Of All The Things That Public Health Tells Us Not to Do, What Are Winnipeg Youth Most

Concerned About? – A Quantitative Exploratory Study

By Shivoan Balakumar

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Department of Community Health Sciences, Rady Faculty of Health Sciences

University of Manitoba

Winnipeg

Abstract

Effective youth health promotion should reflect the concerns and interests of the youth community being served. A quantitative exploration of youth concern related to HRB engagement was conducted among youth in central Winnipeg, MB. This study involved descriptive and inferential analysis of HRB engagement and attitude data from a cross-sectional survey of 250 youth (14–24 years). Chi-squared tests, Fisher's exact tests, logistic regression and cluster analyses were employed to explore potential relationships between sociodemographic traits, HRB engagement, and HRB-specific concern. Findings demonstrated that A) youth in Winnipeg, regardless of their sociodemographic characteristics, do express concern about HRBs that they engage in; B) the likelihood of concern varies depending on what HRB one is examining; and C) while youth display similar trends in their concern about HRBs, different groups of youth, characterized by different patterns of engagement and sociodemographic traits vary in their likelihood of being concerned about particular HRBs.

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1. <u>Introduction</u>

The promotion of health and well being among youth and young adults is a goal sought after by governments, organizations and communities across the globe. Significant investment in youth health promotion has been justified by evidence indicating that early adoption of certain behaviours and avoidance of other behaviours can have beneficial and long lasting effects on both individual and population health and well being (1–3). In North America, significant morbidity, mortality and other social consequences have been associated with a variety of youth behaviours (3): youth eating habits and physical activity have been linked to increased obesity rates and chronic diseases at all ages (4,5); unprotected sex has been associated with high rates of sexually transmitted infections (STIs) and teen pregnancy (3,6); early engagement in violent behaviours has been linked to an elevated risk of a variety of future violent behaviours (7,8); alcohol and substance use problems have been associated with an increased risk of a plethora of downstream consequences such as homelessness and criminal activity (11,12); and smoking at any age has been causally linked to cancers of all forms (11). This has resulted in the prioritization of two major streams of public health activity at local, national and international levels: 1) youth health risk behaviour (HRB) surveillance, and 2) the planning and development of youth health behaviour change interventions. Significant bodies of research and extensive programming have been dedicated to enhancing the effectiveness of these activities in Canada and Manitoba (MB) (3,12). The HRBs that are typically selected for monitoring and interventions are chosen because they a) contribute to the leading causes of morbidity and mortality among youth and adults, b) are generally established during childhood and adolescence, and c) are often interrelated and preventable (13).

With such a diversity of interests invested in youth health promotion, it should come as no surprise to discover a glut of health surveys across Canada dedicated to capturing a variety of youth HRB measures (e.g. the Health Behaviour in School-aged Children Survey (14); the Youth Smoking Survey (15); the Enhanced Surveillance of Canadian Street Youth Survey (16); the National Longitudinal Survey of Children and Youth (17); the Student Drug Use Survey in the Atlantic Provinces (18)). In 2006 a youth HRB surveillance initiative began in Manitoba (MB) known as the Youth Health Survey (YHS) (13). The YHS was conducted in high-schools across all MB health authorities in 2012-13, and included questions on behaviours such as tobacco use, alcohol and substance use, healthy sexuality, violence and injury prevention, healthy eating, physical activity and sedentary behaviour. The purpose of the YHS is similar to that of most youth HRB surveillance initiatives; that is to describe, monitor and study the prevalence and trends of priority HRBs among young populations in order to inform health promotion policy, practice and programs (1-3). The range and number of partners involved in the development and implementation of the YHS facilitated its widespread dissemination and uptake among MB high schools, and is an indicator that youth HRB surveillance is a high priority among health practitioners, educators and policy makers in MB.

The Ottawa Charter for Health Promotion (1987) defines health promotion as a "process of enabling people to increase control over, and to improve, their health" (23). A key characteristic of health promotion, as envisioned by the charter, is that it is enabling – done by, with and for people, not imposed on them (23). While a vast number of health promotion and health behaviour change theories exist, two evidence-based approaches to health behaviour change appear to align, at least partially, with this ideology: the Transtheoretical Model of Change (TTM) (24) and the principles of Motivational Interviewing (MI) (25). The foundation of

both is the importance of working with individuals and tailoring health promotion interventions to peoples' existing interests and motivations (26). They also recognize that motivation is a necessary, but not necessarily sufficient precursor to health behaviour change due to the large number of social and structural determinants of health outside of an individual's control (27,28). Although theoretical and empirical critiques exist, TTM and MI (29–32) each have a strong evidence base related to positive behaviour change outcomes and are well supported in their respective fields, psychology and social work (33–40). MI in particular is seen to be a promising practice with widespread use among social workers and clinicians due to its applicability in a variety of situations and settings (33–37). MI was first developed by William Miller and Stephen Rollnick as a client-centered method of communication designed to enhance intrinsic motivation to change behaviour (2002). The central premise of MI is that strategies to invoke behaviour change must be person-centered and focus on the concerns, perspectives and interests of the individual (25). Miller and Rollnick define three critical components of motivation to change behaviour: readiness, willingness and ability (people must be "ready, willing and able" to make a change) (25). While readiness and ability speak to an individual's own capacity (actual and perceived) as well as the other competing priorities in their life, willingness reflects their interests and concerns about engaging in a behaviour and the discrepancy that exists between their current circumstance and their desires, wills and values for the future. As Miller and Rollnick state, "The proper question is not, "Why isn't this person motivated?" but rather, "For what *is* this person motivated?" (17, p.18). Examining an individual's concerns about his or her engagement in HRBs, and helping them change behaviours that they are already motivated to change are key philosophies of MI that align with the Ottawa Charter and are also promoted by public health entities in MB (26).

A large body of psychological literature on attitudes, intentions and behaviour also supports this approach to health promotion. Evidence suggests that affect or emotions (e.g. concern, worry or excitement) may be just as, if not more important than cognitions (e.g. beliefs or perceived risk) in fostering health behaviour change (41–43). As well, they both appear to interact, cyclically and synergistically (44–46). There is also considerable evidence indicating that goal attainment has positive effects on self-esteem and self-efficacy (47,48), which in turn increases concern for oneself and one's personal health (49). By aiding someone in his or her efforts to change behaviours of concern to them, one may also indirectly increase their concern for other important health related behaviours.

As well, some believe that public health messaging has become overwhelming for many individuals, and that the array of health guidelines and directives regularly communicated could be desensitizing audiences to key messages (50–52). Adolescents in particular are bombarded with paternalistic and authoritative directives at their home, school, work and even play settings (53). Targeted messages and interventions catered to individual and group interests is therefore especially important for youth populations.

With governments and public health entities taking such large initiatives to measure and mitigate HRB engagement among youth (3,20–22), and given the wealth of evidence supporting affect, saliency, and concern as crucial constructs to health behaviour change (25,33,36,37), it would be reasonable to presume that a variety of studies have examined youth concerns about engagement in different HRB's. This is however not the case; very few peer-reviewed studies have analyzed levels of youth concern about engagement in HRBs, and none have quantitatively compared levels across multiple HRBs. In what is often described as a resource-scarce public health landscape (54,55), such studies could enhance traditional youth HRB surveillance and

intervention planning by pointing to more targeted health promotion interventions. Priority setting and intervention selection could be informed by those behaviours which youth consider to be most salient to their health and well being. As well, interventions that lend themselves to increasing awareness and concern, such as education and marketing campaigns, can be directed at behaviours that youth find less concerning.

A primary goal of the current study is to fill this gap in the literature by exploring whether youth in Winnipeg, MB express concern about their engagement in HRBs commonly under public health surveillance in Canada. Additionally, how concern varies across different HRBs and between particular demographic subsets of youth is another principal interest in the study. Given the paucity of literature on youth concern about HRB engagement, a central objective of this quantitative exploratory study is to generate hypotheses which can inform pilot health promotion interventions and future quantitative and qualitative research.

2. <u>Literature Review</u>

2.1 Youth HRB Surveillance in Canada

In contrast to the United States, where the Centers for Disease Control (CDC) Youth Risk Behaviour Surveillance System (YRBSS) has established itself as the largest and most consistent source of information for youth HRB data at national and sub-national levels [20], the youth HRB surveillance landscape in Canada is made up of a large number and variety of data sources bounded by time, region, content and target population. Three large national surveys that currently capture data on youth HRBs are the Canadian Community Health Survey (CCHS), the Canadian Tobacco Alcohol and Drugs Survey (CTADS) and the Canadian Health Measures

Survey (CHMS). The CCHS is an annual household cross-sectional survey administered by

Statistics Canada that collects information related to health status, health care utilization and

health determinants for Canadians aged 12 years and older (56). Within "health determinants"

the CCHS captures information on a variety of risk behaviours including tobacco, alcohol and

drug use, sedentary behaviour and unprotected sex, and allows researchers to analyze these data

for particular population subsets, such as youth (57,58). CTADS is also an active cross-sectional

household survey, but it is administered biennially, targeted at Canadians aged 15 years and

older (with purposeful oversampling of 15-24 year olds), and is specifically focused on tobacco,

alcohol and drug use. CTADS reflects an evolution of two earlier national surveys, the Canadian

Tobacco Use Monitoring Survey (CTUMS) and the Canadian Alcohol and Drug Use Monitoring

Survey (CADUMS) (59). The CHMS is a biennial survey which also captures national HRB

information that can be analyzed for youth populations. CHMS includes questions related to

nutrition, smoking habits, alcohol use, sexual behaviour and physical activity, and supplements

that information with direct physical measurements such as blood pressure, height, weight and

physical fitness (60). Other national surveys have been more specific to youth populations. The

National Longitudinal Survey of Children and Youth (NLSCY) was a biennial survey from

1994-2009 that followed the development of Canadian children from birth to early adulthood.

The survey had specific youth components which contained large sections dedicated to HRBs

(17). The Public Health Agency of Canada's Enhanced Surveillance of Canadian Street Youth

(E-SYS) was a sentinel surveillance system from 1998-2006 that monitored STI rates, risk

behaviours and other health determinants for youth populations (15-24 years old) facing

particular social challenges such as unstable living conditions, poverty and family violence

(termed "street youth") (61). The most comprehensive youth HRB survey currently conducted

nationally (i.e. captures rich data on a full spectrum of HRBs for youth) is the Health Behaviour

in School-aged Children (HBSC) survey. HBSC, which is completed in collaboration with the

World Health Organization (WHO), is administered every four years in classroom settings (21).

Unfortunately, unlike the other surveys mentioned, which invoke a broad definition of youth and

include individuals well into their 20's, the HBSC survey is specifically focused on early

adolescents (ages 11-15) who attend school. Finally, a large number of HRB surveys are

conducted at various sub-national levels, including those across provinces/territories (e.g. 2007

Student Drug Use in the Atlantic Provinces Survey (18)), those within provinces/territories (e.g.

2006 British Columbia Smoking Survey (62)), and those at a municipal level (e.g. 2006

International Youth Survey in Toronto (63)).

   With most of Canada's national surveys focusing only on particular risk behaviours or

limited youth subset populations (e.g. school attending or street involved), there appears to be a

large gap in comprehensive youth HRB data from diverse and inclusive youth populations.

While this study is limited to a Winnipeg population, the questionnaire content and sampling

strategy has produced data on a wide range of HRBs for a diverse spectrum of youth that are

inclusive of population subgroups usually missed in national surveys. As well, none of the

surveys included in the previous review asked youth specifically about their level of concern

related to engagement in particular risk behaviours, the key phenomena being measured in the

current study.

2.2 Youth HRB Surveillance in Manitoba

   The YHS initiative was born out of mutual recognition by MB's regional health

authorities (RHAs) of a distinct lack of local-level data on youth HRBs in MB (22). Provincial

and national level data from surveys such as the CCHS or HBSC were not able to meet the planning needs of local communities, schools or regions in MB. A group of partners from these RHAs, as well as from provincial and federal governments and local organizations dedicated to chronic disease prevention, came together in 2005 to develop and administer the province-wide youth survey which is now considered by some to be Manitoba's "primary risk factor surveillance activity" (3, p.5). The key objective of the YHS is to provide MB's policy makers, educators and health practitioners with information on the prevalence of youth HRBs and trends over time, so as to contribute to the development and evaluation of effective health promotion policies and programs (22). The survey items were informed by an environmental scan of pre-existing and validated HRB surveys across North America and the survey itself is intended to be administered every four years (22).

While the YHS does provide useful information on a large spectrum of HRBs among MB youth, it suffers from the same limitations as the HBSC in that it does not capture youth populations outside of the educational system, for example those youth who have dropped out of school and/or live in unstable housing conditions. Unfortunately, it is exactly these populations of youth who often face complex social factors in their lives which contribute to elevated rates of risk behaviour engagement and subsequent social consequences (64). The survey that was used for the current study invoked a sampling technique that purposefully oversampled individuals who would likely not be captured in school-based surveys such as the YHS (or even household based surveys such as the CCHS). The YHS also follows suit with Canada's other HRB surveys in its lack of items dedicated to risk behaviour-specific concern; something of central focus in the current study.

2.3 The surveillance report formula: prevalence, trends, associations

With public health surveillance having its origins in infectious disease epidemiology (65), it is not surprising that most public health surveillance reports generally produce information on rates, trends and associations. The surveillance of HRBs across surveys exhibits very similar types of descriptive and inferential analyses. In the summary reports created for recent cycles of the HBSC, CCHS, CTADS and YHS, most discussion centered on prevalence rates, time trends and demographic associations (12,21,66,67). While each survey reported on slightly different phenomena due to minor differences in questionnaire content and sample composition, their reports all tended to describe the same "type" of results: "The prevalence of smoking was x; this changed over time by y; higher rates of smoking were associated with demographic traits a, b and c". In addition to HRBs and demographics, some surveys also include questions on other HRB determinants such as mental health status, school connectedness, peer influences and family supports (21). The data sets produced by these surveys are often analyzed by independent researchers who design their own studies to answer research questions outside of the summary reports. This secondary research also tends to follow similar themes. For example, some researchers simply conduct youth subset analyses on the data sets to further report on specific HRB prevalence rates and time trends (58,68,69). Other researchers attempt to discover or test possible associations with groups of survey variables (27,70,71), for example, a 2004 study analyzing the CCHS to identify factors associated with measured overweight and obesity among MB children and youth (72), and a 2012 study using YHS data to examine potential factors associated with physical activity among MB high school students (73). A few studies have even used other sources of neighborhood-level information to supplement the survey data and produce more comprehensive analyses of area-level HRB associations (74–76). A review of Canadian

HRB surveys, reports and associated studies reveals distinct gaps in information regarding

certain individual-level HRB determinants such as risk perceptions, motivation and level of

HRB-associated concern (see Looking for concern).

Much of Canada's recent youth HRB research can be found summarized in *The Chief*

Public Health Officer's 2011 Report on the State of Public Health in Canada, Youth and Young

Adults – Life in Transition (3). This report provides a wealth of information on HRBs and their

determinants among youth and young adults in Canada. In its final chapter, David Butler-Jones

highlights the importance of tailoring health promotion policy and programs to the needs of

different youth sub-populations. He also emphasizes the importance of engaging and involving

youth in the development and implementation of these programs (3, p.116). A goal of the current

study is to act on these recommendations by gaining insights into youth HRB concerns for

various youth sub-populations, which in turn may create a starting point for future youth health

promotion research and planning in Winnipeg.

2.4 Looking For Concern

The central task of most HRB surveys is to capture reliable measures of HRB

engagement in the target population. In order to cover the full spectrum of HRBs and not

overburden survey respondents, this may come at the cost of including other potentially

meaningful measures such as factors which contribute to HRB engagement. This is exemplified

in the *Methodology of the Youth Risk Behavior Surveillance System – 2013,* which explicitly

states that the CDC decided that the YRBSS should "focus almost exclusively on health-risk

behaviors rather than on the determinants of these behaviors (e.g., knowledge, attitudes, beliefs,

and skills) because there is a more direct connection between specific health-risk behaviors and

specific health outcomes than between determinants of behaviors and health outcomes" (1, p.2).

While this rationale may have some merit, this leaves independent researchers having to develop

their own youth HRB surveys and draw their own samples if they are interested in quantitatively

examining such determinants as they relate to HRB engagement (77–80). Alternatively, some

researchers conduct qualitative studies on small samples of youth to gain rich insights into the

context of such determinants for particular youth subsets (53,81–83). The MB YHS takes a

similar approach to the YRBSS and focuses almost exclusively on HRB prevalence measures. As

such, a gap currently exists in the literature around individual-level determinants of youth HRBs

such as perception of risk, motivation, or level of concern. An objective of this study is to add to

existing youth HRB literature information on levels of concern as a HRB determinant.

2.5 Theoretical Construct: Attitudes, Intentions and Behaviour – fitting in concern

The notion of concern fits within a wide array of overlapping and interacting

psychological constructs. Beliefs, opinions, attitudes, intentions and perceptions are all

constructs which can be associated with HRB measures.

Well supported models of attitude-behaviour relations (84–87), health behaviour models

(24,88–90) and goal theories (91–93) all converge on the idea that intentions are a key

determinant of behaviour and goal attainment (94). This is supported by meta-analyses of

correlational studies and experimental studies that suggest intentions have a large effect on

behaviour (94,95). Most of these models and theories also agree that attitudes influence

behaviours by combining with other factors, such as subjective norms and perceived volitional

control to ultimately affect behavioural intentions (84,85,89,96). Attitude is generally seen as a

"psychological tendency that is expressed by evaluating a particular entity with some degree of

favor or disfavor" (97,98). Multiple conceptualizations of attitude exist. While some experts see attitude as a single affective construct (99,100), most psychologists hold a multi-dimensional view of attitude, comprised of two or more components (98,101,102). In addition to the primary affective component, a cognitive component and sometimes a "behavioural tendency" component are also seen as important contributors to an individual's attitude (102,103). The affective and cognitive components of attitude are seen as independent, but synergistic determinants of behavioural intentions (44,46,102). The cognitive component of attitude includes one's beliefs and opinions about an attitude object, whereas the affective component entails emotional evaluations such as excitement, concern or worry (41,104,105). Concern is quite separate from beliefs and opinions, and cannot be assumed to exist even when the constructs appear to align. As Robert Weiler explains, "Analytically distinct from knowledge, beliefs, behaviours or risks, health concerns represent the personal salience of health matters (e.g. events, problems, risks, threat of disease, etc.), linking motivation and behavior" (106). Personal concern is therefore, just as, if not more important to measure than opinions and beliefs when it comes to HRB engagement – the construct reflects a greater personal impetus to cease engagement and thus provides a more reliable indicator of intention to change.

Unfortunately, there is currently no theory, model or framework that conventionally incorporates the health concern concept as a fundamental part of its paradigm (106). As such, the following figure integrates both the multi-component model of attitude with the Theory of Planned Behaviour to form the theoretical construct for this study. This construct suggests that concern, as a significant component of attitude, and in combination with other factors such as subjective norms and perceived control, directly influences behaviour intentions, and in turn, behaviour. Therefore, concern could be seen as an indicator of intentions to change behaviour.

Figure 1 – Multi-Component Model of Attitude integrated with Theory of Planned Behaviour (85,101,102)
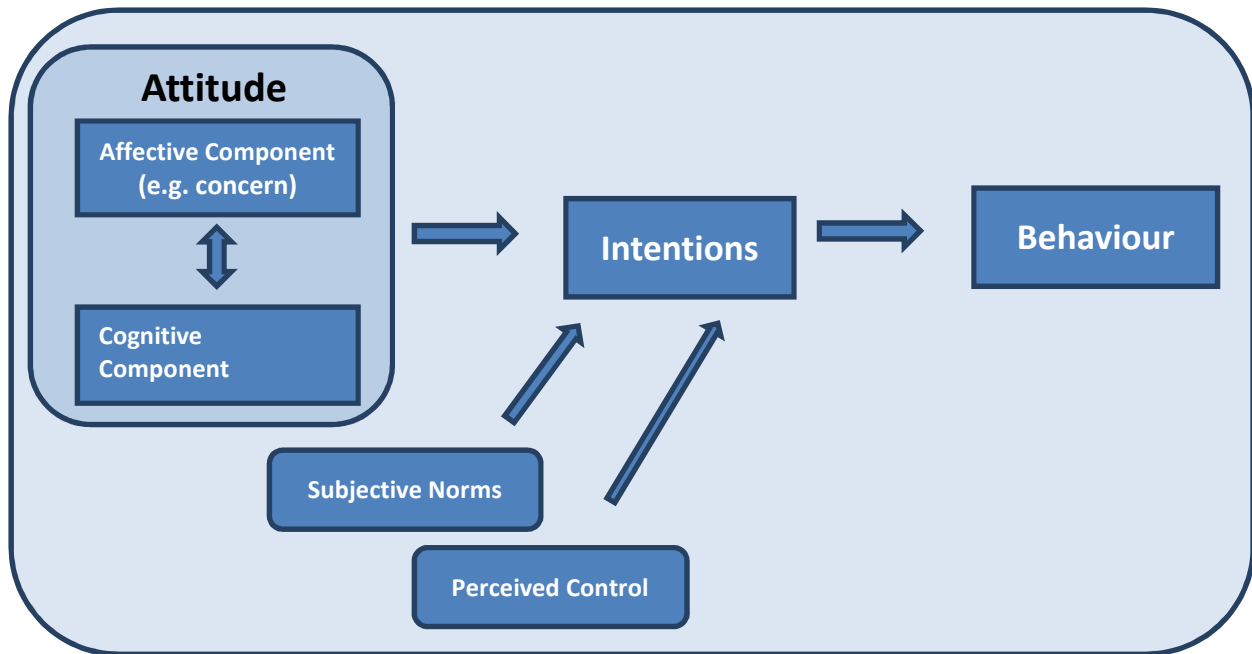
2.6 Capturing Attitude Constructs

A review of questionnaire content from Canada's large national HRB surveys reveals no questions that ask respondents specifically about their level of concern regarding their engagement in HRBs. However, a number of surveys and studies have captured information and investigated phenomena similar to the construct of concern as it relates to personal engagement in HRBs. Many youth HRB studies and surveys have tried to capture information on opinions, beliefs and perceptions of risk and vulnerability ((107–109). While often related to concern (41), perceptions of risk relate more to cognitions than affect or emotions. A number of HRB studies have examined youth perceptions of risk and vulnerability and generally arrive at the same conclusion: youth can competently perceive risk and vulnerability, and understand the

consequences of engaging in HRBs (53,109–111). This is a significant departure from the "incompetent, invulnerable, thrill-seeking" persona of youth in the past, and supports the notion of youth having legitimate concerns about their past and present engagement in certain HRBs. However, as Millstein explains, it is not entirely clear what youth risk assessments mean. Do they reflect true anxiety and/or perceptions of potential harm from outcomes, or are they just a cognitive expression meant to acknowledge that there are outcomes to worry about (109). The ambiguity in meaning from data reflecting the cognitive components of HRB-associated attitudes is exemplified in the "Opinions and Beliefs" section of the 2002 Youth Smoking Survey (107). Responses to survey questions such as, "Is there any danger to your health from smoking occasional cigarettes?", or "Do you think smoking is cool?" would not provide an accurate indication of how a respondent would answer the question, "Are you concerned about the fact that you smoke?". As MI theory purports, an individual could believe that cigarettes are unhealthy and that smoking is not cool, but still not be truly concerned about his or her own smoking. Miller and Rollnick refer to this phenomenon as "ambivalence", and partially attribute it to other competing life factors which outweigh such opinions and beliefs (25). For example, temporary stress management is often cited as a competing factor for engagement in many HRBs (25). Asking youth specifically about whether or not they are concerned about their HRB engagement can paint a more discernable picture of their attitude towards changing those behaviours. Additionally, surveys that ask questions about HRB-associated attitudes and beliefs, without actually tying them to past HRB engagement, run a greater risk of diluting responses with socially desirable cognitive expressions.

