Motivation and Readiness in Managing Adolescent Obesity: Treatment Fidelity, Lived Experiences, and *Readiness to Change Ruler*

by

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Abstract

Background. One in three Canadian children and adolescents are living with obesity, so evidence-based, effective interventions for managing adolescent obesity are critically important. Motivation (*i.e.,* desire and drive for change) and readiness to change (*i.e.,* capability for change) are constructs that are often integrated into the assessment tools and interventions for managing adolescent obesity, but the contribution of these inter-related concepts remain poorly characterized. Health care practitioners need more evidence to help them tailor interventions for managing adolescent obesity, including measuring families' motivation and readiness, selecting appropriate assessment tools, and gaining a better understanding of adolescents' lived experiences with obesity.

Objectives. To *(i)* assess the fidelity, key-elements, and reporting of interventions based on motivational interviewing (MI) for managing adolescent obesity, *(ii)* understand adolescents' experiences living with obesity and making behavioural changes, and *(iii)* evaluate the scores and psychometric properties of the *Readiness to Change Ruler* in obesity management and predictors of readiness to change at baseline, 6-, and 12-months follow-up in adolescents with obesity and their parents.

Methods. This multiple-methods dissertation includes three studies conducted between 2017 and 2022. Study 1 was a scoping review and stakeholder consultation on the application and reporting of MI for the management of adolescent obesity (objective 1). Study 2 was a qualitative study that used interpretative phenomenological analysis and involved one-on-one, semi-structured, virtual interviews with adolescents with obesity enrolled in pediatric obesity management (objective 2). Study 3 was a quantitative study that involved secondary analysis of

data from a prospective cohort study to examine the reliability (*i.e.,* internal consistency, levels of agreement) and validity (*i.e.,* construct validity) of the 5-item *Readiness to Change Ruler* and calculate associations with readiness to change (objective 3).

Results. Study 1 (n=26 studies; n=13 stakeholders) found that MI-based interventions for managing adolescent obesity had 'low treatment fidelity'. In addition, there were no studies with 'high treatment fidelity' across all five domains — theory, training, implementation, treatment receipt, and treatment enactment. Of the treatment fidelity strategies, fidelity to theory was the most adhered to while treatment enactment was the lowest. In Study 2, adolescents' (n=7) lived experiences with obesity were related to: *(i)* emotional reactions during clinical encounters, including positive, neutral, or negative reactions; *(ii)* fear and apprehension when changing behaviours, particularly fear of failure and motivational readiness to change physical activity, nutrition, and sleep habits; and *(iii)* behaviour change complications that included unexpected circumstances (*e.g.,* COVID-19 pandemic) and required family involvement and interest. In Study 3, data analyses were conducted with 54 adolescent-parent dyads (n=108 participants). Cronbach's α coefficients for the 5-item *Readiness to Change Ruler* completed by adolescent-parent dyads were ≥0.8 (range: 0.8 to 0.9), indicating good internal consistency at all three time points. In addition, adolescent-parent mean ICCs were ≥0.7 (range: 0.7 to 0.8), suggesting good levels of agreement for the total scale. For construct validity, exploratory factor analysis for the *Readiness to Change Ruler* identified a one-factor structure (all factor loadings ≥0.3) for adolescents at all three time points and parents at 6- and 12-months follow-up. At baseline, no family history of chronic diseases was positively associated with parents' readiness to change their adolescents' behaviours (β=0.416, $p<0.001$).

Conclusions. Findings from this dissertation offer valuable insights into motivation and readiness to change for managing adolescent obesity and highlight the importance of reporting treatment fidelity in MI-based interventions, providing tailored health care services, and utilizing an evidenced-based assessment tool. Treatment fidelity is important in the planning, implementation, and evaluation of MI-based interventions for managing adolescent obesity. Adolescents' lived experiences with obesity revealed varying behavioural changes. This can be attributed to their individual needs, as well as emotions, apprehension, and difficulties with changing behaviours. The 5-item *Readiness to Change Ruler* provides evidence that it is a reliable and valid measure for assessing readiness to change in adolescents with obesity and their parents. The relationships between sociodemographic variables, personal health history, and readiness to change require further study.

Preface

This thesis is an original work by Nadia E. Browne. Ethics approval was obtained from the Health Research Ethics Board at the University of Alberta for the research studies which form this thesis: Study Name "Applying and Reporting Motivational Interviewing in Managing Adolescent Obesity: A Scoping Review and Stakeholder Consultation", Pro00100039, approved on January 21, 2021; "The lived experiences of changing lifestyle habits in adolescents with obesity: An Interpretative Phenomenological Analysis", Pro00112714, approved on September 13, 2021; and "Developing and validating the readiness and motivation interview for families (RMI-Family) managing pediatric obesity", Pro00051447, approved on November 19, 2014 and the Conjoint Health Research Ethics Board at the University of Calgary: Study Name "Developing and validating the readiness and motivation interview for families (RMI-Family) managing pediatric obesity", REB14-2320, approved on January 21, 2015. Some of the research conducted for this thesis also forms part of a multidisciplinary research project funded by the Canadian Institutes of Health Research (CIHR), led by Co-Principal Investigators Geoff DC Ball (University of Alberta) and Josie Geller (University of British Columbia).

Chapter 2 of this thesis was published as Browne NE, Newton AS, Gokiert R, Holt NL, Gehring ND, Perez A, Ball GDC. The Application and Reporting of Motivational Interviewing in Managing Adolescent Obesity: A Scoping Review and Stakeholder Consultation. Obes Rev 2022; 23: e13505. Alongside the mentorship of Geoff Ball, I was responsible for *(i)* designing the study, *(ii)* collecting, analyzing, and interpreting the data, and *(iii)* writing the first draft of the manuscript and subsequent revisions.

Chapter 3 of this thesis is being prepared for submission as Browne NE, Newton AS, Gokiert R, Holt NL, Perez A, Ball GDC. Adolescents' lived experiences with obesity and

changing behavioural habits: An interpretative phenomenological analysis. Target journal is Journal of the Academy of Nutrition and Pediatrics. Alongside the mentorship of Geoff Ball, I was responsible for *(i)* designing the study, *(ii)* collecting, analyzing, and interpreting the data, and *(iii)* writing the first draft of the manuscript and subsequent revisions.

Chapter 4 of this thesis is being prepared for submission as Browne NE, Gokiert R, Newton A, Holt NL, Spence N, Mâsse LC, Geller J, Ho J, Ball GDC; and the RMI-Family Study Team. Measuring Adolescents' and Parents' Readiness for Behaviour Change in Managing Adolescent Obesity: Psychometric Properties of the *Readiness to Change Ruler*. Target journal is Journal of Nutrition Education and Behavior. Alongside the mentorship of Geoff Ball, I was responsible for *(i)* defining the research question, *(ii)* designing the study, *(iii)* coordinating data extraction and cleaning, *(iv)* collecting (some of the data), analyzing, and interpreting the data, and *(iii)* writing the first draft of the manuscript and subsequent revisions. An operating grant from CIHR supported this research.

Dedication

This dissertation is dedicated to my parents, Cynthia Hope-Browne and Eric Browne, who were my pillars of strength during graduate school. They encouraged me endlessly — this milestone would not have been possible without them. My deepest gratitude is to my parents.

My devoted supervisor, Dr. Geoff DC Ball, deserves immense credit for his capacity to be patient and compassionate. Though it was a long and arduous journey, his extensive support through good and bad times was phenomenal.

This dissertation also commemorates the memory of my childhood friend, Kimone Francis, who was a constant source of inspiration throughout my life. While I miss her daily, I am forever grateful for her encouragement during my doctoral program.

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Firstly, I want to thank God for his unconditional love and grace. A few years into my doctoral program, I was diagnosed with an autoimmune condition, which required me to take a leave of absence. At the time, I was uncertain about my future. Considering returning to my program, I feared the obstacles that awaited me. Even though my journey took longer than expected and looked different from what I had imagined, God was always at the helm.

It gives me great pleasure to thank my supervisor, Dr. Geoff DC Ball, for his unwavering support, guidance, patience, and encouragement; I am deeply indebted to him. Dr. Ball played a crucial role in my academic journey, which was emotional, challenging, and rewarding. Besides being a thoughtful, exceptional mentor, he provided numerous networking opportunities and pushed me far beyond my comfort zone; he deserves all the accolades. From the depths of my heart, thank you, Dr. Ball. My sincere appreciation and thanks also go out to my committee members, Drs. Rebecca Gokiert, Nicholas Holt, and Amanda Newton for contributing their time, ingenious feedback, unconditional guidance, and challenging me to grow as a clinician-scientist. The mentorship they provided was instrumental in nurturing my critical thinking and honing my research skills.

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Virtanen, and Samantha Davies, I would not have been able to conduct my research studies. I cannot adequately thank you all for your assistance and participation.

