[a]	-0.291	.125	-2.325	.020*	**.005**	.085	-0.24	.128	-1.882	.060	.003	.098
	Latent Positive[a]	-0.198	.109	-1.821	.069	.003	.083	-0.22	.119	-1.853	.064	.003	.098
	Latent Negative	-0.190	.099	-1.930	.054	.003	.084	-0.040	.101	-0.395	.693	.000	.095
Social Hygge – Sub.	Perceived Support[a]	-0.008	.012	-0.626	.531	.000	.081	0.002	.014	0.137	.891	.000	.095
	(Less) Time Terse[b]	-0.024	.012	-1.932	.053	.004	.084	-0.008	.014	-0.552	.581	.000	.095
	Parental Warmth	-0.022	.012	-1.742	.082	.003	.083	-0.045	.013	-3.390	.001**	**.011**	.104
	Safety	0.008	.013	0.624	.533	.001	.081	-0.006	.013	-0.416	.677	.000	.095
	Confiding	-0.004	.013	-0.297	.766	.000	.080	-0.008	.015	-0.560	.576	.000	.095

Note. All models adjusted for age, BMI Z-score and current smoking status; Cases bolded for emphasis.

[a] Component includes additional items for adolescents;

[b] Component includes negatively worded items where higher score indicates *greater* social support;

*$p < .05$ level; **$p < .01$ level.