Some national surveys (17,56) have incorporated measures of behavioural intention from validated "Stages of Change" instruments developed by Prochaska and Diclemente for testing

their Transtheoretical Model of Change (24). Due to the infeasibility of using such large

instruments (15-25 survey items per HRB) when analyzing engagement in multiple HRBs, the

national surveys only contained condensed, single item measures of intention to change for each

HRB studied. The questions generally maintained a similar structure and format: Q. *Do you plan

to quit x?* - A) I have already quit x (Action/Maintenance stage); B) I will quit x within a month

(Preparation stage); C) I will quit x within 6 months (Contemplation stage); and D) No I do not

plan to quit x (Pre-contemplation stage). While this approach may provide more direct measures

of intention to change behaviours, it suffers significant limitations in its capacity to capture

respondents concerned about their HRB engagement. Based on MI theory, these types of

questions would miss youth who express concern about engaging in a specified behaviour, but

have no immediate plans to change that behaviour (particularly in six months). Additionally, the

data from these single item measures of intention to change have not been analyzed across

multiple HRBs - again, a clear gap in youth HRB research that this study addresses.

2.7 Describing Youth Health Concerns

Certain studies on youth HRBs do describe some youth HRB-related concerns. However,

most of these studies focus on specific HRBs or general health concerns of particular youth

populations, and do not directly tie those concerns to recent HRB engagement. A number of

studies in the early 1990's revealed that youth and adolescents reported a wide variety of

physical, psychological, sexual and social health concerns (112–115). As well, recent

descriptions of youth health concerns reflect similar trends (83,116–118). Longstanding youth

concerns include physical appearance such as oral health and acne, medical health, school and

career planning, interpersonal relationships, and mental health (78,83,109). Some studies

exhibited varying concerns across gender and age groups (78,113,119). Beyond the youth concerns themselves, two findings have been established through these studies: 1) adults are very often mistaken about what youth are and aren't concerned about (106,112,120); and 2) a dissonance exists between a young person's personal concerns and what he or she believes to be the concerns of other young people (83,106,109). Specifically, youth have shown a tendency to perceive the concerns of other youth to revolve more around the consequences of HRBs in relation to their own concerns (106,109).These findings further support the rationale for this study by highlighting the importance of avoiding assumptions about youth and their concerns, and emphasizing the need for concern-related questions to be bound to an individual's own behaviour.

Consensus in the literature has not been reached around the extent to which youth are concerned about the consequences of engaging in particular HRBs. While some study samples exhibit low levels of HRB-related concern (78,120,121), other study samples exhibit significant levels of concern around HRB-associated consequences, especially those related to sexual risk behaviour (83,117). With such variation in concern-related outcomes, it is difficult to devise precise hypotheses as to how levels of concern may vary across HRBs and between demographic subgroups. However, this does further support the rationale behind the current exploratory study.

2.8 Associating Concern with Behaviour

A central impetus for this study derives from the theoretical notion that individuals who have negative affects, such as concern or worry, around their engagement in HRBs, will be a) more motivated to change those behaviours and b) more responsive to certain interventions that can facilitate that change. This notion is supported by the previous success of MI strategies in

facilitating health behaviour change using client and concern-focused approaches (25,33,36,37) as well as the extensive bodies of literature that encompass theories of health behaviour and attitude-behaviour relations (24,84,85,88,89). Unfortunately, given the undeveloped state of the health concern concept within the theoretical constructs of health behaviour (106), there appears to be a rarity of empirical research that has directly tested the relationship between concern with HRB engagement and future health behaviour change. The diversity of theories and models that attempt to explain the complex nature of attitudes, intentions and behaviours and the relational pathways between them, add to the difficulty of devising robust study designs around testable hypotheses. An extensive review of health literature reveals only a handful of studies that either investigate HRB-specific concerns (or similar affects) or explicitly tests for associations between HRB concern and specific health behaviour engagement (41,43,44,122–125). Some HRB studies capture information on youth health concerns as well as HRB engagement, but they describe the data sets separately and do not test for associations (78,114,118). Of the studies that have tested the relationship between HRB-related concern (or a similar construct) and HRB engagement, the majority have shown positive associations between concern and engagement (41,43,44,122). These include a 2004 study by Beebe-Dimmer et al., testing for associations between concern about prostate carcinoma and accompanying dietary prevention behaviours (44), a 2006 study by Chapman and Coups examining the effects of worry and anticipated regret on influenza vaccination (123) and a 2014 paper by Sara Tamers et al. exploring potential relationships between health-related concerns, physical activity (PA) and PA intentions. As well, a number of studies on cancer screening have shown that cancer-related worry predicts screening and testing behaviours (41). Two studies did not reveal a significant positive association between affect and behaviour: a 2011 investigation by Ehrlich-Jones et al. determining the relationship between

worry and PA participation among people with rheumatoid arthritis (122), and a 1998 analysis of the relationship between diabetes-related worry and preventative behaviours by Feig et al. (124). Both of these studies, however, suffered from the limitation of having worry-scale items that were not specific to the behaviour being measured, thus compromising the validity of their results. As well, both studies were based on cross-sectional surveys, which limit their potential for causal inference. In fact, all but one of the reviewed studies were cross-sectional in nature. The non-cross-sectional study by Chapman and Coups involved a longitudinal questionnaire administered in three waves over one year (Fall 2001, Spring 2002, Fall 2002). Worry-scale items from the first wave questionnaire were found to be predictive of self-reported vaccination in future waves. This was the only study reviewed that could elucidate a possible causal relationship between concern/worry and health-related behaviour.

The results from Tamers et al. exemplify the complexity of interpreting findings from cross-sectional studies on concern and health-related behaviour associations. After conducting a multivariable logistic regression controlled for demographics, their results revealed a positive association between concern and intention to be physically active, but not with physical activity itself. Tamers et al. interpret this finding as reflecting the tendency for concern (predictor) to prompt attempts at behaviour change (outcome), but not be sufficient to overcome the social/contextual factors thwarting change itself. She notes that the ethnically diverse, low income, inner-city population that the study was conducted on often face unmeasured factors such as diminished access to healthy foods, absence of safe locations for physical activity, negative socio-cultural norms or attitudes, or other competing day-to-day priorities. By this interpretation, concern about HRB engagement would increase one's likelihood of changing behaviour if provided with other supports. However, another possible interpretation of the results

is that trying to exercise and failing to sustain the behaviour (predictor) could have caused the measured levels of concern (outcome) due to disappointment and frustration – this concern would then be seen to have less of an impact on motivation. Studies such as Tamers' that try to illustrate causal relationships between concern and behaviour change using a cross-sectional design produce ambiguous results with mixed implications. As the current study was also based on cross-sectional data, causation between behaviour engagement and behaviour-specific concern was not (and could not be) investigated.

Another good example of the complex relationship between attitude, concern, behaviour and context can be seen in Brenda Bruner's 2013 mixed methods study (126). Bruner assessed physical activity (PA) practices, as well as attitudes and beliefs among First Nations women in a MB Woodland Cree community. The study was initiated after members of the community identified physical inactivity and unhealthy body weights as two areas of concern in their community. Community members all reflected positive attitudes towards PA and perceived it to be beneficial to their health and other outcomes. When asked about barriers to PA however, it became apparent that positive attitudes and even concern about behaviours was not enough to invoke individual actions. While they all appeared "willing", they were not necessarily "ready and able" to make a change. Identified barriers to PA included lack of time, cold weather, child care responsibilities, safety, laziness, lack of encouragement, and lack of opportunities for women to be active (126).

Despite the social and structural barriers that would need to be addressed for intervention success, it would be more than fair to assume, that in both Tamers' and Bruner's selected communities, PA "interventions" (appropriate to the specific needs and makeup of the community) would be well received. In Bruner's case, providing more female-only group PA

opportunities and having more child care spaces were two potential community-identified interventions that could address some of their challenges. When provided with only limited public health dollars, funding favoured interventions in a community over other less valued health behaviour interventions, would be considered a responsible and appropriate decision. Acquiring information on HRB-specific concerns can not only facilitate such public health planning, but allow for more effective and sensitive evaluation of progress.

With so much literature established on youth HRBs and such little on the notion of concern, this exploratory study can hopefully provide a substrate upon which future HRB research and programs can grow.

3. <u>Research Questions</u>

The primary research questions addressed in this study are:

1. Do Winnipeg youth who engage in HRBs express concern about their HRB engagement? – What proportion of youth express concern?

2. Is there variation in the likelihood of concern across different HRBs?

3. Are sociodemographic factors associated with differences in concern about HRB engagement among Winnipeg youth?

4. <u>Hypotheses</u>

Given the exploratory nature of this study and the limited literature on concern as it relates to HRB engagement, no a-priori hypotheses were made regarding specific proportions of youth expressing concern about their engagement. However, it was hypothesized that most youth engaging in HRBs would express at least some concern about one or more of the HRBs that they engaged in. It was also hypothesized that the level of youth concern about HRB engagement would vary significantly between HRBs. Finally, demographics (age, gender, sexual orientation, education, neighborhood and housing status) were hypothesized to be associated with differences in HRB-specific levels of concern among the sampled youth. No hypotheses were formed about specific sizes or directions of associations between sociodemographic characteristics and HRB concern.

5. <u>Methods</u>

5.1 Study Design

This study involved a single phase quantitative analysis of pre-existing, cross-sectional survey data from the Online and On-the-Ground Study of the University of Manitoba. Data were drawn from discrete items on a survey of 250 youth in Winnipeg, MB, administered between September 2012 and February 2013.

5.2 Data Source

5.2.1 Online and On-the-Ground Study and Survey

The Online and On-the-Ground Study was an exploratory investigation, evaluating prospective behaviour change interventions among youth populations at risk for acquiring sexually transmitted and blood-borne infections (STBBI). Phase 1 of the study involved administration of a survey that included measures of youth sociodemographic characteristics and STBBI-related knowledge and behaviours. The survey was administered by research assistants who underwent training in participant recruitment, informed consent and data collection. The survey was designed to generate baseline measures and inform development of a pilot knowledge and behaviour change intervention trial. Survey items included the frequency of youth engagement in 12 different health risk behaviours commonly under public health surveillance (see included survey items - Appendix 1). Items on HRB concern were included to allow for quantitative analysis of the pilot data as well as inform qualitative focus group discussions intended for future stages of the Online and On-the-Ground Study. The full questionnaire was pilot tested on 10 youth to establish suitable language and format for survey

items. Some items were revised for appropriateness prior to sample recruitment and data collection.

5.2.2 *Sampling*

A time-location sampling (TLS) method was conducted for the Online and On-the-Ground Study (127). This method allowed for oversampling of youth populations traditionally under-represented or over-looked in home or school-based health surveys. These over-looked youth populations are generally characterized by those who have dropped out or do not attend school, and those who are homeless or live in unstable housing conditions. Eligible youth were operationally defined as individuals between the ages of 14-24 encountered in various pre-determined public locations in central Winnipeg. The TLS method first involved obtaining information, through formative research (observation and consultation with key informants), on prospective public locations where youth, and particularly over-looked youth, populations could be found. Key informants consisted of staff of community agencies that directly served street-involved youth populations in Winnipeg. This was followed by short observational periods at each site to establish days and times that youth were present at those locations. Sixty-five locations in central Winnipeg and four potential time intervals were selected for sample recruitment. Once the venue-day-time list was established, list items were randomly selected for sample recruitment. A small honorarium was provided to thank participants for their time. A sample size of 250 was chosen for the baseline survey and, as an exploratory study, this sample size was felt to be appropriate for the estimates that would be made in this study. As well, no quantitative estimates of HRB-specific concern among youth could be found in the literature to inform sample size calculations.

5.2.3 Data Collection, Entry and Cleaning

Data collection was conducted by one trained Research Associate, with two trained Research Assistants as supports. Participant involvement was entirely voluntary and surveys were administered in private settings near the locations that participants were recruited. A total of 372 individuals were approached to complete the survey, of which 124 refused or didn't meet the study's inclusion criteria, 248 started the questionnaire and 240 completed all sections. The most commonly reported reason for survey refusal or non-completion was a lack of time to complete the 20 minute questionnaire. While the survey was orally administered, participants were allowed to read and write on the paper survey directly if they preferred.

All data from the survey were entered and cleaned by a study research assistant who was directly involved with data collection and is the principal investigator of this study. Data from the larger study were entered into a Microsoft Access relational database, and the data needed for this study were extracted to Microsoft Excel (2007) and STATA (version 14) for data analysis.

5.2.4 Sociodemographic Items

Data from all seven sociodemographic items of the survey were included for analysis in this study (see included survey items - Appendix 1). The sociodemographic section of the survey included five close-ended, multiple-choice questions regarding gender, sexual orientation, education and housing stability. Two different questions were included to capture the sociodemographic construct of "housing stability": one based on selection from pre-defined categories of housing reflecting various levels of stability (e.g. own house/apartment; group home; hotel; etc.), and one based on self-perceived housing stability (stable vs unstable). Both of

these measures were analyzed individually. The age of participants, in years, was recorded as an open ended response. Participants were also asked for the name of the area of Winnipeg that they resided in as an open ended question: "In what area of Winnipeg do you live?".

5.2.5 HRB Engagement Items

The questionnaire measured the frequency of youth engagement in the twelve different HRBs. The specific behaviours chosen for the survey and the phrasing of HRB questions were informed by a review of large HRB surveys regularly conducted across North America (20–22). They included behaviours that contribute to unintentional injuries and violence, dietary and physical activity-related behaviours, alcohol, tobacco and substance use, and sexual behaviour. Specifically, questions were about frequency of HRB engagement in the six months prior to the survey and provided four Likert scale response categories, ranging from "never" to "daily or close to daily" (see included survey items - Appendix 1). The HRB survey items were developed and formatted to minimize respondent time and burden, and maximize respondent authenticity and comprehension; language was directed at a grade 8 reading level and potentially stigmatizing qualifiers around behaviour engagement were excluded (e.g. "health risk behaviours" was replaced by "things that some people do").

5.2.6 HRB Concern Items

For youth indicating recent engagement in any HRB, the level of concern that they had felt about their engagement was also measured. This was the primary phenomena of interest in the study and was captured on a three point Likert scale from "not worried or concerned" to "it concerns me" (see included survey items - Appendix 1). Youth indicating that they had never

engaged in a particular HRB in the six months prior to the survey were asked to skip the subsequent HRB concern-related item. This item was informed by theoretical literature on health promotion, health behaviour change, and social survey question design (24,25,38,128,129).

5.3 Variables and Data Transformations

The raw data from the survey's sociodemographic, HRB engagement, and HRB concern items were examined prior to formalizing variables and variable categories for descriptive and inferential analysis. A number of factors were considered to ensure that variables and categories were both meaningful and suitable for analysis. These included theories and guidance from public health and HRB surveillance literature, the distribution of responses across survey item categories and statistical power considerations. Data from included survey items were transformed in the manner described below to create the variables required for descriptive, bivariate and multivariate analysis.

5.3.1 Sociodemographic Variables

The data from the survey's seven sociodemographic items were transformed into eight binomial sociodemographic variables for bivariate and multivariate analyses. A variable for **gender** was created from the survey item on gender, but only included *male* and *female* categories. With only four respondents identifying as transgender, it was decided to exclude their responses from analyses of sociodemographic associations with HRB engagement and concern. However, all respondents, regardless of gender response, were included in the descriptive analyses undertaken to answer research questions one and two. **Sexual orientation** response

options were collapsed into two variable categories for inferential analysis -

heterosexual/straight and *sexual minority* status. The small numbers of responses falling under

non-heterosexual-sexual orientation groups (e.g. homosexual, bisexual, two-spirited, etc.) were

combined to create the sexual minority category, resulting in greater power for statistical

inference. *Age* in years was collected and entered as a continuous variable, but transformed into

two age groupings for analysis, *14-18 years of age* and *19-24 years of age*. The age distribution

of respondents as well as legal age of adulthood in various public health contexts provided

rationale for these age groupings. A binomial sociodemographic variable for ***education*** was

created by analyzing and grouping responses to the survey question – "What is the highest level

of education that you have completed?". A "*lower education*" category was created by

combining the responses of those who answered "Grade 8 or less" or "Some high school (gr. 9-

12)-not enrolled", and a "*higher education*" category combined all other responses ("Some high

school (gr. 9-12)-still enrolled"; "High school diploma or GED"; Some postsecondary education

or college or university diploma/degree"). The current ***living situation*** variable consisted of two

categories: 1) *living on one's own or with family or friends in a condo, house or apartment*, and

2) *living in a precarious housing situation*. Responses to the survey question – "Where do you

currently live?" were grouped under one of these two categories. Category 1 combined those

who answered: "my own house/condo/apt"; "family's house/condo/apt"; "friend or

boy/girlfriend's house/condo/apt". Category 2 combined those who selected "group home/foster

home"; "rooming house/boarding house/hostel"; "hotel"; "shelter/institution"; and "on the

street". ***Self-perceived housing stability*** was defined by responses to the questionnaire item "Is

your housing situation: 1) Stable – you have been or will be there for a while; 2) Unstable – you

tend to move around a lot; 3) Unsure; 4) Refused". This was transformed into a binomial

variable by combining those who responded "unsure" with those who responded "unstable" to create only categories: *stable self-perceived housing stability* and *unstable self-perceived housing stability* (zero participants selected "refused"). The two neighborhood variables, **area of Winnipeg – SES** and **area of Winnipeg – inner-city** were developed with data from the open-ended questionnaire item "In what area of Winnipeg do you live?". Qualitative responses were analyzed, and each response was classified as belonging to one of 72 different Community Centre Areas (CCA) of Winnipeg, as defined by the 2006 Census (130). Each of these areas was then further classified as being within Winnipeg's inner-city boundary, or outside of the boundary, as defined by the City of Winnipeg in 2006 (131). This formed the basis of the *inner-city* and *non-inner-city* categories of the variable "area of Winnipeg – inner-city". Each of the responses was also classified under a *lower SES neighborhood* category or *higher SES neighborhood* category for the variable "area of Winnipeg – SES". These classifications were informed by CCA income quintile assignments developed by the Manitoba Centre for Health Policy (MCHP) in 2014 using 2006 Census data (132). Areas assigned to one of the bottom two income quintiles (average household income below $ 48, 525) were classified as a lower SES neighborhood, and areas assigned to one of the upper three quintiles were classified as a higher SES neighborhood (average household income above $ 48, 525). Four survey respondents indicated that they lived outside of Winnipeg. These four responses were excluded from Chi Squared, logistic regression, and cluster analyses conducted to answer research question 3, but were included in the full sample descriptive analysis required for research questions 1 and 2.