My family and friends provided me with the steadfast support I needed to maintain my emotional wellness. An enormous thank you to my parents, Cynthia Hope-Browne and Eric Browne, and brother, Micah Browne for their sacrificial acts of love which never went unnoticed. In addition, a heartfelt thank you to my family and friends in Canada, the United Kingdom, the United States of America, and St. Vincent and the Grenadines for their prayers, kindness, and generosity.

Lastly, I am forever grateful for the financial support I received throughout this journey from the Women and Children's Health Research Institute, Government of St. Vincent and the Grenadines, St. Vincent and the Grenadines Association of Calgary, and the University of Alberta's Faculty of Medicine and Dentistry and Graduate Students' Association.

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List of Abbreviations

AAP	American Academy of Pediatrics
BIPOC	Black, Indigenous, and People of Colour
BMI	Body Mass Index
BREQ	Behavioural Regulation Questionnaire
CDN	Canadian
CI	Confidence Interval
CIHR	Canadian Institutes of Health Research
COS	Canadian Obesity Summit
COVID-19	Coronavirus Disease 2019
e	Electronic
EFA	Exploratory Factor Analysis
FDA	Food and Drug Administration
FRAMES	Feedback, Responsibility, Advice, Menu, Empathy, and Self-Efficacy
HCP	Health Care Practitioners
ICC	Intraclass Correlation Coefficients
IPA	Interpretative Phenomenological Analysis
KMO	Kaiser-Meyer-Olkin
LGBTQIA	Lesbian, Gay, Bisexual, Transgender, Queer, Intersex, and Asexual
LSG	Laparoscopic Sleeve Gastrectomy
MI	Motivational Interviewing
MINT	Motivational Interviewing Network of Trainers
NIH	National Institutes of Health

PCOS	Polycystic Ovarian Syndrome
POM	Pediatric Obesity Management
PRISMA-ScR	Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Review
REDCap	Research Electronic Data Capture
RMI-Family	Readiness and motivation interview for families
RYGB	Roux-en-Y Gastric Bypass
SD	Standard Deviation
SMART	Specific, Measurable, Attainable, Realistic, and Timely
UCDHSC	University of Colorado at Denver and Health Sciences Center
WHO	World Health Organization

Chapter 1

Introduction

In my doctoral dissertation, I explored motivation and readiness to change behavioural habits in adolescents with obesity and their parents for managing adolescent obesity. My multiple-methods dissertation includes primary data collected from two studies: a scoping review study (Study 1, Chapter 2) and a qualitative study (Study 2, Chapter 3), as well as secondary data obtained from an already completed study: quantitative study (Study 3, Chapter 4). Study 1 provided foundational knowledge related to the application and reporting of motivational interviewing (MI) as well as evidence on treatment fidelity of MI-based interventions for managing obesity in adolescents. Study 2 explored how adolescents with obesity experience changing their behavioural habits (*e.g.,* diet, physical activity, sedentary activity, sleep) within a Pediatric Obesity Management (POM) clinic. Study 3 (secondary data from a CIHR-funded, multi-site study) evaluated the scores and psychometric properties of the *Readiness to Change Ruler* in families (*i.e.,* adolescents and their parents) in POM clinics and examined sociodemographic and personal health history variables related to readiness to change over time.

This paper-based dissertation consists of three original studies and includes one publication (Browne et al., 2022 [Chapter 2]), one prepared manuscript (Chapter 3), and another manuscript that is being prepared for submission (Chapter 4). In this introductory chapter, I provide a general overview of my dissertation, including *(i)* background literature on adolescent obesity management, *(ii)* rationale for the three studies that comprise my dissertation, *(iii)* ontological, epistemological, and theoretical underpinnings of my research, and *(v)* the overarching objectives of the included studies.

1.1. Background

1.1.1. Obesity Prevalence, Etiology, and Consequences

Over one billion people worldwide live with obesity (World Health Organization, 2022), a complex, chronic disease that requires long-term management and support. Between 1975 and 2016, obesity nearly tripled in children, adolescents, and adults worldwide (Abarca-Gómez et al., 2017). More specifically, the number of children and adolescents aged 5-19 years living with obesity increased from 11 to 124 million (Abarca-Gómez et al., 2017). Therefore, implementing comprehensive population public health strategies are necessary for controlling the global obesity epidemic and related chronic diseases.

Obesity is characterized by excessive or abnormal fat accumulation, which may impair physical, psychological, and metabolic health (World Health Organization, 2021). Body mass index (BMI) is a simple, inexpensive, albeit indirect, measure commonly used to assess body fat (Adab et al., 2018; Anderson et al., 2017). One-third of children and adolescents aged 12-17 years in Canada are classified as living with overweight or obesity (Rao et al., 2016). For Canadian children and adolescents (5-19 years old), overweight (BMI equal to or greater than the 85^{th} and less than the 95^{th} percentile) and obesity (BMI equal to or greater than the 95^{th} percentile) are defined using the 2007 World Health Organization (WHO) Growth Reference (Dietitians of Canada, 2010; Onis et al., 2007). Globally, in health care and research settings, the Centers for Disease Control and Prevention 95th percentile and WHO z-score have been used interchangeably when referring to adolescents with obesity. In a recent Canadian study, which examined data from children and adolescents aged 3-18 years, the authors suggested that using the WHO BMI z-score could be valuable for health care and research professionals who follow the WHO growth reference for severe obesity (Ball et al., 2023).

Obesity is due to an imbalance between energy intake and energy expenditure; there is no single factor contributing to the disease (Crocker and Yanovski, 2011). Rather, obesity is a disease with a multifactorial etiology including biological, environmental, and social factors (Kumar and Kelly, 2017; Skelton et al., 2011; Vandenbroeck et al., 2007) such as behavioural habits (*e.g.,* poor eating habits), sleep deprivation (*e.g.,* insomnia), endocrine disorders (*e.g.,* hypothyroidism), and medications (*e.g.,* glucocorticoids). Research has shown that adolescent obesity increases the likelihood of living with obesity as an adult (Davis et al., 2012; Guo et al., 1994; Singh et al., 2008). Prolonged obesity in adolescents has been associated with higher morbidity and mortality rates (Harrison and Haslam, 2010; Reilly and Kelly, 2011). It is well documented that biological and environmental factors as well as social inequalities and vulnerabilities contribute to adolescent obesity (Hampl et al., 2023).

Biological factors that influence food intake include the gut-microbiota-brain axis, sensory cues (*e.g.,* sight, smell), and gastrointestinal signals (*e.g.,* ghrelin, peptides) (Asadi et al., 2022; Chaudhri et al., 2008; Skelton et al., 2011). Evidence has also shown that 30 to 70% of an individual's risk for obesity is determined by genetics (Allison et al., 1996; Bouchard, 1997; Maes et al., 1997; Schousboe et al., 2004; Stunkard et al., 1990). In addition, some individuals with obesity have a genetic variation that can result in a lack of physical activity, decrease in metabolism, higher food consumption, and a greater propensity to store fat (Bouchard et al., 2004; Castillo et al., 2017; Martinez, 2000; Rask-Andersen et al., 2017). As adolescents grow, their body composition changes, including the size and number of fat cells and distribution of body fat. Adolescent males tend to deposit fat more prominently in the subcutaneous abdominal area than adolescent females who deposit fat more peripherally (Daniels et al., 2005; Dietz, 1997; Pietrobelli et al., 2005).

Changing environmental factors, such as greater availability of high-calorie fast foods, increased consumption of foods and beverages high in sugar, and sedentary behaviours also contribute to obesity (Banfield et al., 2016; Romieu et al., 2017). Findings from the Canadian Community Health Survey suggest that caloric intake is greatest during adolescence (Garriguet, 2004). Sedentary behaviours and reduced physical activity can further contribute to obesity among adolescents (Nelson et al., 2006; Skelton et al., 2011; Stettler et al., 2004). Parents can shape the home environment of adolescents through direct support, role modeling, monitoring, and reinforcement of healthy behaviours (Faith et al., 2012). Obesity in adolescents can also be influenced by the school environment, which can lead to increased consumption of nutrient-rich foods as well as decreased intake of sugar, sodium, saturated fats, and calories (Critch, 2020).

Social inequities and vulnerabilities such as parental *(i)* low socioeconomic status (*e.g.,* education, income), *(ii)* poor social support and network, and *(iii)* adverse lived experiences in childhood, and *(iv)* community (*e.g.,* disadvantaged group, minority group) have also been identified as contributors for obesity (Iguacel et al., 2021). Obesity has increased in all three obesity classes (*i.e.,* classes 1, 2, and 3), particularly among older, ethnic minority, and low-socioeconomic status adolescents (Skinner et al., 2016). Research has shown that children living in low socioeconomic status families tend to have parents living with overweight or obesity (Bahreynian et al., 2017). This is important to highlight since overweight and obesity in parents is a major predictor of obesity in adolescents (Birbilis et al., 2013). Adolescents also undergo physiological, psychosocial, behavioural, and cognitive changes, all of which can also contribute to obesity and obesity-related complications (Chaudhri et al., 2008; Goran and Treuth, 2001; Lowe et al., 2020). For example, adolescents experiencing psychosocial and emotional distress may use maladaptive coping behaviours such as emotional eating (Kumar and Kelly, 2017).