5.3.2 HRB Engagement Variables

A HRB engagement variable was created for each of the twelve HRB engagement items on the survey. While frequency of engagement was measured on a four point ordinal scale (see included survey items - Appendix 1), HRB engagement was coded as a binomial variable for descriptive, Chi-squared and logistic regression analysis. The two categories of engagement formed were *engaged in HRB* and *not engaged in HRB*. To be operationally considered "engaged" in a HRB, a specific threshold response level of engagement was required on the survey item scale. Each HRB was considered individually when determining thresholds. Within the parameters of the four survey item response categories, efforts were made to align HRB engagement thresholds with frequencies of engagement considered to be detrimental to human health by modern public health guidance and messaging (3). With seven of the twelve HRB variables, youth selecting categories 2, 3 or 4 on the survey item (1-3 times in the past 6 months; at least 4 times in past 6 months; daily or close to daily) were coded as "engaged" in those HRBs. These behaviours were ***drinking and driving, getting into fights, carrying a weapon, using non-injection drugs (besides marijuana), using injections drugs, having sex without the use of a condom*** and ***trying extreme weight loss measures.*** Public health messaging has traditionally suggested that any level of engagement in these behaviours can be significantly detrimental to one's health (3,133). With four of the HRB variables**,:** ***drinking to get drunk, smoking cigarettes, smoking marijuana, and avoiding physical activity****,* being engaged required selecting categories 3 or 4 on the survey item. Youth reporting doing these behaviours only 1-3 times in the past six months (category 2) were not considered to be significantly increasing their risk for negative health consequences under modern public health constructs (3). One HRB variable, ***eating junk food or fast food****,* required respondents to select category 4 (daily or close

to daily) on the survey in order to be classified as engaged in that behaviour; it was deemed that even category 3 would be too low of a threshold to apply to this behaviour under current public health guidance (3,12). While HRB engagement response categories were collapsed for the descriptive, Chi-squared and logistic regression analyses, no data transformations were made for the cluster analysis; i.e. the full extent of HRB engagement responses were included to maximize use of the available data (see *Cluster Analysis*).

5.3.3 HRB Concern Variables

Twelve binomial HRB concern variables were created from the survey item asking youth about their concern regarding their engagement in each HRB ("Are you concerned or worried about doing that?)". When a respondent reported never engaging in a specific behaviour, they were excluded from answering the follow up question on concern, and were coded as "not applicable" for that particular HRB concern variable. Responses to the three-category HRB concern item were grouped into one of two variable categories: *no concern about engaging in that behaviour* and *any concern about engaging in that behaviour*. With relatively small subsets of the sample reporting engagement in many of the HRBs on the survey, it was decided to collapse the three concern item response options into two categories, thus facilitating statistical analysis; categories 2 and 3 on the HRB concern scale (a little concerned; I'm concerned) were grouped to create the "any concern" category of the binomial concern variable. For the five HRBs that had alternative thresholds for "engagement", concern responses recorded for youth doing a HRB below the new threshold level were recoded as "not applicable".

5.4 Data Analysis

5.4.1 Descriptive Analysis

Prior to analyzing data on HRB engagement and concern, responses to sociodemographic items were examined to determine the sociodemographic characteristics of the full sample and individual gender groups (Table 1). Particular sample characteristics that could effect the interpretation of study findings were noted.

Both univariate and bivariate descriptive analyses of HRB engagement and HRB concern were conducted to answer research questions one and two. Frequencies, proportions and distributions were generated for all HRB engagement and HRB concern variables. To help contextualize the results, the number of HRBs engaged in by each youth respondent was analyzed in relation to the number of behaviours they expressed concern about. The proportion of youth engaging in each HRB was then computed, and of those youth engaging, the proportion of them who were concerned about their engagement was calculated (Table 3). The nature of the HRB concern item precluded the use of several statistical analyses when comparing relative concern between HRBs. This was due to the fact that responses to each HRB concern item were collected from different subsets of youth (only those youth engaging in that particular HRB). Research question 3 was therefore addressed by computing 95% confidence intervals for all proportion estimates of HRB concern items and comparing all twelve proportions on a forest plot. Statistically significant differences in proportion estimates were determined by assessing overlap between confidence intervals (134).

5.4.2 Tests of Association

To address research question 3, multivariable tests of association were run between sociodemographic variables and HRB engagement and concern variables.

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For each HRB, sixteen 2x2 contingency tables were created to display frequencies and proportions between: a) the eight sociodemographic predictor variables and the HRB engagement outcome variable, and b) the eight sociodemographic predictor variables and the HRB concern outcome variable. A Chi-squared test or Fisher's Exact test of association was conducted for each 2x2 contingency table to reveal significant relationships between predictors and outcomes. Fisher's Exact tests of association were run when the expected frequency of one or more cells was less than or equal to five, otherwise a Chi-squared test of association was conducted. While running this many simultaneous tests may generally involve applying a Bonferroni correction (135), the exploratory nature of the study justified the use of less stringent criteria when analyzing the results. Tests of association generating p-values ≤ 0.05 as well as those generating p-values ≤ 0.10 were noted for statistical significance, and identified as warranting further examination in future research.

Univariable and multivariable logistic regression and exact logistic regression models were run to further investigate associations between sociodemographic characteristics and HRB engagement and concern. Separate models were run, first with HRB engagement, then with HRB concern as the outcome. For each HRB, all predictor variables demonstrating association with engagement or concern at p-value alpha ≤ 0.10 in the contingency table analysis were included in the logistic regression or exact logistic regression models. Exact logistic regression was employed over logistic regression in situations of small cell size; specifically when significant associations between variables in the contingency table analysis were indicated by a Fisher's Exact test as opposed to a Chi-squared test.

Multivariable logistic and exact logistic regression models were created when more than one sociodemographic predictor variable demonstrated association with an outcome variable.

Unadjusted and adjusted odds ratios were generated as a part of the multivariable analysis, however, this is as far as the analysis was taken for both HRB engagement and HRB concern models. Normally, a final parsimonious regression model would be determined through a purposeful or stepwise variable selection process, then the fit of the final model would be established by other statistical tests (136); however, these model building steps were deemed unnecessary following the contingency table analysis as very few significant associations between sociodemographic variables and HRB concern were revealed (see *Results*). While some associations between demographics and HRB engagement were identified, model fit, etc. were not carried out as associations with HRB engagement were not of principle interest to the study.

5.4.3 Cluster Analysis

Cluster Analysis was used as an additional tool to investigate and determine associations between demographics, HRB engagement and HRB concern. Cluster analysis is an exploratory statistical technique that can be used to generate hypotheses, group entities, and identify unknown heterogeneity in a sample by focusing on inherent differences between cases rather than variables (137). Cluster analysis has been used widely in health, psychological and social sciences research (137–139), including HRB analyses (139–141). A vast number of different clustering methods exist, with most methods allowing for a variety of different measures to determine similarity or dissimilarity between observations (137,142). For the purposes of this study, hierarchical agglomerative cluster analysis based on Ward's linkage was used with squared Euclidean distance specified as the dissimilarity measure. Ward's method (143) forms clusters on the basis of loss of information. The algorithm begins with each case representing a single cluster; a situation in which the largest amount of information is available. The algorithm then considers all possible clusters that could be formed, joining the two that result in a minimal

loss of information. This algorithm is repeated until the data are systematically reduced to a single cluster. Ward's linkage was chosen as it has shown to be more likely to produce groups of similar size (137,142), thus facilitating statistical comparison given the small sample size in use. Several authors advise using squared Euclidean distance as the dissimilarity measure for Ward's linkage cluster methods (142,144).

Clustering variables consisted of 12 HRB engagement variables. Response categories for these variables were different than those used in the above Chi-squared and logistic regression analysis; they were ordinal rather than binary and incorporated all four survey response options as variable categories. This allowed for maximal use of available HRB engagement data. Four additional participants with missing HRB concern data were excluded from the cluster analysis, resulting in an n of 228.

Cluster dendograms were analyzed to determine the best cluster solution. Duda's pseudo T^2 statistic and Calinski's pseudo F statistic (145,146) were used as stopping rules to inform the optimum cluster number. Robustness of the results was assessed by repeating the cluster analysis on a subset of the clustering variables (dropping the three least frequently engaged HRBs) and also repeating the analysis using the full set of 12 clustering variables but using average linkage or single linkage methods in place of Ward's linkage. Cluster solutions were similar for all of the above secondary analyses (i.e. main groupings were similar with only slight differences in cluster sizes and composition) but Wards linkage remained the most useful method for analytical purposes. Only the results encompassing the full set of 12 clustering variables using Ward's linkage are shown in the results.

To examine which (and how) cluster variables drove the clustering, an analysis of associations between HRB engagement cluster variables and cluster solution group membership was conducted using Wilcoxon rank-sum (Mann-Whitney) tests.

Post clustering-analysis was conducted to identify potential sociodemographic associations with cluster membership and to determine whether clusters differed in their likelihood of being concerned about particular HRBs. First, Chi-squared tests and logistic regression was used to examine relationships between dichotomous sociodemographic variables (as predictors) and cluster groups (as outcomes). Second, Chi-squared tests of association were conducted between HRB concern and cluster membership for each HRB. Level of significance for inclusion in the final multivariable analyses was set at p-value ≤ 0.05.

5.5 Ethics

This study involved an analysis of survey data previously collected by Dr. John Wylie and his staff as part of a multi-site study funded by the Canadian Institutes of Health Research (CIHR). The data are anonymous and were acquired with full informed consent by all study participants. The investigator obtained full permission from Dr. Wylie to conduct descriptive and inferential quantitative analyses on the existing data set and disseminate the results to appropriate audiences. Ethics approval for the current research was obtained from the University of Manitoba Health Research Ethics Board (U of M HREB) on December 1, 2015 (Ethics # HS19154 (H2015:430)) (see Appendix 2), and ethics approval for the larger study had been obtained in 2012 from the U of M HREB as well as the Public Health Agency of Canada Research Ethics board.

6. <u>Results</u>

6.1 Sample Characteristics

A total of 240 youth completed the sociodemographic and HRB sections of the survey. Table 1 provides descriptive statistics for each of the sociodemographic variables in the study broken down by gender. Variable categories in Table 1 are stratified beyond the dichotomous levels used for analysis to reveal more nuanced characteristics of the sample. Table 2 presents a correlation matrix of the dichotomous sociodemographic variables to help further contextualize the sample's characteristics.

The full sample was almost evenly split between *males* (51.3%) and *females* (47.1%), with a small percentage identifying as *transgender* (1.7%). The sample was also evenly divided between age groups with a mean sample age of 18.7 years and slightly more participants *aged 14 to 18 years* (53.3%) than *19 to 24 years* (46.7%). A quarter of the sample identified as sexual minority status, with two thirds of those identifying specifically as *bisexual* and the other third as either *homosexual*, *not sure* or *other*. Just over a quarter of the sample (26.3%) was categorized as having left school early. These included those indicating that their highest level of education was *grade 8 or less* (4.6%) or those having *some high school but not presently enrolled* (21.7%). The rest of the sample were in the higher education category as either *enrolled in high school* (41.7%), *graduated high school with a diploma or GED* (17.5%) or had *some postsecondary education, college or university diploma/degree* (14.6%).

A majority of the sample reported currently living in their *family's house/condo/apartment* (61.2%), in their *friend or boy/girlfriend's house/condo/apartment* (12.9%), or in their *own house/condo/apartment* (12.5%). A smaller proportion of the sample were categorized as living in a precarious housing situation – including those living in a *group*

home or foster home (9.6%), or those living in a *rooming house, boarding house, hostel, hotel, shelter, institution or on the street* (3.3%). Stability of housing/living conditions was assessed by two separate measures. A total of 63 youth (26.3%) were either living in *precarious housing* conditions (12.9% of the sample) or perceived their housing as *unstable* (17.5% of the sample). While these two variables may be seen as aligned conceptually, very little correlation between them was observed (Table 2). In fact, very few correlations were seen among any of the sociodemographic variables in Table 2, even those which would traditionally be considered to be highly associated (e.g. education and living situation).

Over two-thirds of the sample lived in Winnipeg's inner-city (69.2%), and a similar proportion lived in a low-SES neighborhood (63.3%). A strong correlation (0.726) between these two neighborhood variables can be seen in Table 2 as many of Winnipeg's inner-city neighborhoods are also characterized as being low-SES.

For all sociodemographic factors assessed, only a few significant differences between males and females were seen. Specifically, 40% of female youth identified as sexual minority compared to 11% of male youth; and 32% of male youth were categorized as leaving school early compared to 21% of female youth.

Table 1: Sociodemographic Characteristics of Sample (n = 240)

Variable	Categories	Male (%)	Female (%)	Transgender (%)	Total (%)
Full Sample		123	113	4	**240**
Sexual Orientation	Heterosexual	109 (89)	68 (60)	3 (75)	**180** (75)
	Sexual Minority	14 (11)	45 (40)	1 (25)	**60** (25)
	Homosexual	1	7	1	9
	Bisexual	8	31	0	39
	Other	0	2	0	2
	Not Sure	5	5	0	10
Age	14-18 yr	66 (54)	62 (55)	0	**128** (53)
	19-24 yr	57 (46)	51 (45)	4 (100)	**112** (47)
Living Situation	In own house/condo/apt	14 (11)	15 (13)	1 (25)	**30** (13)
	In family's house/condo/apt	81 (66)	66 (58)	1 (25)	**148** (62)
	In friend or partner's house/condo/apt	10 (8)	19 (17)	2 (50)	**31** (13)
	Group Home / Foster Home *(precarious)*	12 (10)	11 (10)	0	**23** (10)
	Rooming or boarding house/ hostel/hotel/street/shelter/ institution *(precarious)*	6 (5)	2 (2)	0	**8** (3)
Perceived Housing Stability	Stable	100 (81)	94 (83)	4 (100)	**198** (83)
	Unstable	23 (19)	19 (17)	0	**42** (17)
Education	Grade 8 or less *(Left school early)*	6 (5)	5 (4)	0	**11** (4)
	Some high school – not enrolled *(Left school early)*	33 (27)	19 (17)	0	**52** (22)
	Some high school – still enrolled	49 (40)	50 (44)	1 (25)	**100** (41)
	High school diploma	22 (18)	19 (17)	1 (25)	**42** (18)
	Some post-secondary edu.	13 (10)	20 (18)	2 (50)	**35** (15)
Area of Winnipeg – Inner/ Non-Inner City	Inner City	89 (72)	75 (66)	2 (50)	**166** (69)
	Non-Inner City	33 (27)	35 (31)	2 (50)	**70** (29)
	Outside Winnipeg	1 (1)	3 (3)	0	**4** (2)
Area of Winnipeg – Lower SES / Higher SES neighborhood	Low SES neighborhood	84 (68)	67 (59)	1 (25)	**152** (63)
	Higher SES neighborhood	38 (31)	43 (38)	3 (75)	**84** (35)
	Outside Winnipeg	1 (1)	3 (3)	0	**4** (2)

Table 2 – Correlation Matrix of Sociodemographic Variables

	Gender	Sexual Orient.	Age	Education	Living Situation	Perc. H-Stblty	Area - SES	Area – InCty
Gender	1.0000							
Sexual Orient.	0.3351	1.0000						
Age	-0.0239	0.0407	1.0000					
Education	-0.1263	-0.1201	0.0831	1.0000				
Living Situation	-0.0391	0.0836	-0.0325	0.1856	1.0000			
Perc. H-Stblty	-.0369	-0.0266	0.0869	0.1901	0.1008	1.0000		
Area - SES	-0.0886	-0.1698	0.0460	0.1745	-0.1882	0.2183	1.0000	
Area - InCty	-.0651	-0.1107	0.0581	0.1341	-0.0964	0.1747	0.7260	1.0000

6.2 Research Question 1 – Do Winnipeg youth who engage in HRBs express concern about their HRB engagement? – What proportion of youth express concern?

Table 3 contains data showing the number of HRBs that youth engaged in, in relation to the number of HRBs youth expressed concern about. Of the 240 youth in the study, 208 (86.7%) reported engagement in one or more HRBs ("HRB engagement" operationally defined in Methods). The remaining 32 youth did not report any HRB engagement. The vast majority (88.5%) of youth who reported HRB engagement did not engage in more than 6 of the 12 HRBs listed, and over two thirds of the sample (69%) engaged in 4 or less HRBs.

Of the 208 youth who engaged in one or more HRBs, 150 (72.1%) expressed concern about at least one of the behaviours that they engaged in. The other 58 youth (27.9%) did not express concern about any of their HRBs. Most (56.9%) of these "universally not-concerned" youth only engaged in one or two of the 12 HRBs listed.

Of the 150 youth expressing some level of concern about one or more HRBs, most (82.0%) expressed concern about only a subset of the behaviours that they engaged in. A small proportion (18.0%) expressed concern about every behaviour that they engaged in. Most of these "universally concerned" youth also only engaged in one or two of the 12 HRBs listed.

Table 3: Bivariate Frequency Distribution - Number of HRBs that Youth Engaged in by Number of HRBs Youth Expressed Concern About

Number of HRBs Youth Engaged In	Number of HRBs Engaged That Youth Expressed Concern About								
	0	1	2	3	4	5	6	Total	Cumulative Percent
0	32	0	0	0	0	0	0	32	13.33
1	17	11	0	0	0	0	0	28	25
2	16	12	6	0	0	0	0	34	39.17
3	7	10	12	4	0	0	0	33	52.92
4	12	6	11	8	1	0	0	38	68.75
5	3	3	10	5	3	3	0	27	80.83
6	3	3	3	7	2	4	2	24	90
7	0	4	2	2	4	0	1	13	95.42
8	0	1	0	1	3	3	0	8	98.75
9	0	0	0	1	0	1	0	2	99.58
11	0	0	1	0	0	0	0	1	100
Total	90	50	45	28	13	11	3	240	100
Dark shade	Expressed concern about all HRBs that they engaged in								
Light shade	Expressed no concern for any HRB that they engaged in								

6.3 Research Question 2 – Does concern vary across different HRBs? – How does it vary?

Table 4 presents HRB engagement and concern descriptive statistics specific to each of the 12 studied HRBs. Behaviours are listed in order of prevalence of engagement within the sample. Proportions of youth engaged in a particular HRB ranged from 3% to 57%. *Smoking cigarettes* (≥4x in past 6 months), *having sex without a condom* (≥1x in past 6 months), and *smoking marijuana* (≥4x in past 6 months) were the three most prevalent HRBs with 57%, 50%, and 47% of the sample engaging in them respectively. *Drinking to get drunk* (43%) and *getting into fights* (43%) were also relatively prevalent compared to other HRBs. The three least prevalent HRBs were *drinking and driving* (8%), *trying extreme weight loss measures* (3%) and *injection drug use* (3%).

The proportion of youth concerned about specific HRBs that they were engaged in ranged from 21% to 72%. Figure 2 displays all 12 HRBs ordered by the proportion of those engaging who expressed concern about their engagement. By examining overlap in confidence intervals, the following significant differences in HRB concern were found: 1) the proportion of youth expressing concern about *avoiding physical activity* (72%) was significantly greater than the proportions of youth who expressed concern about 8 other HRBs - *smoking cigarettes, getting into fights, carrying a weapon, having sex without a condom, eating junk/fast food, using non-injection drugs, drinking to get drunk, smoking marijuana*; 2) the proportion of youth concerned about smoking marijuana (21%) was significantly lower than the proportions of youth concerned about 9 other HRBs - *avoiding physical activity, drinking and driving, smoking cigarettes, getting into fights, carrying a weapon, having sex without a condom, eating junk/fast food, using non-injection drugs, drinking to get drunk*. Significant differences were not found between any other proportions of youth HRB concern.

Table 4: Frequencies and Proportions of Youth Engaged in HRBs and Youth Concerned about HRBs that they are Engaged in

n = 240

Health Risk Behaviour	Recently Engaged in HRB			Concerned about Recent Engagement in HRB		
	Count	% of n	Order	Count	% Of Those Engaged	Order
Smoke Cigarettes (≥4x in past 6mo)	136	57%	1	67	49%	3
Have Sex without a Condom (≥1x in past 6mo)	119	50%	2	50	42%	6
Smoke Marijuana (≥4x in past 6mo)	113	47%	3	24	21%	12
Drink to get Drunk (≥4x in past 6mo)	103	43%	4	39	38%	9
Get into Fights (≥1x in past 6mo)	102	43%	5	48	47%	4
Eat Junk/Fast Food (daily or close to daily)	74	31%	6	30	41%	7
Use Non-Injection Drugs (≥1x in past 6mo)	50	21%	7	20	40%	8
Carry a Weapon (≥1x in past 6mo)	41	17%	8	19	46%	5
Avoid Physical Activity (≥4x in past 6mo)	36	15%	9	26	72%	1
Drink and Drive (≥1x in past 6mo)	18	8%	10	11	61%	2
Try Extreme Weight Loss Measures (≥1x in past 6mo)	7	3%	11	2	29%	11
Inject Drugs (≥1x in past 6mo)	6	3%	12	2	33%	10

Figure 2: HRBs Ordered by Proportion of Engaged who are Concerned
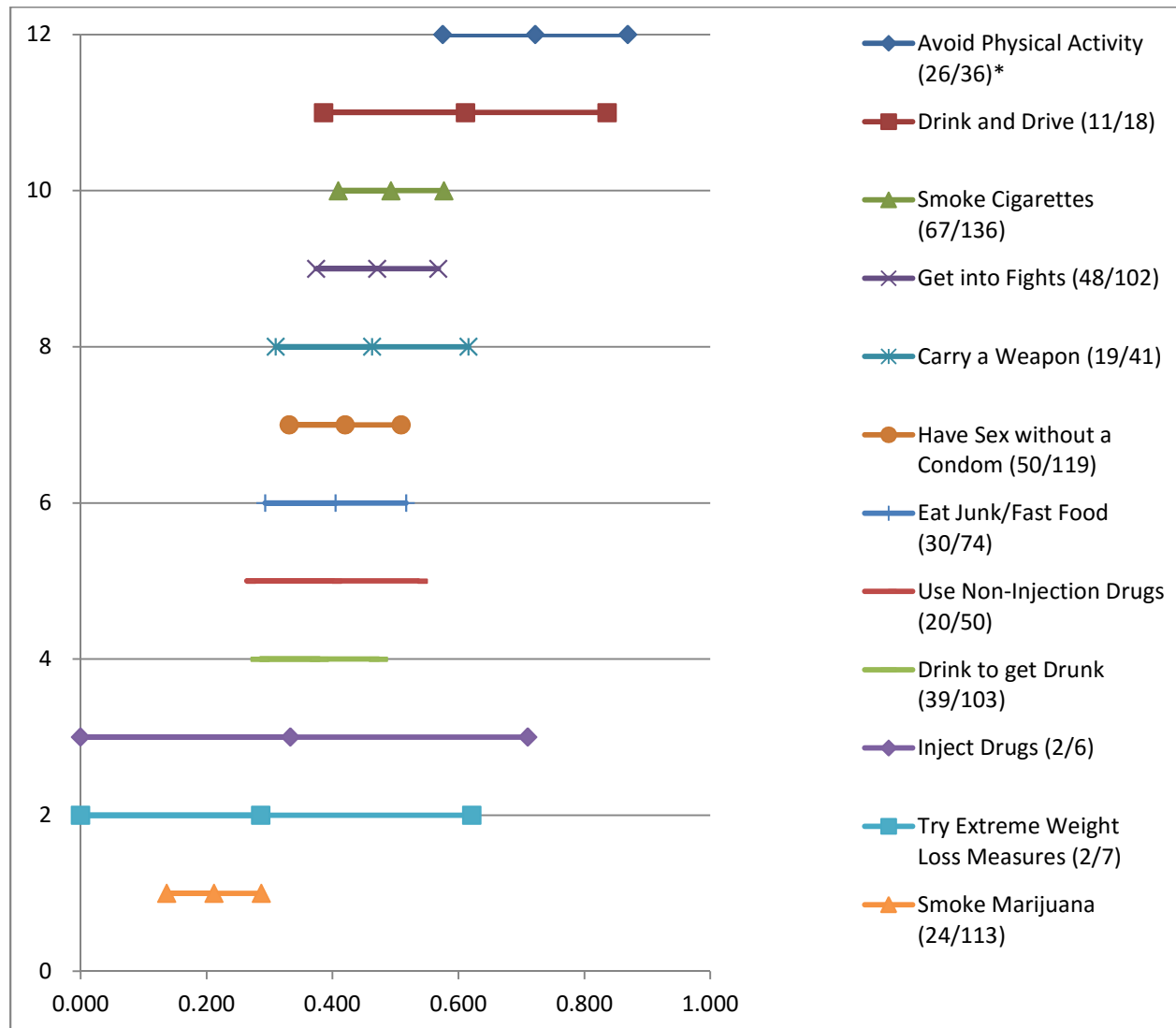
*Represents number of youth concerned about HRB engagement over number of youth engaged in HRB

6.4 Research Question 3 – Are sociodemographic factors associated with differences in concern about HRB engagement among Winnipeg youth?

6.4.1 Results from tests of association

Tables 5 through to 16 present the results of multivariable tests of association between sociodemographic variables and HRB engagement and concern variables. Each table displays up to three sub-tables. Sub-table A presents results from Chi-squared and Fisher's exact tests of association (contingency table analyses); sub-table B presents results from logistic regression or exact logistic regression models on selected variables from the contingency table analyses with *HRB engagement* as the outcome; sub-table C presents results from logistic regression or exact logistic regression models on selected variables from the contingency table analyses with *HRB concern* as the outcome. As mentioned in Methods, all predictor variables demonstrating association with engagement or concern at p-value alpha ≤ 0.10 in the contingency table analysis were included in the logistic regression or exact logistic regression models – thus, if no significant associations were found, no model was built. Tables 17 and 18 summarize results from all Chi-squared and Fisher's exact tests of association. Table 17 describes sociodemographic associations with HRB engagement and Table 18 summarizes sociodemographic associations with HRB concern. Many associations in the contingency table analysis became non-significant in the adjusted logistic regression and exact logistic regression models. Significant results from adjusted logistic regression and exact logistic regression models are summarized below. Significance was set at p-value alpha ≤ 0.05 for HRB engagement outcomes, and at p-value alpha ≤ 0.10 for HRB concern outcomes due to the much smaller sample sizes and the exploratory nature of the study.

Gender – Female youth were significantly more likely than male youth to report smoking

cigarettes (p = 0.003, AOR = 2.49) and having sex without a condom (p = 0.006, AOR = 2.20).

Female youth were also shown to be more likely to try extreme weight loss measures (p = 0.010)

as determined by the contingency table analysis, but no regression analysis could be performed

due to small cell sizes. No significant differences at p-value alpha ≤ 0.10 were found between

males or females regarding their likelihood of concern about their HRB engagement for any of

the 12 HRBs.

Sexual Orientation – Sexual minority youth were significantly more likely than heterosexual

youth to report avoiding physical activity (p = 0.042, AOR = 2.22). Sexual minority youth were

also shown to be more likely to try extreme weight loss measures (p = 0.034) as determined by

the contingency table analysis, but no regression analysis could be performed due to small cell

sizes. At a less stringent significance level (p ≤ 0.10), sexual minority youth appeared more

likely to drink to get drunk (p = 0.072, AOR = 1.75). No significant differences at p-value alpha

≤ 0.10 were found between heterosexual or sexual minority youth regarding their likelihood of

concern about their HRB engagement for any of the 12 HRBs.

Age – Youth between the ages 19 and 24 were significantly more likely than youth aged 14-18 to

report avoiding physical activity (p = 0.019, AOR = 2.45) and having sex without a condom (p <

0.001, AOR = 2.61). Younger youth were shown to be more likely to try extreme weight loss

measures (p = 0.033) as determined by the contingency table analysis, but no regression analysis

could be performed due to small cell sizes. At p-value alpha ≤ 0.10, older youth who smoked

cigarettes were more likely to be concerned about their smoking than younger youth who

smoked cigarettes (p = 0.086, OR = 1.83). No significant differences were found in likelihood of

concern for any other HRBs.

Education – Youth categorized as having left school early were significantly more likely than those in the higher education category to report smoking cigarettes (p < 0.001, AOR = 4.01), having sex without a condom (p = 0.011, AOR = 2.33), and smoking marijuana (p < 0.001, AOR = 3.08). While no significant differences at p-value alpha ≤ 0.10 were found between groups in likelihood of concern for any HRBs, youth leaving school early were more likely, at a nearly significant level, to be concerned about carrying a weapon (p = 0.108, AOR = 4.27).

Living Situation – Youth categorized as living in a precarious housing situation were significantly more likely than youth who were not to report smoking cigarettes (p < 0.001, AOR = 8.59), getting into fights (p = 0.021, AOR = 2.72)., carrying a weapon (p = 0.022, AOR = 2.76), and using non-injection drugs (p = 0.031, AOR = 2.56). At p-value alpha ≤ 0.10, youth in precarious housing conditions who regularly drank to get drunk were significantly more likely to be concerned about their drinking than other youth who drank to get drunk (p = 0.079, OR = 2.93). No significant differences were found in likelihood of concern for any other HRBs.

Perceived Housing Stability – Youth perceiving their housing as unstable were significantly more likely than youth perceiving their housing as stable to report smoking cigarettes (p = 0.018, AOR = 2.96), using non-injection drugs (p = 0.037, AOR = 2.27) and drinking to get drunk (p = 0.011, AOR = 2.44). At a less stringent significance level (p ≤ 0.10), youth perceiving their housing as unstable were also more likely to smoke marijuana (p = 0.055, AOR = 2.02) and have sex without a condom (p = 0.057, AOR = 2.09). While no significant differences at p-value alpha ≤ 0.10 were found between groups in likelihood of concern for any HRBs, youth perceiving their housing as unstable were more likely, at a nearly significant level, to be concerned about smoking marijuana (p = 0.109, AOR = 2.27).

Area of Winnipeg (Inner-city/Non-inner-city) - No significant differences in likelihood of HRB engagement or concern were found between youth categorized as living in the inner-city and those not living in the inner-city.

Area of Winnipeg (Lower/Higher SES neighborhood) - No significant differences in likelihood of HRB engagement were found between youth categorized as living in a lower SES neighborhood compared to those living in a higher SES neighborhood. Youth living in a lower SES neighborhood were however significantly less likely to be concerned about their regular consumption of junk or fast food than those living in a higher SES neighborhood (p = 0.043, AOR = 0.36).

Table 5: *Drinking and driving* - **analysis of sociodemographic associations with reported engagement and concern about engagement in HRB**

A) **Chi-Squared/Fisher's Exact Test Results †**

† Fisher's exact test run when expected frequency of one or more cells ≤ 5.0, otherwise Chi-squared test conducted

Variable n = 232	Recent Engagement in RB (Drank and drove ≥ 1x in past 6 mo)				Concerned about Recent Engagement		
	No n = 216 (93.1 %)	Yes n = 16 (6.9 %)	P-Value (X^2/FE)		No n = 6 (37.5 %)	Yes n = 10 (62.5 %)	P-Value (X^2/FE)
Gender							
Male (122)	114 (93.4%)	8 (6.6%)	0.830		4 (50.0%)	4 (50.0%)	0.608
Female (110)	102 (92.7%)	8 (7.3%)	(X^2)		2 (25.0%)	6 (75.0%)	(FE)
Sexual Orientation							
Heterosexual (174)	162 (93.1%)	12 (6.9%)	1.000		6 (50.0%)	6 (50.0%)	0.234
Sexual Minority (58)	54 (93.1%)	4 (6.9%)	(FE)		0 (0%)	4 (100.0%)	(FE)
Age Group							
14-18yrs (126)	117 (92.9%)	9 (7.1%)	0.872		5 (55.6%)	4 (44.4%)	0.145
19-24 yrs (106)	99 (93.4%)	7 (6.6%)	(X^2)		1 (14.3%)	6 (85.7%)	(FE)
Education							
In or graduated high school (170)	157 (92.4%)	13 (7.6%)	0.455		4 (30.8%)	9 (69.2%)	0.518
Left high school early (62)	59 (95.2%)	3 (4.8%)	(FE)		2 (66.7%)	1 (33.3%)	(FE)
Living Situation							
On own/with family /friends (202)	186 (92.1%)	16 (7.9%)	0.236		6 (37.5%)	10 (62.5%)	---
Precarious housing (30)	30 (100%)	0 (0 %)	(FE)		0	0	
Perceived Housing Stability							
Stable (190)	176 (92.6%)	14 (7.4%)	0.743		5 (35.7%)	9 (64.3%)	1.000
Unstable (42)	40 (95.2%)	2 (4.8%)	(FE)		1 (50.0%)	1 (50.0%)	(FE)
Area of Winnipeg							
Non-Inner City neighborhood (68)	65 (95.6%)	3 (4.4%)	0.569		0 (0%)	3 (100.0%)	0.250
Inner City neighborhood (164)	151 (92.1%)	13 (7.9%)	(FE)		6 (46.2%)	7 (53.8%)	(FE)
Area of Winnipeg							
Higher SES neighborhood (81)	76 (93.8%)	5 (6.2%)	0.408		1 (20.0%)	4 (80.0%)	0.588
Low SES neighborhood (151)	140 (92.7%)	11 (7.3%)	(FE)		5 (45.5%)	6 (54.5%)	(FE)

*Indicates p-value ≤ 0.05 (all p-values below 0.10 bolded)

B) **Adjusted and unadjusted odds ratios of selected demographics from contingency table analysis with *reported engagement* using multivariable logistic regression**

No multivariable logistic regression model required following results of contingency table analysis as no sociodemographic variables demonstrated associations with p-values ≤ 0.100.

C) **Adjusted and unadjusted odds ratios of selected demographics from contingency table analysis with *reported concern about engagement* using multivariable logistic regression**

No multivariable exact logistic regression model required following results of contingency table analysis as no sociodemographic variables demonstrated associations with p-values ≤ 0.100.

Table 6: *Getting into fights* – **analysis of sociodemographic associations with reported engagement and concern about engagement in HRB**

A) Chi-Squared/Fisher's Exact Test Results †

† Fisher's exact test run when expected frequency of one or more cells ≤ 5.0, otherwise Chi-squared test conducted

Variable n = 232	Recent Engagement in RB (Got into a fight >1x in past 6 mo)				Concerned about Recent Engagement		
	No n = 131 (56.5%)	Yes n = 101 (43.5%)	P-Value (X^2)		No n = 53 (52.5%)	Yes n = 48 (47.5%)	P-Value (X^2)
Gender							
Male (122)	67 (54.9%)	55 (45.1%)	0.617		32 (58.2%)	23 (41.8%)	0.209
Female (110)	64 (58.2%)	46 (41.8%)			21 (45.6%)	25 (54.4%)	
Sexual Orientation							
Heterosexual (174)	98 (56.3%)	76 (43.7%)	0.939		44 (57.9%)	32 (42.1%)	**0.054**
Sexual Minority (58)	33 (56.9%)	25 (43.1%)			9 (36.0%)	16 (64.0%)	
Age Group							
14-18yrs (126)	72 (57.1)	54 (42.9%)	0.821		31 (57.4%)	23 (42.6%)	0.287
19-24 yrs (106)	59 (55.7)	47 (44.3%)			22 (46.8%)	25 (53.2%)	
Education							
In or graduated high school (170)	103 (60.6%)	67 (39.4%)	**0.036***		38 (56.7%)	29 (43.3%)	0.231
Left high school early (62)	28 (45.2%)	34 (54.8%)			15 (44.1%)	19 (55.9%)	
Living Situation							
On own/with family /friends (202)	120 (59.4%)	82 (40.6%)	**0.019***		45 (54.9%)	37 (45.1%)	0.315
Precarious housing (30)	11 (36.7%)	19 (63.3%)			8 (42.1%)	11 (57.9%)	
Perceived Housing Stability							
Stable (190)	112 (59.0%)	78 (41.0%)	0.105		44 (56.4%)	34 (43.6%)	0.145
Unstable (42)	19 (45.2%)	23 (54.8%)			9 (39.1%)	14 (60.9%)	
Area of Winnipeg							
Non-Inner City neighborhood (68)	41 (60.3%)	27 (39.7%)	0.449		11 (40.7%)	16 (59.3%)	0.154
Inner City neighborhood (164)	90 (54.9%)	74 (45.1%)			42 (56.8%)	32 (43.2%)	
Area of Winnipeg							
Higher SES neighborhood (81)	52 (64.2%)	29 (35.8%)	**0.082**		13 (44.8%)	16 (55.2%)	0.329
Low SES neighborhood (151)	79 (52.3%)	72 (47.7 %)			40 (55.6%)	32 (44.4%)	

*Indicates p-value ≤ 0.05 (all p-values below 0.10 bolded)

B) Adjusted and unadjusted odds ratios of selected demographics from contingency table analysis with *reported engagement* using multivariable logistic regression

Variable	Unadjusted OR (95% CI)	P-Value		Adjusted OR (95% CI)	P-Value
Education – Left high school early	1.87 (1.04, 3.36)	**0.037***		1.47 (0.79, 2.73)	0.223
Living Situation – "Precarious" housing	2.53 (1.14, 5.59)	**0.022***		2.72 (1.16, 6.34)	**0.021***
Area of Winnipeg – Low SES neighborhood	1.63 (0.94, 2.85)	0.083		1.70 (0.92, 3.14)	0.058

C) Adjusted and unadjusted odds ratios of selected demographics from contingency table analysis with *reported concern about engagement* using multivariable logistic regression

Variable	Unadjusted OR (95% CI)	P-Value
Sexual Orientation– Sexual Minority	1.84 (0.84, 4.06)	0.129

Table 7: *Carrying a weapon* **- analysis of sociodemographic associations with reported engagement and concern about engagement in HRB**

A) Chi-Squared/Fisher's Exact Test Results †

† Fisher's exact test run when expected frequency of one or more cells ≤ 5.0, otherwise Chi-squared test conducted

Variable n = 232	Recent Engagement in RB (Carried a Weapon >1x in past 6 mo)				Concerned about Recent Engagement		
	No n = 193 (83.2%)	Yes n = 39 (16.8%)	P-Value (X^2)		No n = 20 (51.3%)	Yes n = 19 (48.7%)	P-Value (X^2/FE)
Gender							
Male (122)	98 (80.3%)	24 (19.7%)	0.220		13 (54.2%)	11 (45.8%)	0.648
Female (110)	95 (86.4%)	15 (13.6%)			7 (46.7%)	8 (53.3%)	(X^2)
Sexual Orientation							
Heterosexual (174)	148 (85.1%)	26 (14.9%)	0.188		16 (61.5%)	10 (38.5%)	**0.096**
Sexual Minority (58)	45 (77.6%)	13 (22.4%)			4 (30.8%)	9 (69.2%)	(FE)
Age Group							
14-18yrs (126)	102 (81.0%)	24 (19.0%)	0.320		14 (58.3%)	10 (41.7%)	0.265
19-24 yrs (106)	91 (85.9%)	15 (14.1%)			6 (40.0%)	9 (60.0%)	(X^2)
Education							
In or graduated high school (170)	144 (84.7%)	26 (15.3%)	0.306		16 (61.5%)	10 (38.5%)	**0.096**
Left high school early (62)	49 (79.0%)	13 (21.0%)			4 (30.8%)	9 (69.2%)	(FE)
Living Situation							
On own/with family /friends (202)	173 (85.6%)	29 (14.4%)	**0.009***		16 (55.2%)	13 (44.8%)	0.480
Precarious housing (30)	20 (66.7%)	10 (33.3%)			4 (40.0%)	6 (60.0%)	(FE)
Perceived Housing Stability							
Stable (190)	162 (85.3%)	28 (14.7%)	**0.072**		16 (57.1%)	12 (42.9%)	0.301
Unstable (42)	31 (73.8%)	11 (26.2%)			4 (36.4%)	7 (63.6%)	(FE)
Area of Winnipeg							
Non-Inner City neighborhood (68)	53 (77.9%)	15 (22.1%)	0.169		5 (33.3%)	10 (66.7%)	**0.100**
Inner City neighborhood (164)	140 (85.4%)	24 (14.6%)			15 (62.5%)	9 (37.5%)	(FE)
Area of Winnipeg							
Higher SES neighborhood (81)	64 (79.0%)	17 (21.0%)	0.213		8 (47.1%)	9 (52.9%)	0.643
Low SES neighborhood (151)	129 (85.4%)	22 (14.6%)			12 (54.6%)	10 (45.4%)	(X^2)

*Indicates p-value ≤ 0.05 (all p-values below 0.10 bolded)

B) Adjusted and unadjusted odds ratios of selected demographics from contingency table analysis with *reported engagement* using multivariable logistic regression

Variable	Unadjusted OR (95% CI)	P-Value		Adjusted OR (95% CI)	P-Value
Living Situation – "Precarious" housing	2.98 (1.27, 7.01)	**0.012***		2.76 (1.16, 6.57)	**0.022***
Perceived Housing Stability - Unstable	2.05 (0.93, 4.55)	**0.077**		1.85 (0.82, 4.18)	0.140

C) Adjusted and unadjusted odds ratios of selected demographics from contingency table analysis with *reported concern about engagement* using multivariable exact logistic regression

Variable	Unadjusted OR (95% CI)	P-Value		Adjusted OR (95% CI)	P-Value
Sexual Orientation – Sexual Minority	3.48 (0.73, 19.89)	0.140		3.06 (0.52, 20.72)	0.274
Education – Left high school early	3.48 (0.73, 19.89)	0.140		4.27 (0.79, 30.06)	0.108
Area of Winnipeg – Inner City neighborhood	0.31 (0.06, 1.39)	0.148		0.39 (0.06, 2.08)	0.345

Table 8: *Drinking to get drunk* **- analysis of sociodemographic associations with reported engagement and concern about engagement in HRB**

A) Chi-Squared/Fisher's Exact Test Results †

† Fisher's exact test run when expected frequency of one or more cells ≤ 5.0, otherwise Chi-squared test conducted

Variable n = 232	Recent Engagement in RB (Drank to get Drunk >4x in past 6 mo)				Concerned about Recent Engagement		
	No n = 134 (57.8%)	Yes n = 98 (42.2%)	P-Value (X^2)		No n = 60 (61.2%)	Yes n = 38 (38.8%)	P-Value (X^2)
Gender							
Male (122)	76 (62.3%)	46 (37.7%)	0.141		31 (67.4%)	15 (32.6%)	0.239
Female (110)	58 (52.7%)	52 (47.3%)			29 (55.8%)	23 (44.2%)	
Sexual Orientation							
Heterosexual (174)	106 (60.9%)	68 (39.1%)	**0.091**		40 (58.8%)	28 (41.2%)	0.847
Sexual Minority (58)	28 (48.3%)	30 (51.7%)			20 (66.7%)	10 (33.3%)	
Age Group							
14-18yrs (126)	77 (61.1%)	49 (38.9%)	0.260		29 (59.2%)	20 (40.8%)	0.678
19-24 yrs (106)	57 (53.8%)	49 (46.2%)			31 (63.3%	18 (36.7%)	
Education							
In or graduated high school (170)	101 (59.4%)	69 (40.6%)	0.399		43 (62.3%)	26 (37.7%)	0.732
Left high school early (62)	33 (63.2%)	29 (46.8%)			17 (58.6%)	12 (41.4%)	
Living Situation							
On own/with family /friends (202)	117 (57.9%)	85 (42.1%)	0.897		55 (64.7%)	30 (35.3%)	**0.071**
Precarious housing (30)	17 (56.7%)	13 (43.3%)			5 (38.5%)	8 (61.5%)	
Perceived Housing Stability							
Stable (190)	117 (61.6%)	73 (38.4%)	**0.012***		47 (64.4%)	26 (35.6%)	0.273
Unstable (42)	17 (40.5%)	25 (59.5%)			13 (52.0%)	12 (48.0%)	
Area of Winnipeg							
Non-Inner City neighborhood (68)	34 (50.0%)	34 (50%)	0.123		22 (64.7%)	12 (35.3%)	0.606
Inner City neighborhood (164)	100 (61.0%)	64 (39.0%)			38 (59.4%)	26 (40.6%)	
Area of Winnipeg							
Higher SES neighborhood (81)	44 (54.3%)	37 (45.7%)	0.438		23 (62.2%)	14 (37.8%)	0.882
Low SES neighborhood (151)	90 (59.6%)	61 (40.4%)			37 (60.7%)	24 (39.3%)	