Consequently, adolescents with obesity are susceptible to low self-esteem, depression, anxiety, social isolation, weight stigmatization, and decreased health-related quality of life (Modi et al., 2008; Puhl et al., 2013; Sawyer et al., 2011; Schwimmer et al., 2003; Strauss, 2000).

1.1.2. Obesity Management

The American Academy of Pediatrics (AAP) guideline is a valuable resource for health care professionals as it provides evidence-based recommendations and guidance on obesity management for adolescents. This guideline includes recommendations for treatments such as behavioural interventions and MI, which are posited to be effective in managing adolescent obesity and related co-morbidities, as well as pharmacotherapy and bariatric surgery which may also be part of a comprehensive approach to obesity management (Hampl et al., 2023). This guideline can also be used in conjunction with the upcoming update of the Canadian clinical practice guideline for pediatrics (Johnston et al., 2022). By following the guideline, health care professionals can make informed, evidence-based clinical decisions about various interventions for children and adolescents to enhance their care, reduce the risk of comorbidities, and improve overall health outcomes.

Behavioural interventions/strategies are the cornerstones for obesity management in adolescents (Al-Khudairy et al., 2017; Baur et al., 2011; Cardel et al., 2020; Psaltopoulou et al., 2019; Steinbeck et al., 2018). These include collaborative SMART goal setting (Specific, Measurable, Attainable, Realistic, and Timely), stimulus control, self-monitoring, cognitive behavioural therapy, and MI, which are often incorporated into behavioural interventions for adolescents with obesity (Joosten et al., 2008; Kang and Kwack, 2020; Steinbeck et al., 2018). When behavioural interventions alone fail to result in desired changes in BMI, a weight

management program with a multidisciplinary approach that is tailored to adolescents' age, gender, autonomy, and culture, which is family-centered, becomes necessary (Golan, 2006; Katzmarzyk et al., 2014; Steinbeck et al., 2018; Styne et al., 2017).

According to the AAP clinical practice guideline, adolescents with obesity, aged 12 years and older, with a BMI equal to or greater than 35 should be considered for pharmacotherapy in conjunction with behavioural interventions (Hampl et al., 2023). Pharmacotherapy should be prescribed based on the overall benefits to adolescents' health and potential risks. Orlistat, Liraglutide, Semaglutide, and Qsymia (Phentermine and Topiramate) are FDA (Food and Drug Administration)-approved weight loss medications for adolescents (Center for Drug Evaluation and Research, 2023, 2022, 2021; Forrester, 2009; Woodard et al., 2020). Research has shown that when Semaglutide, a newly approved, once-weekly weight loss medication for children and adolescents, is combined with behavioural interventions, there is a greater BMI reduction in comparison to behavioural interventions alone (Kelly et al., 2023; Weghuber et al., 2022). Additionally, there are non-approved medications like metformin which are used for weight management in children and adolescents with obesity (Brufani et al., 2013; Hampl et al., 2023; Park et al., 2009; Sadeghi et al., 2020).

Bariatric surgery has been shown to effectively reduce obesity in adolescents over the long-term. In several longitudinal studies, Roux-en-Y Gastric Bypass (RYGB) and Laparoscopic Sleeve Gastrectomy (LSG) in adolescents has led to a substantial reduction in BMI of 25–40% (Elhag and El Ansari, 2021; Inge et al., 2019, 2017, 2016; Olbers et al., 2017). It has also been shown that RYGB results in better outcomes for weight loss and obesity-related comorbidities than LSG (Inge et al., 2017, 2014; Järvholm et al., 2020). For adolescents with severe obesity, however, LSG is the most commonly recommended and performed procedure (Pratt et al., 2018).

Adolescents with obesity are eligible for bariatric surgery if they present with a BMI equal to or greater than 35 and comorbidities (*e.g.,* type 2 diabetes, hypertension) of clinical significance or a BMI equal to or greater than 40 (Pratt et al., 2018). Contraindications for bariatric surgery do exist and include substance abuse as well as conditions (*e.g.,* psychiatric, psychosocial) which prevent adolescents' compliance with dietary and medication requirements after surgery.

1.1.2.1. Motivational Interviewing for Obesity Management

MI was the intervention focus in my dissertation research as it is considered to be effective in facilitating health-related behaviour change (Bischof et al., 2021; Hampl et al., 2023). MI is a client-centered counselling approach that facilitates behaviour change by helping individuals to address their ambivalence to change (Miller, 1983; Miller and Rollnick, 1991). It was developed from Rogers and Carkhuff's client-centered approach (Carkhuff, 1993, 1979; Rogers, 1986) and Miller and Rollnick's addiction research (Miller and Rollnick, 2002), which outlined three components of motivation: importance, confidence, and readiness. Through MI, adolescents and their parents can identify behavioural habits for change based on the previously mentioned components of motivation to families (Resnicow et al., 2006). Adolescents' maturity and health-related behaviour for change determine whether parents need to take a more or less active role in their obesity management (Erickson et al., 2005; Resnicow et al., 2006).

MI has been used in obesity management interventions for the past 20+ years in adolescents 13-17 years (Browne et al., 2022). Often, MI is used to strengthen a person's motivation for behaviour change (Miller, 1983; Miller and Rollnick, 1991). An important aspect of MI is embodied in its spirit — way of being with people (Miller and Rollnick, 2013). In MI, the spirit is the cornerstone of the counselling approach, which is necessary to strengthen

individuals' motivation to change. This spirit aims to capture partnership, evocation, acceptance, and compassion. Partnership establishes that MI is a collaborative effort, which may include adolescents, their parents, and health care professionals (Miller and Rollnick, 2013). Evocation is useful for exploring reasons for behaviour change and fostering a positive outcome. Acceptance means that the application of MI should be non-judgmental, demonstrate empathy, consider lived experiences, emphasize any relevant positive aspects, and allow autonomy by supporting individuals (*e.g.,* adolescents) informed decisions about ambivalence (Miller and Rollnick, 2013). Compassion is about taking an active role in improving the health (*e.g.,* physical, emotional, mental) of individuals such as adolescents. Miller and Rollnick proposed that the application of several MI strategies and techniques such as reflective listening, shared decision-making, and eliciting change talk, without the spirit, could prove ineffective (Miller and Rollnick, 2002).

Research has shown that using MI can contribute to health-related behaviour changes in adolescents with obesity and is commonly used to complement other interventions (Resnicow et al., 2006). With the support and involvement of parents and frequent follow-up visits with health care professionals, MI has been shown to lead to improved behavioural habits (*e.g.,* diet and physical activity) and decreased BMI in adolescents (Armenta and James, 2021). In one meta-analysis (Cushing et al., 2014), a small effect size was detected across various adolescent health-related behaviours including diet, physical activity, sedentary activity, and sleep (Hedge's g = 0.16; 95% confidence interval (CI): 0.05, 0.27). However, MI alone (without complementary interventions or parental involvement) may not reduce BMI (mean difference (MD) −0.27; 95% CI [-0.98, 0.44]) or BMI percentile (MD −1.07; CI [−3.63, 1.48]) (Vallabhan et al., 2018). Based on these findings, it has been noted that delivery context (*e.g.,* dose, duration) is an important

treatment consideration and one that may influence health outcomes (Vallabhan et al., 2018). Treatment fidelity has also been noted as an important, potential contributor to variability in treatment outcomes (Cushing et al., 2014; Vallabhan et al., 2018) with time and cost cited as barriers to high-fidelity MI-based interventions (Browne et al., 2022). Further, while MI may be beneficial to adolescents during a stage of increasing independence and development, understanding adolescents' motivation and readiness to change is critical as health-related behaviours may be difficult to sustain over the long-term.

1.2. Rationale and Perspective

1.2.1. Rationale for my Dissertation Studies

In my role as a Clinical and Administrative Dietitian in the Nutrition Unit within the Ministry of Health, Wellness, and the Environment (Kingstown, St. Vincent and the Grenadines), I gained experience working with multidisciplinary teams in primary and secondary health care. I also pursued academic, professional, and volunteer opportunities that enhanced my Master's degree in Human Nutrition. These included lecturing at the college-level, giving public health presentations on nutrition, and volunteering in clinical and community settings. These experiences contributed to my professional development and growth and reinforced my desire to become a clinician scientist. My interests in *(i)* adolescent obesity management, *(ii)* population health and behaviour change, and *(iii)* MI, resulted in my undertaking a Doctor of Philosophy degree in Medical Sciences in the Department of Pediatrics, Faculty of Medicine and Dentistry at the University of Alberta, (Edmonton, Alberta).

My dissertation research sought to understand motivation and readiness to change for eliciting behaviour change in adolescent obesity management. The motivation focus of my

research complements a CIHR-funded study (Ball et al., 2017) designed to understand how adolescent and parent motivation influence obesity management. After a preliminary examination of the literature on motivation in adolescent obesity management, it became clear that while numerous primary studies and reviews had been conducted with MI as the focus, the evidence on MI for obesity management in this population focused primarily on adults. Based on these findings, I identified the need for an in-depth examination of MI in adolescent obesity management. Since effective management of adolescent obesity requires delivering interventions as intended, I was also interested in examining treatment fidelity of MI-based interventions. The readiness to change focus of my research is based on my interest in exploring how adolescents with obesity experience behavioural changes while receiving treatment at a pediatric obesity management clinic. Adolescents' lived experiences with obesity during treatment have not been well documented in the literature. Since *Readiness to Change Rulers* are used to assess the readiness of families to change their behaviour during treatment, but have not been extensively studied in research on adolescent obesity management (Dhuper et al., 2021; Steele et al., 2012; Taveras et al., 2009; Williams et al., 2017), I decided that my research should also include this focus.

1.3. Ontological, Epistemological, and Theoretical Underpinnings

The studies that comprise my dissertation research were informed by multiple paradigms, or philosophical positions based on a set of basic beliefs that guides action (Guba, 1990; Guba and Lincoln, 1994). These paradigms encompassed several views, including my own ontological (nature of reality), epistemological (nature of knowledge), and theoretical positions (Guba and Lincoln, 1994; Mayan, 2023).

Studies 1 (qualitative and quantitative) and 3 (quantitative) were guided by pragmatism. As a research paradigm, pragmatism is associated with mixed methods or multiple methods (Creswell and Clark, 2011; Tashakkori and Teddlie, 2010). Pragmatism encourages researchers to use the philosophical and/or methodological approach that is most appropriate to the research question (Tashakkori and Teddlie, 2003), and holds that the nature of reality and nature of knowledge are shaped by socially constructed beliefs and habits (Yefimov, 2004). Pragmatism may involve the use of deductive and inductive reasoning to make sense of the data (Johnson and Onwuegbuzie, 2004). Another defining feature of pragmatism is a non-commitment to specific ontological and epistemological views, so researchers are free to use different research inquiries, methods, and approaches to answer research questions and achieve study objectives.

Study 2 was designed to explore adolescents' lived experiences, and was informed by an interpretative paradigm (Guba and Lincoln, 1994), which assumes a relativist ontological view and subjectivist epistemological perspective (Creswell and Poth, 2017). Ontologically, I believe that reality is multiple, subjective, and socially constructed. In my view, there is an external social reality, which consists of multiple socially constructed realities (*e.g.,* adolescents' lived experiences with obesity while enrolled in a POM clinic). Thus, I can only understand an individual's reality through their experience of it, which may differ from another individual's, depending on their social perspective. Although both the external social reality and representations of that reality are constructed, they cannot be understood independently. From an epistemological standpoint, realities need to be interpreted to understand the underlying meaning and experiences from the perspectives of participants. Meaning is always constructed (*e.g.,* analysis, interpretations) by the researcher's perspectives, feelings, beliefs, experiences, and interactions with participants (Charmaz, 2004), and understanding and experiences of knowledge

are influenced by contextual forces, including social, historical, and political factors (Singer, 2004). A researcher will also construct knowledge socially through their lived experiences in real-world settings (Punch, 2013). This standpoint assumes that meaning is co-created by the researcher and participants (*i.e.,* shared meaning making). As a researcher, my analysis of the data was shaped by the interactions with participants, being a clinician scientist, and knowledge in MI and obesity management.

1.4. Overarching Aim and Thesis Outline

The overarching aim of my dissertation research was to explore and examine motivation and readiness to change in adolescent obesity management. To address this aim, I conducted three independent, complementary studies that involved the use of multiple methods.

Study 1 (Chapter 2) was a scoping review that examined the use of MI-based interventions for managing adolescent obesity. The objectives in this review were to *(i)* retrieve and summarize data regarding the fidelity and elements of MI-based interventions (including instruments to assess motivation) and *(ii)* examine the application and reporting of MI-based interventions for the management of adolescent obesity. To complement the review, a stakeholder consultation was completed to *(i)* verify (*i.e.,* discuss the review findings with stakeholders for accuracy) and validate (*i.e.,* evaluate the review findings on key elements of MI-based interventions and treatment fidelity) review findings, *(ii)* gain perspectives on the limitations of MI-based interventions, *(iii)* document knowledge gaps not identified by our review, and *(iv)* address questions from our findings on MI and treatment fidelity assessment.

In Study 2 (Chapter 3), using Interpretative Phenomenological Analysis (IPA), I explored how adolescents with obesity experience change in their behavioural habits (*e.g.,* diet, physical

activity, sedentary activity, sleep). In this study, I sought to understand adolescents' changes and experiences while enrolled in a pediatric obesity management clinic.

In Study 3 (Chapter 4), I utilized quantitative exploratory research methods to *(i)* evaluate the scores and psychometric properties (internal consistency, levels of agreement within adolescent-parent dyads, and construct validity) of the *Readiness to Change Ruler* in families' (*i.e.,* adolescents' and parents') enrolled in pediatric obesity management clinics, and *(ii)* examine sociodemographic and personal health history variables related to readiness to change.

The remainder of my thesis provides a general discussion (Chapter 5) that highlights key research findings, recommendations and lessons learned, and future directions for research and clinical practice.

1.5. References

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Chapter 2

Browne NE, Newton AS, Gokiert R, Holt NL, Gehring ND, Perez A, Ball GDC. The Application and Reporting of Motivational Interviewing in Managing Adolescent Obesity: A Scoping Review and Stakeholder Consultation. Obes Rev 2022; 23: e13505.

2.1. Summary

Motivational interviewing (MI) is an evidence-based counselling approach that can help individuals make positive behavioural and cognitive changes for managing obesity. We conducted a scoping review to summarize evidence on fidelity and key elements of MI-based interventions for managing adolescent obesity and examine the reporting of these interventions. Ten electronic databases and grey literature were searched systematically and included literature from January 1983 to February 2022, and 26 studies were included. Data on MI features, delivery context, training, and fidelity to treatment were summarized. Fidelity was assessed using an assessment grid with five domains — theory, training, implementation, and treatment receipt and enactment. The last step of the review involved stakeholder consultation with clinician-scientists and researchers with experience in MI and managing adolescent obesity. Thirteen stakeholders were interviewed about our review findings on MI and treatment fidelity. Our analyses revealed that MI-based interventions for managing adolescent obesity had 'low treatment fidelity'; no studies had 'high treatment fidelity' across all five domains. Fidelity strategies adhered to most were theory and treatment enactment lowest. Stakeholders mentioned that 'low treatment fidelity' may be due to increased time to complete fidelity assessments and increased cost associated with treatment fidelity. These findings have implications for planning, implementing, and evaluating MI-based interventions for managing adolescent obesity.

2.2. Introduction

Obesity is a common, complex, and chronic disease (Wharton et al., 2020) that requires multi-faceted approaches for effective treatment and management. In adolescents, obesity is a serious public health concern that is related to an increased risk of health consequences such as type 2 diabetes, cardiovascular disease, and asthma (Daniels, 2009; Skinner et al., 2015), all of which can persist into adulthood (Singh et al., 2008). Studies have also reported mental health concerns and psychological issues (*e.g.,* depression, low self-esteem, sadness) in adolescents with obesity (Bean et al., 2008; Strauss, 2000). The adverse consequences of adolescent obesity require evidence-based intervention strategies for effective management that can improve health outcomes. Behavioural and psychological interventions that emphasize a healthy diet, physical activity, and sleep habits have a key role to play in managing adolescent obesity. Motivational interviewing (MI) — a client-centered counselling approach used to elicit behaviour change by helping patients to explore and resolve ambivalence to change (Miller, 1983; Miller and Rollnick, 1991) — has been applied in interventions to manage adolescent obesity (Cushing et al., 2014; Gayes and Steele, 2014; Jensen et al., 2011). During MI, the focus is on creating an empathetic approach with clients by using techniques and strategies, such as affirmations, reflective listening, agenda-setting as well as shared decision making, to support clients' self-efficacy (Miller and Rollnick, 2013; Resnicow et al., 2006; Rollnick and Miller, 1995; Walpole et al., 2011). A recent meta-analysis reported that MI-based interventions for managing adolescent obesity had no significant effects on reducing BMI and BMI percentile (Vallabhan et al., 2018); however, the qualitative synthesis that accompanied the review suggested that MI-based interventions can result in positive behaviour changes.