*Indicates p-value ≤ 0.05 (all p-values below 0.10 bolded)

B) Adjusted and unadjusted odds ratios of selected demographics from contingency table analysis with *reported engagement* using multivariable logistic regression

Variable	Unadjusted OR (95% CI)	P-Value		Adjusted OR (95% CI)	P-Value
Sexual Orientation – Sexual Minority	1.67 (0.92, 3.04)	**0.093**		1.75 (0.95, 3.21)	**0.072**
Perceived Housing Stability - Unstable	2.36 (1.19, 4.66)	**0.014***		2.44 (1.23, 4.86)	**0.011***

C) Adjusted and unadjusted odds ratios of selected demographics from contingency table analysis with *reported concern about engagement* using multivariable logistic regression

Variable	Unadjusted OR (95% CI)	P-Value
Living Situation – Precarious housing	2.93 (0.88, 9.76)	**0.079**

Table 9: *Smoking cigarettes* **- analysis of sociodemographic associations with reported engagement and concern about engagement in HRB**

A) Chi-Squared/Fisher's Exact Test Results †

† Fisher's exact test run when expected frequency of one or more cells ≤ 5.0, otherwise Chi-squared test conducted

Variable n = 232	Recent Engagement in RB (Smoked Cigarettes > 4x in past 6 mo)				Concerned about Recent Engagement		
	No n = 100 (43.1%)	Yes n = 132 (56.9%)	P-Value (X^2)		No n = 68 (51.5%)	Yes n = 64 (48.5%)	P-Value (X^2)
Gender							
Male (122)	60 (49.2%)	62 (50.8%)	**0.049***		35 (56.4%)	27 (43.6%)	0.286
Female (110)	40 (36.4%)	70 (63.6%)			33 (47.1%)	37 (52.9%)	
Sexual Orientation							
Heterosexual (174)	76 (43.7%)	98 (56.3%)	0.759		50 (51.0%)	48 (49.0%)	0.847
Sexual Minority (58)	24 (41.4%)	34 (58.6%)			18 (52.9%)	16 (47.1%)	
Age Group							
14-18yrs (126)	56 (44.4%)	70 (55.6%)	0.653		41 (58.6%)	29 (41.4%)	**0.085**
19-24 yrs (106)	44 (41.5%)	62 (58.5%)			27 (43.5%)	35 (56.5%)	
Education							
In or graduated high school (170)	88 (51.8%)	82 (48.2%)	**<0.001***		39 (47.6%)	43 (52.4%)	0.244
Left high school early (62)	12 (19.4%)	50 (80.6%)			29 (58.0%)	21 (42.0%)	
Living Situation							
On own/with family /friends (202)	97 (48.0%)	105 (52.0%)	**<0.001***		52 (49.5%)	53 (50.5%)	0.367
Precarious housing (30)	3 (10.0%)	27 (90%)			16 (59.3%)	11 (40.7%)	
Perceived Housing Stability							
Stable (190)	92 (48.4%)	98 (51.6%)	**0.001***		51 (52.0%)	47 (48.0%)	0.837
Unstable (42)	8 (19.1%)	34 (80.9%)			17 (50.0%)	17 (50.0%)	
Area of Winnipeg							
Non-Inner City neighborhood (68)	31 (45.6%)	37 (54.4%)	0.623		19 (51.3%)	18 (48.7%)	0.981
Inner City neighborhood (164)	69 (42.1%)	95 (57.9%)			49 (51.6%)	46 (48.4%)	
Area of Winnipeg							
Higher SES neighborhood (81)	41 (50.6%)	40 (49.4%)	**0.091**		19 (47.0%)	21 (53.0%)	0.543
Low SES neighborhood (151)	59 (39.1%)	92 (60.9%)			49 (53.3%)	43 (46.7%)	

*Indicates p-value ≤ 0.05 (all p-values below 0.10 bolded)

B) Adjusted and unadjusted odds ratios of selected demographics from contingency table analysis with *reported engagement* using multivariable logistic regression

Variable	Unadjusted OR (95% CI)	P-Value		Adjusted OR (95% CI)	P-Value
Gender – Female	1.69 (1.00, 2.87)	**0.050***		2.49 (1.36, 4.57)	**0.003***
Education – Left high school early	4.47 (2.22, 8.99)	**<0.001***		4.01 (1.85, 8.70)	**<0.001***
Living Situation – Precarious housing	8.31 (2.44, 28.28)	**0.001***		8.59 (2.30, 31.96)	**0.001***
Perceived Housing Stability - Unstable	3.99 (1.76, 9.07)	**0.001***		2.96 (1.21, 7.26)	**0.018***
Area of Winnipeg – Low SES neighborhood	1.60 (0.93, 2.76)	**0.091**		1.61 (0.85, 3.05)	0.145

C) Adjusted and unadjusted odds ratios of selected demographics from contingency table analysis with *reported concern about engagement* using multivariable logistic regression

Variable	Unadjusted OR (95% CI)	P-Value
Age – 19-24 yrs	1.83 (0.92, 3.66)	**0.086**

Table 10: *Smoking marijuana* **- analysis of sociodemographic associations with reported engagement and concern about engagement in HRB**

A) Chi-Squared/Fisher's Exact Test Results †

† Fisher's exact test run when expected frequency of one or more cells ≤ 5.0, otherwise Chi-squared test conducted

Variable n = 232	Recent Engagement in RB (Smoked Marijuana > 4x in past 6 mo)				Concerned about Recent Engagement		
	No n = 125 (53.9%)	Yes n = 107 (46.1%)	P-Value (X^2)		No n = 84 (78.5%)	Yes n = 23 (21.5%)	P-Value (X^2/FE)
Gender							
Male (122)	64 (52.5%)	58 (47.5%)	0.648		46 (79.3%)	12 (20.7%)	0.825
Female (110)	61 (55.5%)	49 (44.5%)			38 (77.5%)	11 (22.5%)	(X^2)
Sexual Orientation							
Heterosexual (174)	95 (54.6%)	79 (45.4%)	0.704		62 (78.5%)	17 (21.5%)	0.992
Sexual Minority (58)	30 (51.7%)	28 (48.3%)			22 (78.6%)	6 (21.4%)	(X^2)
Age Group							
14-18yrs (126)	68 (54.0%)	58 (46.0%)	0.976		49 (84.5%)	9 (15.5%)	**0.100**
19-24 yrs (106)	57 (53.8%)	49 (46.2%)			35 (71.4%)	14 (28.6%)	(X^2)
Education							
In or graduated high school (170)	105 (61.8%)	65 (38.2%)	**<0.001***		51 (78.5%)	14 (21.5%)	0.989
Left high school early (62)	20 (32.3%)	42 (67.7%)			33 (78.6%)	9 (21.4%)	(X^2)
Living Situation							
On own/with family /friends (202)	113 (55.9%)	89 (44.1%)	0.102		68 (76.4%)	21 (23.6%)	0.350
Precarious housing (30)	12 (40.0%)	18 (60.0%)			16 (88.9%)	2 (11.1%)	(FE)
Perceived Housing Stability							
Stable (190)	110 (57.9%)	80 (42.1%)	**0.009***		66 (82.5%)	14 (17.5%)	**0.083**
Unstable (42)	15 (35.7%)	27 (64.3%)			18 (66.7%)	9 (33.3%)	(X^2)
Area of Winnipeg							
Non-Inner City neighborhood (68)	38 (55.9%)	30 (44.1%)	0.694		25 (83.3%)	5 (16.7%)	0.448
Inner City neighborhood (164)	87 (53.1%)	77 (46.9%)			59 (76.6%)	18 (23.4%)	(X^2)
Area of Winnipeg							
Higher SES neighborhood (81)	47 (58.0%)	34 (42.0%)	0.354		29 (85.3%)	5 (14.7%)	0.243
Low SES neighborhood (151)	78 (51.7%)	73 (48.3%)			55 (75.3%)	18 (24.7%)	(X^2)

*Indicates p-value ≤ 0.05 (all p-values below 0.10 bolded)

B) Adjusted and unadjusted odds ratios of selected demographics from contingency table analysis with *reported engagement* using multivariable logistic regression

Variable	Unadjusted OR (95% CI)	P-Value		Adjusted OR (95% CI)	P-Value
Education – Left high school early	3.39 (1.83, 6.28)	**<0.001***		3.08 (1.65, 5.76)	**<0.001***
Perceived Housing Stability - Unstable	2.48 (1.24, 4.95)	**0.010***		2.02 (0.98, 4.17)	**0.055**

C) Adjusted and unadjusted odds ratios of selected demographics from contingency table analysis with *reported concern about engagement* using multivariable logistic regression

Variable	Unadjusted OR (95% CI)	P-Value		Adjusted OR (95% CI)	P-Value
Age – 19-24 yrs	2.18 (0.85, 5.59)	0.106		2.10 (0.81, 5.46)	0.128
Perceived Housing Stability - Unstable	2.36 (0.88, 6.32)	0.088		2.27 (0.83, 6.16)	0.109

Table 11: *Using injection drugs* - analysis of sociodemographic associations with reported engagement and concern about engagement in HRB

A) Chi-Squared/Fisher's Exact Test Results †

† Fisher's exact test run when expected frequency of one or more cells ≤ 5.0, otherwise Chi-squared test conducted

Variable n = 232	Recent Engagement in RB (Used injection drugs >1x in past 6 mo)				Concerned about Recent Engagement		
	No n = 226 (97.4%)	Yes n = 6 (2.6%)	P-Value (FE)		No n = 4 (66.7%)	Yes n = 2 (33.3%)	P-Value (FE)
Gender							
Male (122)	118 (96.7%)	4 (3.3%)	0.686		3 (75.0%)	1 (25.0%)	1.000
Female (110)	108 (98.2%)	2 (1.8%)			1 (50.0%)	1 (50.0%)	
Sexual Orientation							
Heterosexual (174)	171 (98.3%)	3 (1.7%)	0.167		2 (66.7%)	1 (33.3%)	1.000
Sexual Minority (58)	55 (94.8%)	3 (5.2%)			2 (66.7%)	1 (33.3%)	
Age Group							
14-18yrs (126)	124 (98.4%)	2 (1.6%)	0.416		2 (100%)	0 (0%)	0.467
19-24 yrs (106)	102 (96.2%)	4 (3.8%)			2 (50.0%)	2 (50.0%)	
Education							
In or graduated high school (170)	166 (97.7%)	4 (2.3%)	0.659		2 (50.0%)	2 (50.0%)	0.467
Left high school early (62)	60 (96.8%)	2 (3.2%)			2 (100%)	0 (0%)	
Living Situation							
On own/with family /friends (202)	198 (98.0%)	4 (2.0%)	0.174		3 (75.0%)	1 (25.0%)	1.000
Precarious housing (30)	28 (93.3%)	2 (6.7%)			1 (50.0%)	1 (50.0%)	
Perceived Housing Stability							
Stable (190)	186 (97.9%)	4 (2.1%)	0.298		2 (50.0%)	2 (50.0%)	0.467
Unstable (42)	40 (95.2%)	2 (4.8%)			2 (100%)	0 (0%)	
Area of Winnipeg							
Non-Inner City neighborhood (68)	68 (100%)	0 (0%)	0.184		0 (0%)	0 (0%)	---
Inner City neighborhood (164)	158 (96.3%)	6 (3.7%)			4 (66.7%)	2 (33.3%)	
Area of Winnipeg							
Higher SES neighborhood (81)	80 (98.8%)	1 (1.2%)	0.668		0 (0%)	1 (100%)	0.333
Low SES neighborhood (151)	146 (96.7%)	5 (3.3%)			4 (80.0%)	1 (20.0%)	

*Indicates p-value ≤ 0.05 (all p-values below 0.10 bolded)

B) Adjusted and unadjusted odds ratios of selected demographics from contingency table analysis with *reported engagement* using multivariable logistic regression

No multivariable logistic regression model required following results of contingency table analysis as no sociodemographic variables demonstrated associations with p-values ≤ 0.100.

C) Adjusted and unadjusted odds ratios of selected demographics from contingency table analysis with *reported concern about engagement* using multivariable logistic regression

No multivariable logistic regression model required following results of contingency table analysis as no sociodemographic variables demonstrated associations with p-values ≤ 0.100.

Table 12: *Using Non-Injection drugs* **- analysis of sociodemographic associations with reported engagement and concern about engagement in HRB**

A) Chi-Squared/Fisher's Exact Test Results †

† Fisher's exact test run when expected frequency of one or more cells ≤ 5.0, otherwise Chi-squared test conducted

Variable	Recent Engagement in RB (Used non-inj drugs >1x in past 6 mo)				Concerned about Recent Engagement		
n = 232	No n = 185 (79.7%)	Yes n = 47 (20.3%)	P-Value (X^2)		No n = 28 (59.6%)	Yes n = 19 (40.4%)	P-Value (X^2/FE)
Gender							
Male (122)	102 (83.6%)	20 (16.4%)	0.123		11 (55.0%)	9 (45.0%)	0.582
Female (110)	83 (75.5%)	27 (24.5%)			17 (63.0%)	10 (37.0%)	(X^2)
Sexual Orientation							
Heterosexual (174)	138 (79.3%)	36 (20.7%)	0.777		23 (63.9%)	13 (36.1%)	0.312
Sexual Minority (58)	47 (81.0%)	11 (19.0%)			5 (45.4%)	6 (54.6%)	(FE)
Age Group							
14-18yrs (126)	105 (83.3%)	21 (16.7%)	0.138		12 (57.1%)	9 (42.9%)	0.760
19-24 yrs (106)	80 (75.5%)	26 (24.5%)			16 (61.5%)	10 (38.5%)	(X^2)
Education							
In or graduated high school (170)	142 (83.5%)	28 (16.5%)	**0.017***		19 (67.9%)	9 (32.1%)	0.160
Left high school early (62)	43 (69.4%)	19 (30.6%)			9 (47.4%)	10 (52.6%)	(X^2)
Living Situation							
On own/with family /friends (202)	167 (82.7%)	35 (17.3%)	**0.004***		23 (65.7%)	12 (34.3%)	0.182
Precarious housing (30)	18 (60.0%)	12 (40.0%)			5 (41.7%)	7 (58.3%)	
Perceived Housing Stability							
Stable (190)	158 (83.2%)	32 (16.8%)	**0.006***		21 (65.6%)	11 (34.4%)	0.217
Unstable (42)	27 (64.3%)	15 (35.7%)			7 (46.7%)	8 (53.3%)	(X^2)
Area of Winnipeg							
Non-Inner City neighborhood (68)	54 (79.4%)	14 (20.6%)	0.936		6 (42.9%)	8 (57.1%)	0.128
Inner City neighborhood (164)	131 (79.9%)	33 (20.1%)			22 (66.7%)	11 (33.3%)	(X^2)
Area of Winnipeg							
Higher SES neighborhood (81)	63 (77.8%)	18 (22.2%)	0.586		9 (50.0%)	9 (50.0%)	0.292
Low SES neighborhood (151)	122 (80.8%)	29 (19.2%)			19 (65.5%)	10 (34.5%)	(X^2)

*Indicates p-value ≤ 0.05 (all p-values below 0.10 bolded)

B) Adjusted and unadjusted odds ratios of selected demographics from contingency table analysis with *reported engagement* using multivariable exact logistic regression

Variable	Unadjusted OR (95% CI)	P-Value		Adjusted OR (95% CI)	P-Value
Education – Left high school early	2.24 (1.14, 4.40)	**0.019***		1.68 (0.82, 3.45)	0.156
Living Situation – "Precarious" housing	3.18 (1.41, 7.20)	**0.005***		2.56 (1.09, 6.01)	**0.031***
Perceived Housing Stability - Unstable	2.74 (1.31, 5.73)	**0.007***		2.27 (1.05, 4.89)	**0.037***

C) Adjusted and unadjusted odds ratios of selected demographics from contingency table analysis with *reported concern about engagement* using multivariable logistic regression

No multivariable logistic regression model required following results of contingency table analysis as no sociodemographic variables demonstrated associations with p-values ≤ 0.100.

Table 13: *Having sex without a condom* **- analysis of sociodemographic associations with reported engagement and concern about engagement in HRB**

A) Chi-Squared/Fisher's Exact Test Results †

† Fisher's exact test run when expected frequency of one or more cells ≤ 5.0, otherwise Chi-squared test conducted

Variable n = 227	Recent Engagement in RB (Sex without a condom >1x in past 6 mo)				Concerned about Recent Engagement		
	No n = 113 (49.8%)	Yes n = 114 (50.2%)	P-Value (X^2)		No n = 66 (57.9%)	Yes n = 48 (42.1%)	P-Value (X^2)
Gender							
Male (120)	68 (56.7%)	52 (43.3%)	**0.028***		30 (57.7%)	22 (42.3%)	0.968
Female (107)	45 (42.1%)	62 (57.9%)			36 (58.1%)	26 (41.9%)	
Sexual Orientation							
Heterosexual (169)	86 (50.9%)	83 (49.1%)	0.569		47 (56.6%)	36 (43.4%)	0.654
Sexual Minority (58)	27 (46.6%)	31 (53.4%)			19 (61.3%)	12 (38.7%)	
Age Group							
14-18yrs (124)	75 (60.5%)	49 (39.5%)	**<0.001***		28 (57.1%)	21 (42.9%)	0.888
19-24 yrs (103)	38 (36.9%)	65 (63.1%)			38 (58.5%)	27 (41.5%)	
Education							
In or graduated high school (168)	92 (54.8%)	76 (45.2%)	**0.011***		43 (56.6%)	33 (43.4%)	0.687
Left high school early (59)	21 (35.6%)	38 (64.4%)			23 (60.5%)	15 (39.5%)	
Living Situation							
On own/with family /friends (199)	102 (51.3%)	97 (48.7%)	0.236		57 (58.8%)	40 (41.2%)	0.654
Precarious housing (28)	11 (39.3%)	17 (60.7%)			9 (52.9%)	8 (47.1%)	
Perceived Housing Stability							
Stable (188)	100 (53.2%)	88 (46.8%)	**0.024***		50 (56.8%)	38 (43.2%)	0.668
Unstable (39)	13 (33.3%)	26 (66.7%)			16 (61.5%)	10 (38.5%)	
Area of Winnipeg							
Non-Inner City neighborhood (68)	32 (47.1%)	36 (52.9%)	0.592		21 (58.3%)	15 (41.7%)	0.949
Inner City neighborhood (159)	81 (50.9%)	78 (49.1%)			45 (57.7%)	33 (42.3%)	
Area of Winnipeg							
Higher SES neighborhood (81)	36 (44.4%)	45 (55.6%)	0.231		27 (60.0%)	18 (40.0%)	0.713
Low SES neighborhood (146)	77 (52.7%)	69 (47.3%)			39 (56.5%)	30 (43.5%)	

*Indicates p-value ≤ 0.05 (all p-values below 0.10 bolded)

B) Adjusted and unadjusted odds ratios of selected demographics from contingency table analysis with *reported engagement* using multivariable logistic regression

Variable	Unadjusted OR (95% CI)	P-Value		Adjusted OR (95% CI)	P-Value
Gender – Female	1.82 (1.08, 3.06)	**0.025***		2.20 (1.25, 3.86)	**0.006***
Age – 19-24 yrs	2.63 (1.54, 4.48)	**<0.001***		2.61 (1.50, 4.55)	**0.001***
Education – Left high school early	2.30 (1.26, 4.22)	**0.007***		2.33 (1.21, 4.48)	**0.011***
Perceived Housing Stability - Unstable	2.48 (1.21, 5.06)	**0.013***		2.09 (0.98, 4.46)	**0.057**

C) Adjusted and unadjusted odds ratios of selected demographics from contingency table analysis with *reported concern about engagement* using multivariable logistic regression

No multivariable logistic regression model required following results of contingency table analysis as no sociodemographic variables demonstrated associations with p-values ≤ 0.100.