A crucial feature of MI-based interventions includes adherence to the principles and practices that are linked with MI. Adherence can be evaluated based on treatment fidelity, which is the extent to which an intervention is implemented as intended (Bellg et al., 2004). Assessing the treatment fidelity of an intervention enhances the methodological rigor of a study (Breitenstein et al., 2010) When high treatment fidelity is reported for a study, it is often associated with better treatment outcomes (Durlak and DuPre, 2008). For example, higher levels of treatment fidelity were associated with positive changes in regimen adherence and metabolic control (glycated hemoglobin) among adolescents with diabetes (Ellis et al., 2007). Hence, it is critical to determine if the lack of changes from MI-based interventions for managing adolescent obesity is due to 'low treatment fidelity', since this decreases confidence that the changes were due to the application of MI.

Optimizing adolescent obesity management includes ensuring that evidence-based interventions are delivered in the manner with which they are intended. This helps to ensure that adolescents and their families derive the greatest possible benefits from their time in care. While other reviews have examined the fidelity of MI in specific populations (*e.g.,* children, adults), to our knowledge, this is the first review to complete an in-depth analysis of the evidence on treatment fidelity of MI-based interventions for managing obesity in adolescents. To address this gap, the objectives of our scoping review were to *(i)* retrieve and summarize data regarding the fidelity and elements of MI-based interventions (including instruments to assess motivation) and *(ii)* examine the application and reporting of MI-based interventions for the management of adolescent obesity.

2.3. Methods

Study design

Our scoping review followed the framework established by Arksey and O'Malley (Arksey and O'Malley, 2005), which was subsequently expanded by Levac et al. (2010). Reporting of this review adheres to the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist (Tricco et al., 2018). As a final step in the review, we completed a stakeholder consultation to *(i)* verify (*i.e.,* discuss the review findings with stakeholders for accuracy) and validate (*i.e.,* evaluate the review findings on key elements of MI-based interventions and treatment fidelity) review findings, *(ii)* gain perspectives on the limitations of MI-based interventions, *(iii)* document knowledge gaps not identified by our review, and *(iv)* address questions from our findings on MI and treatment fidelity assessment. Ethics approval for the stakeholder consultation was obtained from the Human Research Ethics Board at the University of Alberta (Pro00100039).

Literature search strategy

An experienced research librarian conducted a comprehensive search to identify literature related to MI-based intervention for managing adolescent obesity. The initial search was conducted from January 1983 to July 2017 in 10 electronic databases, including MEDLINE, Embase, PsycINFO, Eric, CINAHL, Cochrane Reviews, Cochrane Controlled Trials, Health Technology Assessment, ProQuest Dissertations and Theses Global, and Google Scholar. Information on MI was first conceptualized in 1983 (Miller, 1983), so our time frame included any literature published on this topic. As an exemplar, the detailed search strategy for the MEDLINE database is presented in Appendix A. The following terms were used for the searches: overweight, obese, obesity,

pediatric, youth, teenager, adolescent, child, childhood, children, under 18 years old, BMI ≥85th percentile, motivational interviewing, motivation interviewing, motivational interview, motivational counselling, direct counselling, and psychological intervention. For each database, the research librarian tailored the key terms accordingly. The search strategy was limited to English language literature and youth and adolescent studies.

Grey literature (*i.e.,* theses, dissertations, conference proceedings) were searched from January 2015 to July 2017 to identify unpublished studies, which included conference proceedings from the Canadian Obesity Summit (COS; 2015, 2017), Obesity Week (2015, 2016) and International Society of Behavioral Nutrition and Physical Activity (ISBNPA; 2016, 2017) as well as dissertations from ProQuest Dissertations and Theses Global, PsycINFO, and CINAHL. The reference lists of included articles and relevant reviews identified during the search were also screened to identify relevant additional studies.

Two search updates were conducted: the first for literature available from July 2017 to October 2019 for all 10 electronic databases and grey literature (COS 2019; Obesity Week 2017, 2018; ISBNPA 2018, 2019), and the second from October 2019 to February 2022 for the same databases and grey literature (COS 2021; Obesity Week 2019 to 2021; ISBNPA 2020, 2021). Due to technical challenges, our second updated search did not include the Health Technology Assessment database. We also created email alerts (from July 2017 to February 2022) in Google Scholar using the term 'motivational interviewing'.

Inclusion and exclusion criteria

We included studies of any design with MI-based interventions that: *(i)* focused on the secondary prevention and/or management of childhood obesity, and *(ii)* included 13–17-year-olds with

overweight or obesity, regardless of how excess weight was defined. Adolescents were the focus of our review because they experience physiological, psychological, and behavioural changes which may lead to obesity and its associated complications. Documents that did not include original data, including research protocols, commentaries, opinion papers, letters to the editor, and expert committee recommendations were excluded.

Screening for eligibility

The titles and abstracts of articles from the initial and first updated searches were screened independently (NEB and NDG) in RefWorks by classifying each as 'include', 'exclude', or 'uncertain' based on our *a priori* inclusion and exclusion criteria. The inter-rater agreement was subsequently calculated with the kappa statistic (Altman, 1990). The agreement between reviewers was excellent (initial search [κ=0.948] and first updated search [κ=1]). Full text articles categorized as 'include' and 'uncertain' were reviewed independently by the same reviewers. One reviewer (NEB) contacted primary authors of studies when articles were missing information or ambiguous. Any discrepancies in screening decisions were discussed to reach an agreement between the reviewers (NEB and NDG) or through consultation with a third independent reviewer (GDCB), as necessary. The same two reviewers (NEB and NDG) screened all articles for study inclusion, which included both the initial and search update in 2019. For the initial and first updated searches, we used the Legacy RefWorks (Ex Libris; A ProQuest Company) bibliographic management software to organize and screen retrieved articles. For the updated search in February 2022, the bibliographic management software Covidence (Veritas Health Innovation) was used to organize and screen retrieved articles since RefWorks was no

longer accessible. One reviewer (NEB) screened all titles, abstracts, and selected articles to be included in the second updated search.

Data extraction

All data were exported to Legacy RefWorks or Covidence and duplicates were removed. Two reviewers (NEB and NDG) extracted relevant data independently from included studies and entered them into a data extraction table in Microsoft Excel. Data elements were chosen through discussion among authors (GDCB, ASN and NEB). Extraction discrepancies pertaining to 43 studies were resolved by consensus (GDCB, NEB and NDG).

Extraction data included: *(i)* study details (*i.e.,* title, author name[s], year of publication, country, main objective, study design, sample size, main findings, limitations, conclusions, and recommendations), *(ii)* participant characteristics (*i.e.,* age, sex, ethnicity, and weight), *(iii)* MI-based intervention details (*i.e.,* setting, delivery mode, delivered by, duration, frequency, MI training, and MI components), and (iv) MI-based intervention outcomes (*i.e.,* behavioural, biomedical, and cognitions). Study findings for instruments to assess motivation were also extracted and included the number of items in the instrument, domains, and psychometric data (validity and reliability). Motivational interviewing can increase motivation for improving health behaviours. Identifying the active ingredients in MI-based interventions helps to enhance its effectiveness (Miller and Rollnick, 2014), which can be accomplished by using psychometrically appropriate instruments.

Treatment fidelity

Two reviewers (NEB and NDG) independently assessed the treatment fidelity of studies using an assessment grid that was adapted by ©UCDHSC (University of Colorado at Denver and Health Sciences Center) Center for Nursing Research (UCDHSC Center for Nursing Research, 2006) (based on a report by Bellg et al. 2004). The data were coded as 'not reported', 'reported' or 'not applicable' for five domains: Fidelity to Theory, Provider Training, Treatment Implementation, Treatment Receipt, and Treatment Enactment. We used definitions by Bellg et al., (2004) to describe these domains (see Table 2.1). Ambiguities in the domains were resolved through discussion (GDCB, NEB and NDG).

Stakeholder consultation

We used purposive sampling to recruit stakeholders who were clinician-scientists and researchers with experience in MI and managing adolescent obesity; they were identified as the first or corresponding authors from the articles that we included in our review. Recruitment occurred between January to May 2021 and February to May 2022 via email with individuals invited to complete a virtual one-on-one interview via videoconference. We used the Dillman Total Design Survey method (Dillman, 1991; Hoddinott and Bass, 1986), which involved sending index and reminder email invitations at 2, 3, and 7 weeks to maximize recruitment.

Consultations consisted of individual interviews that lasted 45–60 minutes. Demographic information on stakeholder characteristics (*i.e.,* age, sex, country, education, and position) was collected. All stakeholders gave oral informed consent before the consultation. We used an interview guide with open- and closed-ended questions to: *(i)* verify (*i.e.,* discuss the review findings with stakeholders for accuracy) and validate (*i.e.,* evaluate the review findings on key

elements of MI-based interventions and treatment fidelity) review findings, *(ii)* gain perspectives on the limitations of MI-based interventions, *(iii)* document knowledge gaps not identified by our review, and *(iv)* address questions from our findings on MI and treatment fidelity assessment. During the interviews, stakeholders also provided additional information and insights into their MI-based research; this information helped to augment data extracted from the studies included in our review or fill in gaps (in the case of information that was not provided in the published study/grey literature). For anonymity, we assigned each participant a unique identifier (*e.g.,* Stakeholder #1). See Appendix A for interview guide.