Table 14: Trying *extreme weight loss measures* - analysis of sociodemographic associations with reported engagement and concern about engagement in HRB

A) Chi-Squared/Fisher's Exact Test Results †

† Fisher's exact test run when expected frequency of one or more cells ≤ 5.0, otherwise Chi-squared test conducted

Variable n = 231	Recent Engagement in RB (Tried extreme weight loss measures >1x in past 6 mo)				Concerned about Recent Engagement		
	No n = 225 (97.4%)	Yes n = 6 (2.6%)	P-Value (FE)		No n = 4 (66.7%)	Yes n = 2 (33.3%)	P-Value (FE)
Gender							
Male (122)	122 (100%)	0 (0%)	**0.010***		0	0	---
Female (109)	103 (94.5%)	6 (5.5%)			4 (66.7%)	2 (33.3%)	
Sexual Orientation							
Heterosexual (174)	172 (98.8%)	2 (1.2%)	**0.034***		1 (50.0%)	1 (50.0%)	1.000
Sexual Minority (57)	53 (93.0%)	4 (7.0%)			3 (75.0%)	1 (25.0%)	
Age Group							
14-18yrs (126)	120 (95.2%)	6 (4.8%)	**0.033***		4 (66.7%)	2 (33.3%)	---
19-24 yrs (105)	105 (100%)	0 (0%)			0	0	
Education							
In or graduated high school (169)	166 (98.2%)	3 (1.8%)	0.347		1 (33.3%)	2 (66.7%)	0.400
Left high school early (62)	59 (95.2%)	3 (4.9%)			3 (100%)	0 (0%)	
Living Situation							
On own/with family /friends (201)	197 (98.0%)	4 (2.0%)	0.176		2 (50.0%)	2 (50.0%)	0.467
Precarious housing (30)	28 (93.3%)	2 (6.7%)			2 (100%)	0 (0%)	
Perceived Housing Stability							
Stable (189)	185 (97.9%)	4 (2.1%)	0.300		3 (75.0%)	1 (25.0%)	1.000
Unstable (42)	40 (95.2%)	2 (2.8%)			1 (50.0%)	1 (50.0%)	
Area of Winnipeg							
Non-Inner City neighborhood (68)	64 (94.1%)	4 (5.9%)	**0.064**		3 (75.0%)	1 (25.0%)	1.000
Inner City neighborhood (163)	161 (98.8%)	2 (1.2%)			1 (50.0%)	1 (50.0%)	
Area of Winnipeg							
Higher SES neighborhood (80)	76 (95.0%)	4 (5.0%)	0.186		3 (75.0%)	1 (25.0%)	1.000
Low SES neighborhood (151)	149 (98.7%)	2 (1.3%)			1 (50.0%)	1 (50.0%)	

*Indicates p-value ≤ 0.05 (all p-values below 0.10 bolded)

B) Adjusted and unadjusted odds ratios of selected demographics from contingency table analysis with *reported engagement* using multivariable exact logistic regression

Exact logistic regression not run due to small cell sizes for individuals engaging in this risk behavior.

C) Adjusted and unadjusted odds ratios of selected demographics from contingency table analysis with *reported concern about engagement* using multivariable exact logistic regression

No multivariable logistic regression model required following results of contingency table analysis as no sociodemographic variables demonstrated associations with p-values ≤ 0.100.

Table 15: *Eating junk food or fast food -* **analysis of sociodemographic associations with reported engagement and concern about engagement in HRB**

A) Chi-Squared/Fisher's Exact Test Results †

† Fisher's exact test run when expected frequency of one or more cells ≤ 5.0, otherwise Chi-squared test conducted

Variable n = 232	Recent Engagement in RB (Ate junk/fast food daily or close to daily in past 6 mo)				Concerned about Recent Engagement		
	No n = 159 (68.5%)	Yes n = 73 (31.5%)	P-Value (X^2)		No n = 44 (60.3%)	Yes n = 29 (39.7%)	P-Value (X^2/FE)
Gender							
Male (122)	80 (65.6%)	42 (34.4%)	0.306		26 (61.9%)	16 (38.1%)	0.740
Female (110)	79 (71.8%)	31 (28.2%)			18 (58.1%)	13 (41.9%)	(X^2)
Sexual Orientation							
Heterosexual (174)	119 (68.4%)	55 (31.6%)	0.935		36 (65.4%)	19 (34.6%)	0.114
Sexual Minority (58)	40 (69.0%)	18 (31.0%)			8 (44.4%)	10 (55.6%)	(X^2)
Age Group							
14-18yrs (126)	81 (64.3%)	45 (35.7%)	0.129		28 (62.2%)	17 (37.8%)	0.666
19-24 yrs (106)	78 (73.6%)	28 (26.4%)			16 (57.1%)	12 (42.9%)	(X^2)
Education							
In or graduated high school (170)	113 (66.5%)	57 (33.5%)	0.262		35 (61.4%)	22 (38.6%)	0.710
Left high school early (62)	46 (74.2%)	16 (25.8%)			9 (56.2%)	7 (43.8%)	(X^2)
Living Situation							
On own/with family /friends (202)	137 (67.8%)	65 (32.2%)	0.544		39 (60.0%)	26 (40.0%)	1.000
Precarious housing (30)	22 (73.3%)	8 (26.7%)			5 (62.5%)	3 (37.5%)	(FE)
Perceived Housing Stability							
Stable (190)	130 (68.4%)	60 (31.6%)	0.937		34 (56.7%)	26 (43.3%)	0.176
Unstable (42)	29 (69.1%)	13 (30.9%)			10 (76.9%)	3 (23.1%)	(X^2)
Area of Winnipeg							
Non-Inner City neighborhood (68)	45 (66.2%)	23 (33.8%)	0.618		11 (47.8%)	12 (52.2%)	0.140
Inner City neighborhood (164)	114 (69.5%)	50 (30.5%)			33 (66.0%)	17 (34.0%)	(X^2)
Area of Winnipeg							
Higher SES neighborhood (81)	56 (69.1%)	25 (30.9%)	0.885		11 (44.0%)	14 (56.0%)	**0.040***
Low SES neighborhood (151)	103 (68.2%)	48 (31.8%)			33 (68.7%)	15 (31.3%)	(X^2)

*Indicates p-value ≤ 0.05 (all p-values below 0.10 bolded)

B) Adjusted and unadjusted odds ratios of selected demographics from contingency table analysis with *reported engagement* using multivariable exact logistic regression

No multivariable logistic regression model required following results of contingency table analysis as no sociodemographic variables demonstrated associations with p-values ≤ 0.100.

C) Adjusted and unadjusted odds ratios of selected demographics from contingency table analysis with *reported concern about engagement* using multivariable exact logistic regression

Variable	Unadjusted OR (95% CI)	P-Value
Area of Winnipeg – Low SES neighborhood	0.36 (0.13, 0.97)	**0.043***

Table 16: *Avoiding physical activity* **- analysis of sociodemographic associations with reported engagement and concern about engagement in HRB**

A) Chi-Squared/Fisher's Exact Test Results †

† Fisher's exact test run when expected frequency of one or more cells ≤ 5.0, otherwise Chi-squared test conducted

Variable n = 231	Recent Engagement in RB (Avoided Phys Act >4x in past 6 mo)				Concerned about Recent Engagement		
	No n = 195 (84.4%)	Yes n = 36 (16.0%)	P-Value (X^2/FE)		No n = 10 (27.8%)	Yes n = 26 (72.2%)	P-Value (FE)
Gender							
Male (121)	105 (86.8%)	16 (13.2%)	0.299		4 (25.0%)	12 (75.0%)	1.000
Female (110)	90 (81.8%)	20 (18.2%)	(X^2)		6 (30.0%)	14 (70.0%)	
Sexual Orientation							
Heterosexual (173)	152 (87.9%)	21 (12.1%)	**0.013***		8 (38.1%)	13 (61.9%)	0.142
Sexual Minority (58)	43 (74.1%)	15 (25.9%)	(X^2)		2 (13.3%)	13 (86.7%)	
Age Group							
14-18yrs (126)	113 (89.7%)	13 (10.3%)	**0.016***		3 (23.1%)	10 (76.9%)	0.716
19-24 yrs (105)	82 (78.1%)	23 (21.9%)	(X^2)		7 (30.4%)	16 (69.6%)	
Education							
In or graduated high school (169)	142 (84.0%)	27 (16.0%)	0.786		5 (18.5%)	22 (81.5%)	**0.079**
Left high school early (62)	53 (85.5%)	9 (14.5%)	(X^2)		5 (55.6%)	4 (44.4%)	
Living Situation							
On own/with family /friends (202)	170 (84.2%)	32 (15.8%)	1.000		10 (31.2%)	22 (68.8%)	0.559
Precarious housing (29)	25 (86.2%)	4 (13.8%)	(FE)		0 (0%)	4 (100%)	
Perceived Housing Stability							
Stable (189)	158 (83.6%)	31 (16.4%)	0.467		7 (22.6%)	24 (77.4%)	0.119*
Unstable (42)	37 (88.1%)	5 (11.9%)	(X^2)		3 (60.0%)	2 (40.0%)	
Area of Winnipeg							
Non-Inner City neighborhood (68)	54 (79.4%)	14 (20.6%)	0.176		1 (7.1%)	13 (92.9%)	**0.054**
Inner City neighborhood (163)	141 (86.5%)	22 (13.5%)	(X^2)		9 (40.9%)	13 (59.1%)	
Area of Winnipeg							
Higher SES neighborhood (81)	64 (79.0%)	17 (21.0%)	**0.096**		2 (11.8%)	15 (88.2%)	**0.065**
Low SES neighborhood (150)	131 (87.3%)	19 (12.7%)	(X^2)		8 (42.1%)	11 (57.9%)	

*Indicates p-value ≤ 0.05 (all p-values below 0.10 bolded)

B) Adjusted and unadjusted odds ratios of selected demographics from contingency table analysis with *reported engagement* using multivariable exact logistic regression

Variable	Unadjusted OR (95% CI)	P-Value		Adjusted OR (95% CI)	P-Value
Sexual Orientation – Sexual Minority	2.52 (1.20, 5.31)	**0.015***		2.22 (1.03, 4.81)	**0.042***
Age – 19-24 yrs	2.44 (1.17, 5.10)	**0.018***		2.45 (1.16, 5.19)	**0.019***
Area of Winnipeg - Low SES neighborhood	0.55 (0.27, 1.12)	**0.099**		0.60 (0.28, 1.26)	0.177

C) Adjusted and unadjusted odds ratios of selected demographics from contingency table analysis with *reported concern about engagement* using multivariable exact logistic regression

Variable	Unadjusted OR (95% CI)	P-Value		Adjusted OR (95% CI)	P-Value
Education – Left high school early	0.19 (0.03, 1.25)	**0.093**		0.29 (0.03, 2.34)	0.331
Area of Winnipeg – Inner City neighborhood	0.12 (0.002, 1.06)	**0.060**		0.16 (0.002, 16.48)	0.619
Area of Winnipeg - Low SES neighborhood	0.19 (0.01, 1.23)	**0.094**		1.22 (0.02, 31.99)	1.000

Table 17: Chi-Squared/Fisher's Exact P-values - Demographics and HRB Engagement (n = 232)

Dark shade indicates p-value ≤ 0.05; Light shade indicates p-value ≤ 0.10; Risk grp below p-value indicates direction of positive association												
	Phys Act	**DrkDrv**	**Smk**	**Fight**	**Weap**	**No Cond**	**J/F Food**	**N-inj Drg**	**Drk**	**IDU**	**ExWL**	**MJ**
n = 232												
Gender	0.299	0.830	**0.049** Fem	0.617	0.220	**0.028** Fem	0.306	0.123	0.141	0.686	**0.010** Fem	0.648
Sexual Orientation	**0.013** SMin	1.000	0.759	0.939	0.188	0.569	0.935	0.777	**0.091** SMin	0.167	**0.034** SMin	0.704
Age Group	**0.016** Older	0.872	0.653	0.821	0.320	**<0.001** Older	0.129	0.138	0.260	0.416	**0.033** Yng	0.976
Education	0.786	0.455	**<0.001** LEdu	**0.036** LEdu	0.306	**0.011** LEdu	0.262	**0.017** LEdu	0.399	0.659	0.347	**<0.001** LEdu
Living Situation	1.000	0.236	**<0.001** Precar	**0.019** Precar	**0.009** Precar	0.236	0.544	**0.004** Precar	0.897	0.174	0.176	0.102
Perc. Housing Stability	0.467	0.743	**0.001** Unst	0.105	**0.072** Unst	**0.024** Unst	0.937	**0.006** Unst	**0.012** Unst	0.298	0.300	**0.009** Unst
Area – InCty/ Non-InCty	0.176	0.569	0.623	0.449	0.169	0.592	0.618	0.936	0.123	0.184	**0.064** N-IC	0.694
Area – SES	**0.096** HSES	0.408	**0.091** LSES	**0.082** LSES	0.213	0.231	0.885	0.586	0.438	0.668	0.186	0.354

Table 18: Chi-Squared/Fisher's Exact P-values - Demographics and HRB Concern (n = 232)

|	**Phys Act**	**DrkDrv**	**Smk**	**Fight**	**Weap**	**No Cond**	**J/F Food**	**N-inj Drg**	**Drk**	**IDU**	**ExWL**	**MJ**
	n = 36	n = 16	n = 132	n = 101	n = 31	n = 114	n = 73	n = 47	n = 98	n = 6	n = 6	n = 107
Gender	1.000	0.608	0.286	0.209	0.648	0.968	0.740	0.582	0.239	1.000	---	0.825
Sexual Orientation	0.142	0.234	0.847	**0.054** SMin	**0.096** SMin	0.654	0.114	0.312	0.847	1.000	1.000	0.992
Age Group	0.716	0.145	**0.085** Older	0.287	0.265	0.888	0.666	0.760	0.678	0.467	---	**0.100** Older
Education	**0.079** HEdu	0.518	0.244	0.231	**0.096** LEdu	0.687	0.710	0.160	0.732	0.467	0.400	0.989
Living Situation	0.559	---	0.367	0.315	0.480	0.654	1.000	0.182	**0.071** Precar	1.000	0.467	0.350
Perc. Housing Stability	0.119	1.000	0.837	0.145	0.301	0.668	0.176	0.217	0.273	0.467	1.000	**0.083** Unst
Area – InCty/ Non-InCty	**0.054** N-IC	0.250	0.981	0.154	**0.100** IC	0.949	0.140	0.128	0.606	---	1.000	0.448
Area – SES	**0.065** HSES	0.588	0.543	0.329	0.643	0.713	**0.040** HSES	0.292	0.882	0.333	1.000	0.243

6.4.2 Results from cluster analysis

Dendogram analysis and numeric stopping rules were used to determine the optimal clustering solution. Stopping rules suggested that a 2 cluster solution was best. This was reiterated visually by the length of the two vertical lines at the top of the dendogram (lines reflect the loss of information and longer line length indicates more distinct separation between groups). The analysis did not reveal any outliers that could significantly skew the results.

Cluster 1 and cluster 2 (designated Group 1 and Group 2) consisted of 104 and 124 youth respectively. Tables 19 and 20 shows the characteristics of each cluster based on individual analysis of each HRB engagement clustering variable used. Wilcoxon rank-sum tests revealed associations between particular HRB engagement clustering variables and group membership. Group 2 was characterized as a higher risk group, having more frequent engagement in 8 of the 12 HRBs, specifically smoking cigarettes, smoking marijuana, drinking to get drunk, using non-injection drugs, getting into fights, carrying a weapon, having sex without a condom and trying extreme weight loss measures. Group 1 was characterized as a lower risk group; however membership was associated with more frequent engagement in one of the 12 HRBs, avoiding physical activity. Engagement levels for the remaining three behaviours, eating junk food or fast food, injection drug use and drinking and driving, did not differ between the two groups.

Sociodemographic characteristics of the clusters were assessed through Chi-squared tests of association and logistic regression modeling. In comparison to Group 1, Group 2 membership was strongly associated with three sociodemographic traits: leaving high school early (p = 0.002, AOR = 3.07), living in precarious housing situation (p = 0.002, AOR = 7.37.) and low self-perceived housing stability (p = 0.005, AOR = 3.43). Groups were similar in regards to the other five sociodemographic variables.

As seen in Table 23, Chi-squared tests of association revealed that cluster membership was associated with differences in proportions of youth expressing concern about engagement in two HRBs: youth in the lower risk group were significantly more likely than those in the higher risk group to be concerned about their junk food and fast food consumption ($p = 0.041$); youth in the higher risk group were significantly more likely than those in the lower risk group to be concerned about their alcohol consumption ($p = 0.010$). Differences in the likelihood of concern about HRB engagement were not seen between the two groups for any other HRBs. Table 24 presents results displaying how youth concern about HRB engagement varies across HRBs and between clusters.

Figure 3 – Cluster Dendogram – Wards linkage

Dendrogram for wardtest1 cluster analysis
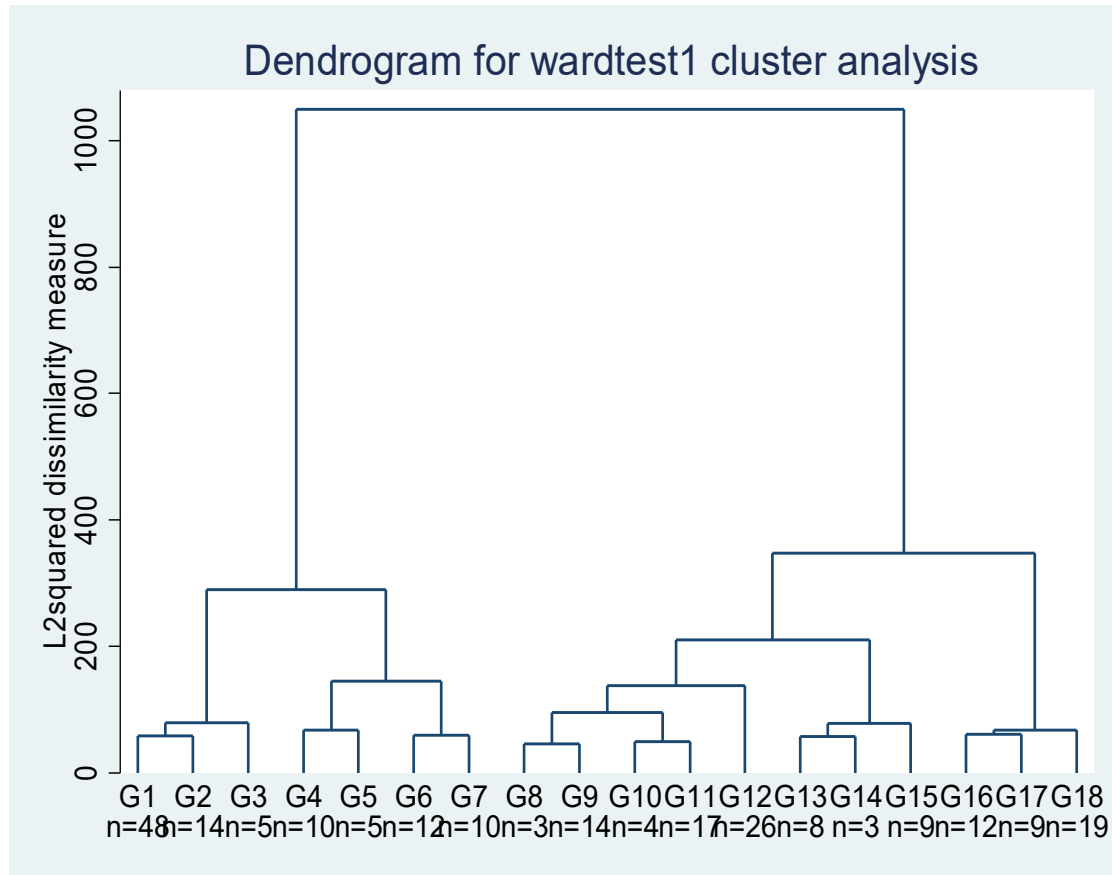
*Note – Cluster dendogram was truncated for clarity, where the maximum number of groups displayed was set at 18. Without truncation, the dendogram would continue until all 228 participants were shown as a distinct group

Table 19 – HRB Engagement - Two Cluster Solution Breakdown

HRB	Cluster Group	HRB Engagement in Past 6 Months			
		Never	1-3 times	≥ 4 times	Daily/Almost Daily
Avoid Physical Activity	Grp 1 (104)	78	2	16	8
	Grp 2 (124)	109	3	11	1
Smoke Cigarettes	Grp 1 (104)	92	4	4	4
	Grp 2 (124)	1	1	21	101
Smoke Marijuana	Grp 1 (104)	63	21	11	9
	Grp 2 (124)	31	8	28	57
Get into Fights	Grp 1 (104)	80	22	2	0
	Grp 2 (124)	48	48	22	6
Use Non-Injection Drugs	Grp 1 (104)	97	5	2	0
	Grp 2 (124)	86	10	20	8
Drink to get Drunk	Grp 1 (104)	56	13	33	2
	Grp 2 (124)	40	23	53	8
Have Sex without a Condom	Grp 1 (104)	64	14	18	8
	Grp 2 (124)	49	30	28	17
Carry a Weapon	Grp 1 (104)	94	4	2	4
	Grp 2 (124)	95	9	11	9
Try Extreme Weight Loss Measures	Grp 1 (104)	104	0	0	0
	Grp 2 (124)	118	0	5	1
Drink and Drive	Grp 1 (104)	100	4	0	0
	Grp 2 (124)	113	7	3	1
Inject Drugs	Grp 1 (104)	103	1	0	0
	Grp 2 (124)	119	4	1	0
Eat Junk/Fast Food	Grp 1 (104)	3	5	60	36
	Grp 2 (124)	12	4	71	37

* HRBs are grouped in order of contribution to cluster membership – refer to Table 20

Table 20 – Analysis of associations between HRB engagement cluster variables and cluster solution group membership - two-sample Wilcoxon rank-sum (Mann-Whitney) test

Association with Grp 1 Membership	No Association with Group Membership	Association with Grp 2 Membership	P-Value
Avoid Physical Activity			**0.0071***
		Smoke Cigarettes	**< 0.0001***
		Smoke Marijuana	**< 0.0001***
		Get into Fights	**< 0.0001***
		Use Non-Injection Drugs	**< 0.0001***
		Drink to get Drunk	**0.0015***
		Have Sex without a Condom	**0.0026***
		Carry a Weapon	**0.0063***
		Try Extreme Weight Loss Measures	**0.0233***
	Drink and Drive		0.1193
	Inject Drugs		0.1490
	Eat Junk/Fast Food		0.2273