Data analysis

We used descriptive, numerical summaries to present the total number of studies, study design, year of publication, study population, and characteristics of study samples. We identified and grouped MI-based intervention data as: *(i)* key intervention elements, *(ii)* delivery context of MI-based interventions and training, and *(iii)* treatment fidelity. For the key intervention data, we used FRAMES (Feedback, Responsibility, Advice, Menu, Empathy, and Self-Efficacy) to identify the components of the MI-based interventions (Miller and Sanchez, 1994) that are known to effectively facilitate behaviour change. For each element, we classified the MI components (*e.g.,* reflections, engaging). We used the treatment fidelity assessment grid to organize and summarize fidelity data per the five domains.

Data from stakeholder consultations was analyzed using qualitative manifest content analysis (Elo and Kyngäs, 2008; Hsieh and Shannon, 2005). Transcripts were read and re-read for data familiarization and an inductive coding scheme was developed. We identified meaning units (words, sentences, or paragraphs), condensed meaning units, developed codes, and

subsequently grouped codes into categories. Discussions were held between authors (GDCB and NEB) to refine the coding scheme and categories. Furthermore, a discussion was held between NEB and a research methodologist (AP) to review the adequacy of assigned codes and exemplar quotes. A qualitative data analysis software program (MAXQDA 2020, VERBI Software) was used to organize and manage qualitative data. Following this analysis, we reviewed and updated the treatment fidelity assessment grids using stakeholder input. This involved updating information that was coded as 'not reported' or 'not applicable' for the five domains to 'reported' if information was provided during a consultation. The updated grids differ from the original grids in several important ways: *(i)* proportion of studies that reported treatment fidelity strategies, *(ii)* mean proportion of adherence, and *(iii)* 'high treatment fidelity'.

Using information from the treatment fidelity grids, we calculated the frequency and overall mean proportion of adherence to the five treatment fidelity domains using SPSS (Version 26.0, IBM Corp.). We also determined whether there was 'high treatment fidelity' in the study, which was defined as ≥80% adherence to the domains (Borrelli et al., 2005). We analyzed data from the treatment fidelity assessment grid using an established analytic plan. To calculate the mean adherence to fidelity strategies for each article, we added all the 'reported' fidelity strategies and divided by the number of fidelity strategies 'applicable' in each domain. The mean proportion of adherence across all articles was calculated to determine 'high treatment fidelity' for each domain and overall. Additionally, we provided numerical summaries of the characteristics of stakeholders and factors affecting 'low treatment fidelity'.

2.4. Results

Literature search and selection

The initial search strategy identified 2,332 articles, while updated searches identified 1,632 additional articles. Of these total articles, 276 were considered relevant based on title and abstract (Figure 2.1). After a full-text review, 26 articles (André and Béguier, 2015; Ball et al., 2011; Bean et al., 2015; Black et al., 2010; Brennan et al., 2008; Carcone et al., 2013; Chahal et al., 2017; Currie et al., 2018; Davis et al., 2011; Flattum et al., 2009; Freira et al., 2018; Gourlan et al., 2013; Irby et al., 2010; Jensen et al., 2019; Kong et al., 2013; Köse and Yıldız, 2021; Love-Osborne et al., 2014; MacDonell et al., 2012; Naar-King et al., 2016; Neumark-Sztainer et al., 2010; Pakpour et al., 2015; Resnicow et al., 2005; Riiser et al., 2014; Vallabhan, 2015; Walpole et al., 2013; Wilson et al., 2002) met inclusion criteria and were included in the review.

Study characteristics, delivery context, and training

Characteristics of included studies and study participants are presented in Table 2.2 Studies were published between 2002 and 2021 with 15% published in the last five years. Most studies were randomized controlled trials (n=20; 77%) and conducted in the United States (n=16; 61%). Sample sizes varied between studies (range: 1–238 participants).

In 50% of the studies, parental involvement in MI-based interventions was reported; however, parental characteristics (*i.e.,* age, sex, ethnicity, weight) were reported in only three (11%) studies. For studies that included details on parents, most were biological mothers (mean age range: 39.4–44.8 years old). Most MI-based interventions were delivered in-person in a health care setting (n=17; 65%) with individual session duration ranging from 4–60 minutes (Table 2.3). The majority of studies (n=24; 92%) provided 2-days of training, and nine (35%) of

those studies had Motivational Interviewing Network of Trainers (MINT) (Motivational Interviewing Network of Trainers, 2021). Few studies included details of ongoing training and supervision during intervention delivery.

Instruments to assess motivation

Of the included studies, 6 (23%) used various instruments (*e.g.,* Behavioural Regulation Questionnaire [BREQ-2], Self-concept Scale) to measure motivation. Two studies used the BREQ-2, but it was only evaluated in one study. The BREQ-2 is a reliable and valid instrument when used among adolescents in an MI-based intervention. The reliability and validity of instruments to measure motivation are presented in Table 2.4.

Stakeholder consultation

Twenty-five individuals were invited and 13 agreed to participate. One of our co-authors (GDCB) was the corresponding author of an article included in our review but was not interviewed. The overall response rate was 52%; five individuals declined participation and seven did not respond to invitations. Most stakeholders were female (n=9; 69%), lived in the United States (n=10; 77%), and represented diverse backgrounds (Table 2.5). Consultations provided critical, additional information on the key elements of MI-based interventions and perspectives on treatment fidelity, which are reported alongside scoping review findings in the sections that follow.

Key elements of MI-based interventions

Using FRAMES, all six components of MI-based interventions were identified in 15 studies, five components in three studies, and four components in four studies; the remaining studies (n=4) had three components or less (see Appendix A). Additional details on the FRAMES approach are provided in Figure 2.2 Interview data from stakeholder consultations resulted in a 7–23% increase in elements reported across five of the six FRAMES components; the advice component remained unchanged. When stakeholders were asked if any FRAMES component of MI-based interventions was more important than any other, most (n=10; 77%) identified self-efficacy as most important. As stakeholder #8 pointed out:

> The most important component is self-efficacy...Because it's actually shifting. It's someone's belief (that) whether or not they can do something. And, you know, one of the goals of motivational interviewing is not just to motivate them to do something, but to actually improve their self-efficacy for doing that, by (giving them) tapping into their own intrinsic motivation, perhaps helping them come up with their (own) action plan and monitoring plan. I think that's probably the most important target of motivational interviewing.

The second most critical component for stakeholders was empathy (n=5; 38%), which should underpin the therapeutic relationship during MI. Stakeholder #9 shared the following experience from providing MI-based counselling:

> Empathy is that kind of number one connector variable that as a therapist, I feel sets me apart sometimes and makes it so that clients really do engage. They [adolescents] come back and they're committed because they really feel heard and listened to, they feel understood. They [adolescents] feel like someone's on their team, they don't feel like they're being pushed too fast. Got to have empathy, can't (almost) do anything else without it.

Assessment of treatment fidelity

Table 2.6 presents the percentage of articles that included details on applying treatment fidelity and Figure 2.3 for the proportion of adherence to treatment fidelity strategies. None of the studies had 'high treatment fidelity' for the MI-based interventions across all five domains (Table 2.7). Two studies (Naar-King et al., 2016; Resnicow et al., 2005) had 'high treatment fidelity' for four domains. The highest mean proportion of adherence was for Fidelity to Theory (17% increase) while the lowest mean proportion of adherence was for Treatment Enactment (13% increase). Even after supplementing our fidelity data from these interviews, none of the studies had 'high treatment fidelity' across all 5 strategies.

Stakeholders shared similar views regarding the potential limitations of MI-based interventions for managing adolescent obesity relative to treatment fidelity practices (Figure 2.4). The most common limitations that emerged were: *(i)* burden (*e.g.,* time-consuming, labour intensive, high level of provider expertise required); *(ii)* lack of knowledge on the adequate context of MI delivery (*e.g.,* training, frequency, dose); *(iii)* high financial costs; *(iv)* difficulty conducting MI-based interventions in populations with obesity due to a variety of factors (*e.g.,*

high attrition, low engagement, limited cognitive development); and *(v)* limited focus on targeted interventions (*e.g.,* MI-based cultural interventions). As stakeholder #7 commented:

> Fidelity is a big problem. I think, people think that after two days of training, your people are ready to go. Obesity is really difficult to use MI with because it has a lot of actions and you have to do a lot of agenda-setting, a lot of focusing. So fidelity's particularly important.

Knowledge gaps not identified by our review

Beyond the findings from our review, stakeholders identified several knowledge gaps including differences in defining, monitoring, and measuring treatment fidelity in MI-based interventions (Table 2.8) including the issue that many MI-based interventions were not 'attention matched' (*i.e.,* there were more contact hours between providers and participants with the intervention *versus* comparison group).