Table 21 – Sociodemographic Associations with Cluster Membership – Chi-squared Test

Variable n = 228	Cluster Group Membership		
	Lower Risk Group (G1) n = 104	Higher Risk Group (G2) n = 124	P-Value (X^2)
Gender			
Male (122)	60 (58%)	62 (50%)	0.246
Female (106)	44 (42%)	62 (50%)	
Sexual Orientation			
Heterosexual (171)	79 (76%)	92 (74%)	0.759
Sexual Minority (57)	25 (24%)	32 (26%)	
Age Group			
14-18yrs (124)	59 (57%)	65 (52%)	0.515
19-24 yrs (104)	45 (43%)	59 (48%)	
Education			
In or graduated high school (167)	90 (87%)	77 (62%)	**< 0.001***
Left high school early (61)	14 (13%)	47 (38%)	
Living Situation			
On own/with family /friends (199)	101 (97%)	98 (79%)	**< 0.001***
Precarious housing (29)	3 (3%)	26 (21%)	
Perceived Housing Stability			
Stable (188)	96 (92%)	92 (74%)	**< 0.001***
Unstable (40)	8 (8%)	32 (26%)	
Area of Winnipeg			
Non-Inner City neighborhood (68)	33 (32%)	35 (28%)	0.564
Inner City neighborhood (160)	71 (68%)	89 (72%)	
Area of Winnipeg			
Higher SES neighborhood (81)	43 (41%)	37 (30%)	0.070
Low SES neighborhood (150)	61 (59%)	87 (70%)	

Table 22 – Adjusted and unadjusted odds ratios of selected demographics from chi-squared test analysis with cluster group membership using multivariable logistic regression

Variable	Odds of Higher Risk Group (Grp 2) Membership				
	Unadjusted OR (95% CI)	P-Value		Adjusted OR (95% CI)	P-Value
Education – Left high school early	3.92 (2.01, 7.67)	**< 0.001***		3.07 (1.52, 6.22)	**0.002***
Living Situation – Precarious housing	8.93 (2.62, 30.47)	**< 0.001***		7.37 (2.10, 25.92)	**0.002***
Perceived Housing Stability - Unstable	4.17 (1.83, 9.53)	**0.001***		3.43 (1.44, 8.17)	**0.005***

Table 23 – Associations between cluster group membership and concern about recent HRB engagement – Chi-squared test

Variable n = 228	Total	Cluster Group Membership		
		Lower Risk Group (G1)	Higher Risk Group (G2)	P-Value (X^2)
Eat Junk/Fast Food	**212**			
No Concern	144 (67.9%)	61 (61.0%)	83 (74.1%)	**0.041***
Concern	68 (32.1%)	39 (39.0%)	29 (25.9%)	
Smoke Cigarettes	**135**			
No Concern	70 (51.9%)	7 (58.3%)	63 (51.2%)	0.638
Concern	65 (48.1%)	5 (41.7%)	60 (48.8%)	
Smoke Marijuana	**134**			
No Concern	105 (78.4%)	32 (78.1%)	73 (78.5%)	0.954
Concern	29 (21.6%)	9 (21.9%)	20 (21.5%)	
Drink to get Drunk	**132**			
No Concern	89 (67.4%)	39 (81.3%)	50 (59.5%)	**0.010***
Concern	43 (32.6%)	9 (18.7%)	34 (40.5%)	
Sex Without a Condom	**113**			
No Concern	65 (57.5%)	27 (67.5%)	38 (52.1%)	0.112
Concern	48 (42.5%)	13 (32.5%)	35 (47.9%)	
Get into Fights	**100**			
No Concern	53 (53.0%)	16 (66.7%)	37 (48.7%)	0.124
Concern	47 (47.0%)	8 (33.3%)	39 (51.3%)	
Use Non-injection Drugs	**45**			
No Concern	27 (60.0%)	5 (71.4%)	22 (57.9%)	0.502
Concern	18 (40.0%)	2 (28.6%)	16 (42.1%)	
Avoid Physical Activity	**40**			
No Concern	14 (35.0%)	10 (40.0%)	4 (26.7%)	0.392
Concern	26 (65.0%)	15 (60.0%)	11 (73.3%)	
Carry a Weapon	**39**			
No Concern	20 (51.3%)	5 (50.0%)	15 (51.7%)	0.925
Concern	19 (48.7%)	5 (50.0%)	14 (48.3%)	
Drink and Drive	**15**			
No Concern	6 (40.0%)	1 (25.0%)	5 (45.5%)	0.475
Concern	9 (60.0%)	3 (75.0%)	6 (54.5%)	
Extreme WL Measures	**6**			
No Concern	4 (66.7%)	0 (0 %)	4 (66.7%)	---
Concern	2 (33.3%)	0 (0 %)	2 (33.3%)	
Inject Drugs	**6**			
No Concern	4 (66.7%)	1 (100.0%)	3 (60.0%)	0.439
Concern	2 (33.3%)	0 (0 %)	2 (40.0%)	

Table 24 – Comparison of Ranked Proportions of Youth Concerned about Recent HRB Engagement within Clusters

Variable n = 228	Full Sample Conc/Eng (%)	Rank	Lower Risk Group (G1) n = 104	Rank	Higher Risk Group (G2) n = 124	Rank
Avoid Physical Activity	26/40 (65.0%)	1	15/25 (60.0%)	2	11/15 (73.3%)	1
Drink and Drive	9/15 (60.0%)	2	3/4 (75.0%)	1	6/11 (54.5%)	2
Carry a Weapon	19/39 (48.7%)	3	5/10 (50.0%)	3	14/29 (48.3%)	5
Smoke Cigarettes	65/135 (48.1%)	4	5/12 (41.7%)	4	60/123 (48.8%)	4
Get into Fights	47/100 (47.0%)	5	8/24 (33.3%)	6	39/76 (51.3%)	3
Sex Without a Condom	48/113 (42.5%)	6	13/40 (32.5%)	7	35/73 (47.9%)	6
Use Non-injection Drugs	18/45 (40.0%)	7	2/7 (28.6%)	8	16/38 (42.1%)	7
Inject Drugs	2/6 (33.3%)	8	0/1 (0 %)	11	2/5 (40.0%)	9
Extreme WL Measures	2/6 (33.3%)	8	0/0 (0 %)	---	2/6 (33.3%)	10
Drink to get Drunk	43/132 (32.6%)	10	9/48 (18.7%)	10	34/84 (40.5%)	8
Eat Junk/Fast Food	68/212 (32.1%)	11	39/100 (39.0%)	5	29/112 (25.9%)	11
Smoke Marijuana	29/134 (21.6%)	12	9/41 (21.9%)	9	20/93 (21.5%)	12

7. <u>Discussion</u>

7.1 Sociodemographic and Risk Behaviour Profile of the Sample

The sampling procedure invoked to obtain the data used in this study was intended to produce a sample with particular sociodemographic characteristics - specifically an over representation of youth with high public health needs due to precarious social and living conditions such as unstable housing and displacement from the education system. As mentioned, these youth are traditionally under-measured by home or school-based HRB surveys and are often required to cope with social conditions that increase their likelihood of engaging in HRBs (16,147,148). The sociodemographic characteristics and HRB engagement profile of the sample, as seen in the results of this study, reflect the intended objectives of the sampling procedure. Overall, the sample was characterized by an age and gender distribution typically found in youth populations, but with sociodemographic traits different than what would be predicted by a random probability sample of youth. For example, in 2006, about 20% of Winnipeg's youth (age 15-24) lived in the inner city (149). In the study sample, nearly 70% of the youth respondents lived in an inner-city neighborhood. As well, while a small minority (< 1%) of Canadian youth and young adults appear to be homeless or unstably housed (3,150), over 26% of the study sample lived in a precarious housing situation or described their housing as unstable. Estimates of sexual minority status among youth and young adults vary significantly, but generally range from 2% to 10% of the population (12,151). This differed from our sample where 25% of the respondents were categorized as sexual minority youth. Finally, the 2007-2010 high school dropout rate in Manitoba was 11.4% (152) which is considerably lower than the 26.3% of youth who were categorized as leaving school early in the study sample.

For each HRB where frequency of engagement was measured, the prevalence of HRB engagement in the sample typically fell in between estimates seen among general youth populations and priority youth populations such as those considered to be "street-involved". Street-involved youth exhibit higher rates of HRB engagement and are generally characterized by socio-demographic traits similar to those oversampled in this study, including poverty, precarious living conditions and early displacement from school (16). The proportion of youth exiting the school system early in our sample was more comparable to the school dropout rate seen among street-involved youth (35%) than the general youth population (16). Associations seen between sociodemographic traits and HRB engagement levels in this study were also consistent with current literature and theory. Some relationships that were expected however, were absent in the study and will be discussed further on.

In 2002, 3% of young women aged 15-29 reported behaviours and symptoms that suggested they were at risk of having an eating disorder (153). This figure is slightly lower but comparable to the 5.3% of females in the study sample who reported trying *extreme weight loss measures* (2.9% of sample). This could be due to the younger age of the study sample (14-24), and the increased likelihood of younger adolescent females suffering from an eating disorder over older adolescent females (3) (an association also seen in the current study).

Estimates for regular fast food consumption in Canada range from 30% to 40% (154) with 38% of high school students in MB reporting fast food consumption daily in 2012 (12). These numbers are congruent with the proportion of youth reporting daily or close-to-daily *consumption of junk food or fast food* in this study (31%). No sociodemographic associations with junk/fast food consumption were seen in the study, and besides gender, few strong relationships have been reported in the literature (155).

Various measures have been used to gauge youth engagement in physical activity. Some surveys ask about engagement in sedentary behaviours such as screen time, while others ask about engagement in behaviours involving physical activity. The current study asked about self reported *avoidance of physical activity* and found that 15% of the sample reported this behaviour. The closest measure that could be used for comparison was one from the 2012 YHS. They found that approximately 12% of all students in MB reported that they are not physically active (12) - a rate that is consistent with what was seen in our study.

In 2013, young adults (20-24 years) had the highest rate of smoking of any age group in Canada – 18% (156). As well, approximately 11% of youth (15-19 years) in Canada and 12% of secondary school students in MB report regular smoking (12,157). Compared to these provincial and national figures, the youth and young adults sampled in the current study demonstrated a much higher smoking rate. Nearly 57% of the entire sample reported *smoking cigarettes* daily or close to daily, and these rates were elevated to 80% - 90% for particular youth subgroups such as those who left school early or lived in unstable housing conditions. Despite this large discrepancy from general smoking rates, these figures were consistent with those found in the 2006 E-SYS report which saw 79% of street-involved youth report smoking every day (61). The rates found in the current study therefore reflect rates in the population of interest from which the investigators purposefully tried to oversample.

Youth and young adults (over the age of 16) have the greatest likelihood of all age groups to get into an impaired driver collision (158). Estimates of drinking and driving prevalence among youth and young adults range from 6% to 18% , and display a positive association with age (12,159). The prevalence of *drinking and driving* in our sample (8%) was at the lower end of this range. This may be due to the over-representation of youth in the sample

who experience low socioeconomic living conditions and potentially limited access to vehicles and/or driver training.

In Canada, approximately 48% of youth report consuming alcohol regularly, one-third of youth (32%) report binge drinking (5 or more drinks) at least once per month, and 7% - 15% of youth report binge drinking at least once per week (160). Approximately 40% of street-involved youth reported recent alcohol intoxication in the 2006 E-SYS surveillance report. Together, these figures appear to be consistent with the current study's finding that 43% of the youth sample reported *drinking to get drunk* at least 4 times in the 6 months prior to the survey.

Cannabis (marijuana) is the most commonly used illicit drug by youth; approximately 22% - 27% of Canadian youth and young adults surveyed in 2013, and 19% of MB students surveyed in 2012, reported recent use of marijuana (within 1 year) (12,157). Among both general youth populations and street-involved youth populations, the most common non-injection drugs, outside of marijuana, are cocaine, ecstasy and hallucinogens (crystal meth is also common among street-involved youth). Between 5% and 6% of youth or young adults in the general population reported use of one of these drugs in 2013 (157). Estimates of lifetime non-injection drug use (including marijuana) among street-involved youth ranged from 73% to 94% between 2001 and 2006 (61,161), however drug-specific rates were not available. Once again, the proportions discovered in the current study sat somewhere in between general youth estimates and street-involved youth estimates - 47% of the sample reported *smoking marijuana* at least 4 times in the past 6 months and 21% reported some *use of other non-injection drugs*. Additionally, the study found significant associations between substance use and sociodemographic characteristics such as unstable housing and displacement from the education system.

Recent estimates for injection drug use in general youth and young adult populations could not be found, however approximately 23% of youth who were street-involved reported *injection drug use* in 2006 (161). The proportion of youth reporting injecting drugs in this study (8%) appears to fit with this estimate as injection drug use is not considered a significant issue for the general youth population (3).

Estimates for the use of condoms or barriers during sex vary significantly depending on the age, gender, sexual orientation and social conditions of respondents. When asked about the most recent incident of sexual intercourse, approximately 25% of youth and 42% of young adults not in a monogamous relationship reported not using a condom (160). Among MB students who have had sex, 17% reported rarely using a condom and 12% reported never using a condom (12). Higher rates of unprotected sex have been seen among sexual minority and street-involved youth, with 41% - 53% of youth in sexual minority and street-involved subgroups reporting not using a barrier in their last sexual encounter (161,162). While the question administered in the current study posed some limitations for comparison and analysis (see Limitations), the proportion of youth reporting *sexual intercourse without using a condom* in the immediate 6 months prior to the survey (50%) appeared to align with these figures.

In the 2006 HSBC survey, between 44% and 53% of high school boys reported getting into a physical fight in the past 12 months (7). This rate was significantly lower among high school girls (33% - 22%) and rates tended to decrease as students progressed through high school grades (7). The HSBC survey also found that a greater proportion of adolescent boys carried weapons to school, with 17% reporting that they carried a weapon in the previous 30 days, compared to only 4% of adolescent girls. Gaetz et al. reported that homeless and street-involved youth were far more likely then general population youth to be involved in violent behavior

(58%) and be a victim of violent crime (82%) (163). It is therefore not surprising to see that 28% of homeless or street-involved youth reported carrying a weapon for protection (163). In the current study, 43% of the youth surveyed reported getting into a fight in the past 6 months and 17% reported carrying a weapon. As well, significant associations were seen between these behaviours and sociodemographic variables characteristics such as precarious housing conditions and early displacement from school. These figures and trends very much align with the literature cited on youth violent behaviours.

As mentioned earlier, certain demographic associations with HRB engagement has been seen in other risk behaviour literature that were not seen in this study. Firstly, many studies have noted that, compared to young females, young males are more prone to engaging in a variety of HRBs related to sex, substance use and violence (164,165). This was not seen in this study, as no gender differences were revealed for any HRBs besides smoking and unprotected sex where females reported a greater prevalence of HRB engagement. This could be an artifact of changing trends as some recent surveys have shown that the sex gap may be narrowing and young women are becoming as likely as young men to binge drink, smoke cigarettes and use other substances (166,167). A second relationship that has been exhibited in past literature but not in this study is the association between sexual minority status and HRB engagement (162,168). This discrepancy may be due to increasing trends in sexual orientation disclosure among youth (151) and thus a dilution of the previous relationship. Finally, with a large body of evidence indicating a connection between residing in a low SES or inner-city neighborhood in Winnipeg and poor health and social outcomes (132,169), it was expected that associations would be seen between neighborhood variables and youth HRB engagement in the study. This however was not the case as no significant associations were revealed. One possible explanation for this is that the

sampling strategy may have accessed youth living in low SES conditions, but living outside of the inner-city and regularly commuting downtown for social activity. Winnipeg is known to have small concentrated pockets of social housing, foster care, group housing and low SES conditions dispersed throughout higher SES suburban neighborhoods. Youth from these neighborhoods may still have characteristics of street-involvement but would not report living in a neighborhood classified as inner-city or low SES. This also explains the low correlation values seen between neighborhood, housing status and education status risk groups. As well, poverty may influence health status though other pathways besides the health behaviour pathway.

Overall, the sociodemographic characteristics and HRB engagement profile of the sample was sufficiently consistent with scientific evidence and theory so as to provide ample confidence that an exploration of HRB concern could generate findings that would fit within the greater body of HRB literature.

7.2 Research Question 1 – Do Winnipeg youth who engage in HRBs express concern about their HRB engagement? – What proportion of youth express concern?

The results from research question 1 supported the study hypothesis by revealing that youth in Winnipeg do express concern about HRBs that they engage in. Of the youth who partook in one or more HRBs, the majority (72.1%) expressed concern about their engagement in at least one. Further to that, youth do not appear to be "universally concerned" or "universally unconcerned" about their HRB engagement. Of the youth expressing HRB concern, 82.0% expressed concern about only a subset of the behaviours that they engaged in. Of the youth who did not express concern about any of their HRBs, most (56.9%) were only engaged in one or two of the listed behaviours.

Congruence with current theory and literature

The results from research question 1 are scientifically plausible and consistent with HRB literature and behaviour theory. As already mentioned, a significant body of literature purports that youth are very much aware of and informed about the risks and potential consequences of engaging in a number of different HRBs (53,83,109,111). In fact some studies have even reported youth overestimating risks or perceiving greater risks than adults regarding certain HRBs (109,111,170). This recognition and acknowledgement of risk plays a large role in forming the cognitive component of HRB attitude (41,104,105). There has also been a growing body of research around whether youth see themselves as vulnerable to the potential consequences of HRBs (109,171). The feeling of vulnerability to harm has been shown to play an important role in the affective component of HRB attitude (44,45,105). This literature however has been less clear. Some studies have described youth as "sensation seeking" and far more likely than adults to see themselves as invulnerable to risky behaviour (172–174). These perceptions of the "invulnerable adolescent" have been perpetuated by other studies that have asked groups of youth about their greatest health and non-health related concerns and found that issues pertaining to school, appearance, relationships and mental health consistently ranked higher than concerns related to HRBs such as substance use, sexual behaviour, nutrition and exercise (78,106,120,121). One key issue however regarding the design of these studies is that they ask ALL youth the same questions about their personal concerns or feelings of vulnerability to HRB consequences. As underscored in a number of HRB survey reports, the majority of youth and adolescents do not engage in HRBs at concerning levels (3,7). Therefore, when asked about their concerns or feelings of vulnerability to the harms of these HRBs, most youth would indicate them to be a low priority, especially in relation to more common experiences, such as many of

the concerns highlighted above. Some studies have therefore tried to control for the effect of

responses from "non-HRB engagers" and have found that many, if not most youth report feeling

some degree of vulnerability to negative outcomes or harm from HRB engagement

(109,111,175). These studies made all youth answer survey questions as though they were

engagers in particular HRBs. As well, qualitative research has also supported the notion that

youth engagement in HRBs isn't the result of egocentrism or a perception of personal

invulnerability to negative outcomes (53,117). The current study builds on these findings by

showing that most youth do express concern about their personal HRB engagement, which could

reflect their feeling of vulnerability to HRB consequences. It should be noted however, that

feelings of concern may result from other sources besides vulnerability, such as moral or ethical

distress.

    The findings from this study also align with theories, principles and literature on

motivational interviewing (25). As alluded to earlier, a central principle of MI is that individuals

regularly manage competing priorities, and each of those priorities invoke different levels of

motivation and concern (25). As Miller and Rollnick explain,

> *A person who is using multiple [substances] may be totally disinterested in*
> *changing one of them, willing to consider reducing another, and highly motivated*
> *to stop using yet another. Insisting that a person abstain from **all** drugs can be an*
> *obstacle to accomplishing positive changes (and associated harm reduction) that*
> *the person **is** willing to pursue.* (25, pg19)

This principle is also reflected in findings from TTM-related studies on individuals with

multiple behaviours of interest – a patient could be at a very early stage of change for some

behaviours and at a late stage for others (176,177). In the current study, the majority of youth

who engaged in multiple HRBs were only concerned about a subset of their behaviours. This finding is therefore consistent with the evidence-based principles of MI and TTM.

7.3 Research Question 2 – Does concern vary across different HRBs? – How does it vary?

The results from research question 2 also support the study hypotheses by showing that concern does vary significantly across different HRB's. However, only a few significant differences between HRB-specific concern levels were seen. Not including the low-prevalence behaviours with very large confidence intervals, most of the HRB concern proportions ranged from 40-50%. Only two HRBs displayed significantly different concern proportions from other HRBs: avoiding physical activity (72%) and smoking marijuana (21%).

Overall, the sample revealed various combinations of engagement and concern including behaviours with: 1) high prevalence and high proportions of youth concern, such as smoking cigarettes or getting into fights; 2) low prevalence and high proportions of youth concern, such as drinking and driving or avoiding physical activity; 3) high prevalence and low proportions of youth concern, such as smoking marijuana or drinking to get drunk; and 4) low prevalence and low proportions of youth concern, such as trying extreme weight loss measures or injection drug use.

Again, it should be reiterated that youth concern about HRB engagement was only measured among those who engaged in HRBs, and therefore does not fully reflect how behaviours are perceived among the general youth population. For example, while only 33% of injection drug users in the sample expressed concern about their injection drug use, this is likely not indicative of how the majority of youth feel about the risks and potential consequences of injection drug use. The very low prevalence of injection drug use in our sample indicates that it

is quite likely that most youth have a generally negative attitude towards the prospect of injecting

drugs. However, as mentioned earlier, the population of interest in this study were youth

engaging in HRBs, and the phenomena of interest was the concern youth had about their own

engagement. This type of information would be distinct from general population attitudes about

HRBs, but potentially more useful for public health intervention planning.