Recommendations when conducting or reporting MI-based interventions

Stakeholders shared recommendations for the conduct and reporting of MI-based interventions. In terms of intervention conduct, stakeholders recommended increased attention to treatment receipt and treatment enactment. One stakeholder (Stakeholder #2) stated:

> So, I would try and do a better job with treatment receipt and treatment enactment. As I said earlier, those are just two other ways to help document that not only is the intervention being delivered, but it's being received...

Other conduct-based recommendations, including providing fewer and shorter MI sessions; standardized support, mentorship and direct observation of visits; ensuring adherence to MI protocol in intervention delivery; established checkpoints to monitor fidelity strategies as the intervention is administered; balance the fidelity domains with pragmatic research considerations and cost constraints; and include a plan in the research protocol to assess treatment fidelity.

In terms of intervention reporting, stakeholders recommended improved reporting of treatment fidelity; when reporting treatment fidelity, a treatment fidelity assessment grid should be used. Stakeholders also suggested that strategies are needed to include all relevant treatment fidelity information and ensure adequate time and resources are spent on reporting treatment fidelity. In support of this final recommendation, Stakeholder #6 stated:

> Well yeah, I think I probably would spend a little bit more time on the fidelity in the research article, like, what was done. Because I honestly don't remember what we wrote. But I know we have like a paragraph and we did do quite a lot. So I think probably a little bit more time, spelling out what we did.

2.5. Discussion

Our scoping review revealed several key findings about the fidelity and elements of MI-based interventions for the management of adolescent obesity. First, studies that described MI-based interventions for adolescents with obesity had 'low treatment fidelity'; none had 'high treatment fidelity' across all five fidelity domains. Second, the fidelity strategies adhered to the most were Fidelity to Theory while the lowest were Treatment Enactment. In addition, our stakeholder consultation highlighted practical and academic issues that influenced fidelity ratings, including

increased time and cost (*e.g.,* ongoing provider training for research staff) in addition to lack of training and awareness of fidelity processes and procedures. Taken together, these findings have important implications for planning, conducting, and reporting MI-based interventions for managing adolescent obesity.

None of the studies included in our review demonstrated 'high treatment fidelity' across all five domains; only two had 'high treatment fidelity' for four domains (Naar-King et al., 2016; Resnicow et al., 2005). Treatment fidelity can be difficult to assess because studies are seldom comprehensive and detailed to evaluate fidelity strategies within all five domains.(Resnick et al., 2005) Therefore, it is important to understand how treatment fidelity is quantified and reported in publications to better inform readers of how well the intervention was implemented. Researchers conducting studies on MI and managing adolescent obesity need to give more consideration to assessing treatment fidelity and accurately reporting results in publications. Interventions delivered with high fidelity provide confidence that they were delivered in the intended manner, thereby giving us confidence in the results regardless of effectiveness. Additionally, 'high treatment fidelity' is relevant for implementation researchers since implementing interventions in the manner with which they are intended leads to improved treatment outcomes (Durlak and DuPre, 2008; Resnick et al., 2005). Results of implementation studies with higher fidelity to treatment were more effective and associated with better outcomes in comparison to studies with lower treatment fidelity (Durlak and DuPre, 2008). However, in the studies we included in our review, all had 'low treatment fidelity'. Our findings are consistent with other research that found poor fidelity documentation and reporting in a range of areas, including health behaviour change, primary and secondary prevention, psychosocial, and childhood obesity (Borrelli et al., 2005; Dane and Schneider, 1998; Gearing et al., 2011; McArthur et al., 2012; Toomey et al.,

2019). Measuring and reporting treatment fidelity improves the interpretation and replicability of treatment outcomes in research studies (An et al., 2020). Based on our data, assessing treatment fidelity offers potential value for researchers leading MI-based interventions (Bellg et al., 2004). By assessing fidelity, it can be easier for obesity researchers to translate health behaviour change interventions from research to health care settings.

Due to the 'low treatment fidelity' of the studies included in our review, it is difficult to conclude whether these interventions were effective. More so, the variability in the reporting of treatment fidelity strategies limits our ability to determine the effectiveness of these interventions. The studies (Naar-King et al., 2016; Resnicow et al., 2005) with high fidelity in four domains showed positive behaviour changes (*e.g.,* BMI, body fat, weight) but not for the primary outcome measures. Although our study found no clear link between high fidelity in specific domains and improved primary outcomes, fidelity is still relevant in adolescent obesity for drawing valid conclusions about intervention effectiveness. If interventions are of higher fidelity, we can conclude that they were implemented as planned.

Across the five fidelity domains we assessed, Fidelity to Theory was adhered to the most while Treatment Enactment was adhered to the least. These findings suggest most researchers focused on issues related to study design and linking behavioural change theory to intervention elements, which was evidenced by the inclusion of study details that included information such as intervention dose, frequency of contact, and intervention duration in most articles. This is not surprising since effective interventions for managing obesity often include a high level of intervention intensity, which is exemplified by frequent contact between individuals with obesity and intervention providers as well as extended treatment duration (*e.g.,* several months or years). The need to improve fidelity reporting is further supported by a systematic review of MI-based

interventions across several areas, including asthma, osteoarthritis, heart disease, diabetes, and exercise, that reported only ~33% (n=22) of studies measured fidelity engagement (*i.e.,* Treatment Enactment and Treatment Receipt) (Walton et al., 2017). These findings suggest the need to emphasize Treatment Enactment and Treatment Receipt when conducting and reporting MI-based interventions. Low Treatment Enactment and Treatment Receipt can be problematic and lead to ineffective interventions, especially if participants do not understand the main components of the intervention or are unable to apply those components in their daily lives to change their behaviours.

Through our stakeholder consultation, we found that practical and academic issues, including increased time, cost, and a lack of awareness of fidelity processes and procedures prevented researchers from planning and delivering MI-based interventions with high fidelity. In their study, Walton et al. (2017) pointed out fidelity assessments take a substantial amount of time (required by participants and providers) and can be expensive, factors that are barriers to fidelity integration. Our stakeholder consultation identified several knowledge gaps that indicated a need for more research in standardizing fidelity assessments. First, we found substantial variability in how fidelity to MI was defined and measured. The meaning and application of treatment fidelity have evolved, with numerous definitions (Bellg et al., 2004; Gearing et al., 2011; Lichstein et al., 1994; Quay, 1977; Yeaton and Sechrest, 1992) and assessment strategies (Moyers et al., 2016) that have often been used interchangeably. Applying a model, such as the National Institutes of Health (NIH) Behavioral Change Consortium treatment fidelity framework (Bellg et al., 2004; Borrelli et al., 2005), would enhance consistency and comparability between studies and across fields. This well-established and comprehensive model is reliable and valid, specifically designed to be relevant for research on

health behaviour change, and allows investigators to assess the five treatment fidelity strategies (Borrelli, 2011). Second, no simple, standard, and reliable tools exist to measure treatment fidelity, including the five domains that comprise MI. While we used a standardized assessment grid adapted by ©UCDHSC from the NIH's model, it was a comprehensive tool and required prior knowledge of the NIH's framework for treatment fidelity. Further, although the Motivational Interviewing Treatment Integrity scale is simple and often used to assess fidelity, it is more concerned with providers' behaviour and global competence. Ginsburg and colleagues (Ginsburg et al., 2021) highlighted the abovementioned issue as a challenge in treatment fidelity. The authors noted that the development of brief tools is required since most fidelity measures are intervention-specific, and generic validated measures are lacking in the literature. Collaboration with key stakeholders (*e.g.,* clinician-scientists, researchers) is essential for developing tools that address both practical and academic issues associated with fidelity yet are succinct, valid, reliable, and readily accessible. By sharing the voices of stakeholders in the development of appropriate tools, they may be more likely to use them consistently in research, potentially improving treatment fidelity. Furthermore, collaboration with these stakeholders can help reduce ambiguity surrounding the definition and measurement of fidelity to MI.

Health care providers with higher levels of professional, theoretical, and practical training can deliver effective MI-based interventions (Carpenter et al., 2012; Mash et al., 2014; VanBuskirk and Wetherell, 2014). For proficiency and knowledge in MI, health care providers are encouraged to undergo training from MINT trainers who adhere to established standards and require ongoing training. However, training in MI must be augmented by ongoing mentorship and support after the initial training to ensure proficiency and adherence to MI principles and practices. As an example, MINT includes a training manual with detailed suggestions for MI

training, including the process of training, teaching the spirit of MI and engaging process, evoking and responding to change talk, and feedback and coaching (Motivational Interviewing Network of Trainers, 2020). Stakeholders need resources and support for the delivery context of MI-based interventions, which include duration, frequency, and training. Our study found substantial heterogeneity in training and mentorship for researchers. This heterogeneity reflects the resources and time required for effective interventions. According to MINT, trained, on-site supervisor(s) are best suited to provide ongoing mentorship and support (Motivational Interviewing Network of Trainers, 2020). Ideally, the supervisor should receive two to three days of supervisor training in MI. Ongoing mentorship and support may include in-person sessions with a MINT trainer as well as feedback, telephone or teleconference consultation, and an on-site peer learning group. However, MINT didn't make any specific recommendations regarding ongoing reading, watching videos, or participating in workshops. Overall, few studies in our review described ongoing supervision and retraining in the domain of Provider Training. To ensure the successful application of MI in managing adolescent obesity, additional workshops, ongoing supervision and consistent feedback are needed (Miller and Rose, 2009; Söderlund et al., 2011).