Congruence with current theory and literature

The results from research question 2 have some congruence with public health literature

and risk behaviour theory. However, as no other studies describing youth concern across

multiple HRBs could be found, robust comparisons with external literature was limited. The

question of what makes someone (or a group) concerned about their engagement in a particular

HRB over another HRB is a very difficult one to answer, and could benefit from more dedicated

research. It is clear that youth have a wide variety of health and social concerns

(78,106,119,120). Robert Weiler put a panel of experts together in 1993 to develop an

"Adolescent Health Concerns Inventory", and ended up with 150 different health-related items

(115). Studies by Weiler and others illustrate that while a few issues consistently rank high

among youth, such as those related to appearance (weight, acne, dental health), relationships

(family, friends, partners), emotional states (anxiety, depression), school (grades, graduation) and

career (occupation, income, success), it is incredibly challenging to predict what specific issues

or factors play a part in an individual's concern or motivation around engaging in a particular

HRB. It is even more challenging to predict the relative importance of each of these factors at an

individual or even population level. Miller and Rollnick explain how in MI, it is unwise to

assume that one already knows the costs and benefits that someone assigns to engaging in a

behaviour; what is valued by some (e.g. being healthy, employed, popular, slim, pious) will be of

little importance to others (25). All of this is further complicated when one tries to develop causal pathways between the vast array of existing public health, social and economic interventions and the concerns, motivations and behaviours of individuals (or populations). It is therefore difficult to interpret or explain how only two significant differences in youth concern proportions were found between different HRBs in the current study; especially given the findings from research question 1, and the fact that two significant differences were found. As is, the finding indicates that the youth in the current sample would be equally likely to be concerned about their engagement in 10 of the 12 HRBs if they were (or started) engaging in them. This would imply that all of the different factors and issues contributing to youth concern around a particular HRB, could equate to roughly the same amount of concern (among those engaging) at a population level across a large number of HRBs. One factor that could have certainly played a role in the near absence of differences was that the study sample size may not have been sufficient to adequately discern statistically significant differences in youth HRB concern proportion sizes. The confidence interval for each proportion was dependent on the prevalence of that behaviour in the sample. The original sample size of 240 was therefore dramatically reduced when creating concern estimates for each HRB which would have had significant effects on statistical power.

In trying to interpret the two significantly different youth HRB concern proportions that were found, challenges still remain, but some research may help explain the findings. Firstly, among the many surveys administered to youth on health and social concerns over the years, body image, appearance and attractiveness consistently rank very high among adolescent concerns (78,106,119,120). With physical activity and athleticism traditionally affiliated with positive body image and appearance traits, this could help explain the high proportion of youth in

the sample who were concerned about their avoidance of physical activity. However, it is recognized that certain ambiguity in the question wording could have affected the concern estimate. Youth who are not actually very active, but do not see themselves as "avoiding physical activity" may not have responded to the question. In this scenario, youth who were more likely to acknowledge their lack of physical activity as avoidance may have been also more likely to report concern. The estimate of concern regarding smoking marijuana is more robust given the smaller confidence interval and less ambiguity in the question. While little research has been conducted on the chronic effects of marijuana consumption, few severe short term or long term outcomes (i.e. death or severe morbidity) have been reported among adolescents (178) and studies indicate potential clinical benefits for some health conditions (179). This has caused many in recent years to campaign for marijuana legalization and commercialization in Canada and downplay its potential harms (133). As well, with marijuana being an illegal substance, governments have not put as much effort into public health messaging as they have for regulated substances such as tobacco or alcohol. Together, all of these factors have likely played a role in influencing youth perceptions around marijuana being less severe and therefore less of a concern than other HRBs that they engage in.

7.4 Research Question 3 – Are sociodemographic factors associated with differences in concern about HRB engagement among Winnipeg youth?

Two different methodological approaches were taken to answer research question 3. First, an isolationist approach was implemented, whereby each HRB was analyzed individually for associations between sociodemographic traits and HRB engagement and HRB concern by way of logistic regression and other tests of association. With respect to HRB concern, this method revealed a small number of significant associations at p-value alpha ≤ 0.10, but only one

significant association at p-value alpha ≤ 0.05 - youth from higher SES neighborhoods were more likely to be concerned about their junk/fast food consumption than youth from lower SES neighborhoods. As this segregated method of analysis was not very revealing, a second approach was taken to analyze the data from a more holistic perspective. This approach involved performing a cluster analysis on all 12 HRB engagement variables to identify any potential hidden patterns or groups in the data that would not have been discernable by looking at the HRBs individually. This method produced results that supported the hypothesis by revealing how differences exist in the likelihood of concern about particular HRBs among different groups of youth with different sociodemographic traits. By looking at the HRB engagement data globally, two clear groups emerged: a "higher risk" group defined by frequent engagement in 8 of the 12 HRBs, particularly those related to tobacco, substance use and violence; and a "lower risk" group defined by low levels of engagement in those 8 HRBs, but a higher likelihood of reporting regular avoidance of physical activity. Further analysis revealed that these two groups had quite different sociodemographic characteristics and diverged significantly in their concern around engagement in 2 of the 12 HRBs. In comparison to the lower risk group, the higher risk group was composed of many more youth who had left school early, lived in a precarious housing situation, or perceived their housing as unstable. These youth were more likely to be concerned about their alcohol consumption than youth in the lower risk group, but were less likely to be concerned about their junk food or fast food consumption. It is also interesting to note that junk food/fast food consumption played no role in contributing to the cluster solution. This finding indicates that with respect to some variables, different groups of youth can show similar frequencies of engagement in a given variable, but differ in their level of concern about that variable. It cannot therefore be assumed that a given percentage of youth will always be

concerned about a specific behaviour they may be engaging in, and prevention measures must potentially account for the specific characteristics of the youth being targeted.

One explanation for why associations may not have been seen by the first method of analysis is that each sociodemographic risk factor, when examined on its own with an isolated HRB, may have had a very small effect size, masked by small cell sizes and a lack of statistical power. However, when these risk factors were combined in one analysis and a fuller picture of HRB engagement was analyzed, stronger patterns in the data could emerge. As will be described in the next section, this approach to studying HRB engagement in a more cohesive and all-encompassing fashion, is one that is gaining wider appreciation and has grown significantly in the past decade.

Congruence with current theory and literature

Until recently, health research has tended to focus on single health-related behaviours in isolation from one another (139). Sexual risk behaviours were analyzed independently from violence-related behaviours, and both were analyzed independently from substance use. While research still continues in each of these areas independently, a new trend has now emerged in HRB research – that of multiple HRB analysis. As public health surveillance began collecting data on multiple HRBs (7,20) and statistical techniques evolved, researchers began taking a broader lifestyle approach in their HRB analysis. A 2013 review of statistical approaches used in the analysis of multiple health-related behaviours revealed a rapid increase in research on concurrent health-related behaviours between 2004 and 2011, and an increasing interest in cluster analytical methods after 2007 (139). Exploratory, data-driven methods such as cluster analysis or latent class analysis, seek to uncover homogenous groups of people based on the actual structure of data, and are thus considered to be person-centered approaches to analysis

(144). As opposed to other statistical methods used to analyze multiple HRB engagement, these methods do not impose pre-defined definitions of what is healthy or unhealthy behaviour and can incorporate a range of response values across each behaviour of interest - a particular feature of cluster analysis that this investigation benefited from (139,141).

A number of studies have demonstrated the clustering of HRBs among youth and adolescent populations (141,180–182). While various cluster solutions have been presented in these studies, generally one or more clusters are always characterized with greater overall HRB engagement than other clusters. As well, in some studies, sedentary behaviour has been split away from other delinquent behaviours (183,184). It therefore came as no surprise when a similar result was found in the current study. Many of these investigations have also demonstrated significant associations between clusters with high levels of HRB engagement and sociodemographic traits such as low levels of education or family income (141,180,181); again, results that seem to align with what was found in the present study. However, what there appears to be little-to-no research on is how youth in these HRB engagement clusters might differ in regards to their likelihood of being concerned about the behaviours that they engage in. The current study helps address this gap by showing that clusters characterized by different HRB engagement profiles exhibit similar proportions of youth concern around certain HRBs, but differing proportions of concern around other HRBs. Another limited area of research that this study sheds light on is the examination of HRB concerns across different sociodemographic groups. While past studies have revealed associations between health concerns and demographic traits such as age or gender (78,113,119), findings have been mixed about HRB-related concerns as they relate to SES conditions (78,117,185). Studies by Feldman (78) and Carroll (185) show little variation in the frequency or type of HRB-related concern between different socioeconomic

groups, whereas a qualitative study conducted by de Moura hinted that some differences in concern could exist (117). De Moura showed that both youth from privileged schools and street-involved youth express concerns and fears about disease, however youth from underprivileged settings emphasize different reasons for their fear or lack of fear (117). This study presented results that reflect some of the consistency across SES groups seen by Feldman and Carroll as well as some of the variation exhibited by de Moura.

A very clear finding in the current study, and one that cannot be understated, is that many youth engaging in multiple high risk behaviours do exhibit feelings of concern and vulnerability to negative outcomes associated with HRB engagement. For these youth, other factors clearly play a significant role in their continued HRB engagement. Equally important, is the finding that youth from marginalized socioeconomic groups generally express no less concern about their HRB engagement than youth from less disadvantaged groups. In fact, a closer inspection of the results from Chi-squared and Fisher's exact analyses reveal the possibility that youth who exhibit characteristics of street-involvement may even express greater concern about their HRB engagement than youth in the general population. Together, these findings help dispel claims by some that the culture and conditions of living on the street reinforces a general disregard for the future consequences of health behaviour due to the basic pressures of day-to-day survival (186,187). These results also support the notion that youth from various socio-economic groups share similar levels of exposure to information on the risks of HRB engagement (53,83). De Moura saw similar things – although some youth in the "deprived adolescent group" shared fatalistic views about future health outcomes, the majority of respondents in the group expressed similar fears and vulnerabilities as youth from the "privileged adolescent group" (117).

As mentioned earlier, trying to interpret the specific differences found in youth concern about HRB engagement poses challenges due to the complex nature of environment-attitude-behaviour relations. However one can speculate plausible explanations for the differences seen between the two HRB engagement clusters regarding likelihood of concern about eating junk food or fast food and binge drinking behaviour. Many adolescents have reported experiencing a plethora of harmful immediate and long term outcomes from drinking, including those related to physical health, relationships, family, work and school (188). For others (and especially those living in marginalized social conditions), alcohol has been associated with violence-related injuries, legal and housing problems and learning difficulties (189,190). As well, alcohol consumption has been associated with increased engagement in a number of other HRBs, including drinking and driving, unprotected sex and substance use (168). In contrast, the harmful effects of having a poor diet are delayed and far less severe (4). It would therefore be reasonable to expect that youth who may be experiencing negative outcomes from frequent engagement in multiple HRBs would see reducing their alcohol consumption as a greater priority than youth with more controlled HRB engagement.

With membership in the low risk cluster being associated with an increased likelihood of reporting an avoidance of physical activity, weight-related health behaviours may logically be a higher priority for this group. However, this explanation conflicts with the finding that both clusters had a similar likelihood of being concerned about their avoidance of physical activity.

A final note that should be made is that in many scenarios, associations between sociodemographic characteristics and HRB concern were not seen where they may have been expected, given previous literature and theory. Examples include age and gender associations with concern about behaviours such as unprotected sex, violence or weight-related behaviours

(78,109,141). It is difficult to discern whether this was due to changing trends in youth culture or simply artifacts of the sample. Regardless, this finding reinforces the notion that assumptions should not be made about whether a person or a demographic subgroup will or won't be concerned about their engagement in a particular HRB.

7.5 Implications for future research, policy and practice

This study was exploratory, and as such was not intended to immediately inform public health policy. However, as an exploratory study, it has succeeded in demonstrating that not only do youth express varying levels of concern across different HRBs, but that different groups of youth exist, characterized by different sociodemographic traits and HRB engagement patterns, who show variation in the specific HRBs that they are concerned about. As well, a construct for HRB concern was developed in relation to previous HRB models and literature, and a particular operationalization of the construct was demonstrated to vary systematically across HRBs and across sociodemographic groups. Despite these findings, one cannot make an immediate jump towards estimating or predicting levels of youth concern about HRB engagement without first pursuing a number of other research questions and streams of scientific inquiry to further elucidate and formalize the construct of youth HRB concern. Firstly, given the undeveloped nature of the health concern concept in psychological, sociological and public health literature, research that can help clarify the exact role of concern in current health behaviour theories, models or frameworks would help one define the scope of the construct in relation to HRB engagement. For example, it is unclear whether various types of concern exist that may have differing impacts on attitude, intentions or behaviour; or whether the term has different cultural meanings for different demographic subgroups. This theory-building research would require qualitative data collection from various groups of youth on what "concern" means to them,

particularly in relation to their HRB engagement. Once a greater level of understanding has been reached about the HRB concern construct, it can then be determined what is and isn't being measured in specific questions about HRB concern on quantitative surveys. This would then allow one to develop validated survey instruments that could ensure accurate and comparable estimates. These instruments could then be administered to large probability samples of youth to generate estimates and test hypotheses with some degree of internal and external validity. A second line of inquiry that would be very relevant is the examination of what individual, social, cultural, environmental and structural factors influence youth concern about HRB engagement. While this would be a daunting task, it would allow for greater predictive and evaluative capability when designing and implementing public health interventions.

Despite the exploratory nature of the study, the findings do reveal particular patterns that may warrant consideration by public health researchers, programmers and policy makers. Firstly, youth do express concern about their HRB engagement and are more likely to be concerned about some behaviours over other behaviours. When resource scarcity is an issue and youth health promotion interventions need to be prioritized, it may be beneficial to assess group or population level concern about behaviours of interest, as this could inform the type of interventions selected. For example, in the study sample, it would be reasonable to presume that a restriction or regulation aimed to promote physical activity may be more embraced by its target population than one aimed at reducing marijuana consumption. As well, interventions designed to increase concern (e.g. education and advertising) may be more suited for marijuana consumption than for other HRBs in this sample, whereas other types of interventions (e.g. environmental restructuring or skill training) may be better suited for promoting youth physical activity, where low concern is less of an issue. The latter could include improving access to fun

and engaging opportunities for physical activity, or adjusting the built environment or school policies to facilitate the incorporation of physical activity into adolescents' day-to-day lives. The second important finding with potential public health implications is that different groups of youth can show similar levels of engagement in a particular HRB, but differ in their level of concern about engaging in it. This would again have implications for the selection and expectations of a particular intervention among different sociodemographic subsets of youth.

8. <u>Limitations</u>

A number of important limitations to this study should be acknowledged. As in most HRB studies, the data analyzed were based on self-reported measures of HRB engagement and concern. While self reported measures are generally affiliated with bias due to issues of social desirability, multiple measures were taken by the survey designers and administrators to maximize respondent authenticity and validity of responses. Questions were developed to be pointed, time-bounded, comprehensible at a low literacy level and non-stigmatizing. Survey administrators were young and trained to deliver questions in a non-imposing or judgmental fashion. As mentioned earlier, the construct of concern has not yet been fully established or formalized, and therefore no validated survey instrument on concern could be used. Although only a single, non-validated measure was used to create concern estimates, the finding of differing levels of expressed concern across different HRBs and subgroups supports the validity of the item. As well, survey administrators collected qualitative notes on reasons for concern when concern was expressed for a large portion of respondents. The coherence of these notes also supports the question's validity. A third limitation relates to particular items where question ambiguity could have affected estimates. Particularly ambiguous items include those for eating

junk food or fast food and having sex without a condom. With junk food or fast food not being operationally defined, interpretation could have varied significantly between respondents; and as a large number of scenarios exist where having sex without using a condom may not be considered a HRB, engagement estimates may have been overestimated and concern estimates may have been underestimated. A better version of the "unprotected sex" question would have used the term "barrier" instead of "condom" and clarified whether respondents were married, in a monogamous relationship, or trying to get pregnant. However, as all HRB engagement estimates were consistent with external literature, item ambiguity did not cause any major concern. A fourth limitation that should be mentioned is that results (both positive and negative) may have been affected by confounding variables that were not measured and not controlled for. Finally, it should be reiterated that the sample in the study was not a random probability sample, and thus results should not be generalized to other youth populations. However, as already mentioned, the aim of this study was to generate hypotheses and not to test them. This allowed the analysis of data from important populations who are traditionally under-represented in probability samples of general youth populations.

9. <u>Conclusion</u>

This exploratory study demonstrated three things: 1) youth in Winnipeg do express concern about HRBs that they engage in; 2) the likelihood of youth being concerned about their HRB engagement varies depending on what HRB one is looking at; and 3) while youth display similar trends in their levels of concern about many HRBs, different groups of youth characterized by different HRB engagement patterns and sociodemographic traits vary in their likelihood of being concerned about some HRBs that they engage in. These findings warrant

further investigation into the phenomena of youth concern about HRB engagement; both in terms of quantitative research to establish more robust estimates (with larger datasets and validated survey instruments) and qualitative research to better understand the construct of concern in relation to youth HRB engagement. Future findings could help inform public health programming and policy in the area of youth health promotion in both urban and non-urban settings.

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Appendix 1 – Survey Items

DEMOGRAPHICS

A1. What is your gender?

(1) Male   (2) Female   (3) Trans M-F   (4) Trans F-M

(88) Not sure/haven't decided/questioning   (99) Refused

A2. Would you describe yourself as:

(1) Heterosexual/ Straight   (2) Queer/Homosexual/ Gay/ Lesbian   (3) Bisexual

(4) Two-spirited   (88) Not sure; haven't decided   (99) Refused

A3. How old are you?

_____ years   (88) Don't Know   (99) Refused

A4. In what area of Winnipeg do you live?

_____

If youth indicate "outside Winnipeg", check here:_____

A5. Where do you currently live? (if multiple, inquire where the participant stayed last night)

(1) Family's house/condo/apartment   (2) My own house/condo/apartment

(3) Friend's or boy/girlfriend's house/condo/apartment   (4) Hotel

(5) Rooming house/boarding house/hostel   (6) Shelter/Institution

(7) Group home/foster home   (8) On the street   (99) Refused

A6. Is your housing situation:

(1) Stable – you have been or will be there for a while

(2) Unstable – you tend to move around a lot, or may not be there for very long

(88) Unsure

(99) Refused

A7. What is the highest level of education that you have completed?

(1) Grade 8 or less

(2) Some high school (gr. 9-12); still enrolled

(3) Some high school (gr. 9-12); not enrolled

(4) High school diploma or GED

(5) Some postsecondary education or college or university diploma/degree

(7) Other _____

(88) Don't Know   (99) Refused

YOUTH CONCERN ABOUT AND FREQUENCY OF BEHAVIOURS

Below is a list of things that some people do. I'm first going to ask you about your own behavior and you can tell me if you do those things and how often. For each behavior that you do, I'll also ask you if it worries, bothers or concerns you that you do it.

Frequency of engaging in that behaviour:

1 = Never, 2 = 1-3 times in past 6 months, 3 = at least 4 times in past 6 months, 4 = daily or close to daily

Level of concern about doing behaviour:

1 = I'm not worried or concerned that I do that, 2 = I'm a little worried or concerned that I do that; 3 = it concerns me that I do that

	D1. In the last 6 months, how often did you:				D2. Are you concerned or worried that you do that?		
Smoke cigarettes	1	2	3	4	1	2	3
Get into fights	1	2	3	4	1	2	3
Carry a weapon	1	2	3	4	1	2	3
Drink to get drunk	1	2	3	4	1	2	3
Drink & drive	1	2	3	4	1	2	3
Smoke marijuana	1	2	3	4	1	2	3
Inject drugs	1	2	3	4	1	2	3
Use other non-Injection drugs (e.g. cocaine, crack, meth, ecstasy, pills not prescribed to you)	1	2	3	4	1	2	3
Have sex without a condom	1	2	3	4	1	2	3
Try extreme weight loss measures (e.g. fasting, vomiting)	1	2	3	4	1	2	3
Eat junk food or fast food	1	2	3	4	1	2	3
Avoid physical exercise or activity	1	2	3	4	1	2	3

## Appendix 2 – Ethics Approval Form

QUALITY ASSURANCE
The University of Manitoba Research Quality Management Office may request to review research documentation from this research study/project to demonstrate compliance with this approved protocol and the University of Manitoba Policy on the Ethics of Research Involving Humans.

CONDITIONS OF APPROVAL:

1. The study is acceptable on scientific and ethical grounds for the ethics of human use only. For logistics of performing the study, approval must be sought from the relevant institution(s).
2. This research study/project is to be conducted by the local principal investigator listed on this certificate of approval.
3. The principal investigator has the responsibility for any other administrative or regulatory approvals that may pertain to the research study/project, and for ensuring that the authorized research is carried out according to governing law.
4. This approval is valid until the expiry date noted on this certificate of approval. A Bannatyne Campus Annual Study Status Report must be submitted to the HREB within 15-30 days of this expiry date.
5. Any changes of the protocol (including recruitment procedures, etc.), informed consent form(s) or documents must be reported to the HREB for consideration in advance of implementation of such changes on the Bannatyne Campus Research Amendment Form.
6. Adverse events and unanticipated problems must be reported to the HREB as per Bannatyne Campus Research Boards Standard Operating procedures.
7. The UM HREB must be notified regarding discontinuation or study/project closure on the Bannatyne Campus Final Study Status Report.

Sincerely,
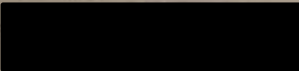
John Arnett, PhD, C. Psych.
Chair, Health Research Ethics Board
Bannatyne Campus

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