Limitations

Our research was not without limitations. First, there was variability in the terminology for the reporting of key elements of MI and treatment fidelity strategies. For example, when data was extracted for feedback using FRAMES, we read each article for evidence of active listening, open-ended questions, and other MI elements associated with feedback. However, we may have missed evidence of feedback that was not stated in articles or reported using interchangeable

terms. Since MI and fidelity research are relatively new areas in adolescent obesity, numerous terms were used interchangeably in the literature, so we adapted our FRAMES and fidelity criteria during the initial search. Second, although we made every effort to include stakeholders from various countries, a considerable proportion of stakeholders lived in the United States and Canada. A lack of diversity and perspectives among stakeholders in Australia, France, Iran, Norway, Portugal, and Turkey may have led to variability in the conceptualization of obesity. Third, selection bias may have occurred since we only included English language literature in our review due to limited translation resources. Finally, a lot of time (*e.g.,* >10 years) elapsed since some included studies were conducted, which may have influenced the response rate from clinician-scientists and researchers. Some clinician-scientists and researchers declined participation in our consultation as they no longer actively worked with adolescents and/or in the field of MI.

2.6. Conclusions

To our knowledge, our study provides the first comprehensive assessment of treatment fidelity in MI-based interventions for managing obesity in adolescents. While MI is fast becoming a promising approach for interventions aimed at managing obesity in adolescents, the implementation of methodological strategies and reporting of treatment fidelity remain sub-optimal. Future studies need to report on each of the treatment fidelity domains for researchers to gain a better understanding of how an intervention was implemented and the extent to which the intervention affects the outcomes. Additionally, more research is needed to address the knowledge gaps identified by stakeholders to establish well-implemented MI-based interventions

in this population. Including treatment fidelity gives researchers confidence that the intervention is truly MI-based.

Table 2.1. Treatment fidelity domain definitions

Treatment Fidelity	
Domain	Definition
Fidelity to Theory	Hypotheses were tested in the study in accordance with the underlying theory and clinical processes
Provider Training	Treatment providers received standardized training, and were monitored to maintain provider proficiency
Treatment Implementation	The intervention was effectively delivered as intended
Treatment Receipt	The study participants' ability to understand and perform behavioural skills and cognitive strategies was acquired during treatment
Treatment Enactment	The ability of study participants to perform behavioural skills and cognitive strategies in relevant real-life situations

Table 2.2. Overview of study characteristics for motivational interviewing-based interventions addressing adolescent obesity

	Study Details				Adolescent Characteristics			
Study (Year, County)	Main Objective	Design	Intervention: Comparison	Sample Size	Age Range [Mean±SD], y	BMI (kg/m^2)[§]	Sex	Ethnicity (% majority)
Andre & Beguier (2015, France)	Compare PA program vs. PA + MI program focused on self-regulated strategies	Pilot RCT	MI + PA: PA	MI=8	12-17 (14.4±1.5)	37.7	F=5 M=3	Caucasian (100%)
Ball et al. (2011, Canada)	Compare MI + CBT program for weight management vs. program without MI + CBT	Pilot RCT	Education, self-monitoring, goal setting, MI + CBT: Education, self-monitoring, goal setting	MI=17	13-17 (14.6±1.3)	34.8	F=10 M=7	Caucasian (82%)
Bean et al. (2015, USA)	Assess effects of MI values on program attrition and adherence	Pilot RCT	MI: Education	MI=58	11-18 (13.6±1.8)	98.9±1.0 percentile	F=44 M=14	Black (73%)
Black et al. (2010, USA)	Evaluate home and community-based programs on changes in BMI, body composition, PA, and diet	RCT	MI + SCT: Program w/o MI + SCT	MI=121	11-16 (13.3±1.0)	45% overweight or obese	F=62 M=59	Black (98%)
Brennan et al. (2008, Australia)	Examine efficacy of CBT + MI	RCT	MI + CBT: Interview w/o MI + CBT	MI=29	11-19 (14.3±1.9)[€]	Overweight or obese[€]	F=34[€] M=29[€]	Australian[¥] (94%)
Carcone et al. (2013, USA)	Identify communication behaviours used by weight loss counselors that predicted motivational statements	Mixed-methods	None	MI=37	12-17 (14.7±1.6)	38.5±8.3	F=27 M=10	Black (100%)
Chahal et al. (2017, Canada)	Determine effectiveness of MI for adolescents with dyslipidemia + parents (dyad) vs. adolescents only	Mixed-methods	MI w/adolescent vs MI w/dyad[†]: None	MI=32	10-17 (13.7±2.5)	31.5±6.4	F=12 M=20	NR

Table 2.2. Overview of study characteristics for motivational interviewing-based interventions addressing adolescent obesity (continued)

	Study Details				Adolescent Characteristics			
Study (Year, County)	Main Objective	Design	Intervention: Comparison	Sample Size	Age Range [Mean±SD], y	BMI (kg/m^2)§	Sex	Ethnicity (% majority)
Currie et al. (2016, USA)	Examine the effect of a 7-week low-dose PA intervention on PA and BMI in severe obese adolescents	Pilot RCT	MI, PA + consultations: Consultations	MI=34	12-18 (14.4±1.9)€	2.5±0.3 z-score	F=36€ M=28€	Black (76%)
Davis et al. (2011, USA)	Test the effects of a circuit training program, with and without MI	RCT	MI + circuit training: circuit training	MI=14	14-18 (15.7±1.2)	34.6±6.0	F=14 M=0	Hispanic (100%)
Flattum et al. (2009, USA)	Evaluate the feasibility of MI as a component in a school-based program	Pilot RCT	MI, PE class, healthy eating + social support: PE class	MI=20	16-18 (17.0±NR)	Overweight or at risk of becoming overweight	F=20 M=0	Caucasian (55%)
Freira et al. (2018, Portugal)	Evaluate the effect of a MI intervention compared to conventional counseling over the anthropometric outcomes of adolescents with obesity/overweight	RCT	MI: Conventional counselling	MI=42	14-19 (16.1±1.5)	1.54±0.50 z-score	F=31 M=15	NR
Gourlan et al. (2013, France)	Evaluate the effectiveness of MI as an addition to a standard weight loss program	RCT	MI + SWLP: SWLP	MI=26	11-18 (13.0±1.7)€	29.6±5.3€	F=25€ M=37€	NR
Irby et al. (2010, USA)	Report a case study on the use of MI with behavioural therapy	Case Study	None	MI=1	14	35.0±NR	F=1 M=0	Caucasian (100%)

Table 2.2. Overview of study characteristics for motivational interviewing-based interventions addressing adolescent obesity (continued)

Study (Year, County)	Study Details				Adolescent Characteristics			
	Main Objective	Design	Intervention: Comparison	Sample Size	Age Range [Mean±SD], y	BMI (kg/m^2)[§]	Sex	Ethnicity (% majority)
Jensen et al. (2019, USA)	Examine the feasibility and acceptability of an adaptive text messaging intervention, delivered along with in-person MI, in a primary care setting.	Between-subjects experimental design + random assignment	MI + self-monitoring vs MI, self-monitoring + adaptive text[†]: None	MI=47	12-18 (15.0±1.5)	91.5±4.2 percentile	F=37 M=10	Non-Hispanic White (64%)
Kong et al. (2013, USA)	Determine the feasibility of a school-based health center program	RCT	MI, obesity risk reduction + clinical encounters: Program w/o MI	MI=28	13-16 (15.0±1.0)	94.5±4.1 percentile	F=17 M=11	Hispanic (75%)
Kose & Yildiz (2021, Turkey)	Investigate the effect of a motivational support program	RCT	MI + reminder messages: Program w/o MI	MI=37	12-18 (14.38±1.5)	29.91±3.42	F=24 M=13	NR
Love-Osborne et al. (2014, USA)	Evaluate the feasibility of adding a health educator to a school-based health center program	RCT	MI, preventive services + text: Preventive services w/o MI	MI=82	14-17 (15.7±1.5)	31.9±6.2	F=48 M=34	Hispanic (88%)
MacDonell et al. (2012, USA)	Pilot MI targeting weight-related behaviours	Pilot RCT	MI: Nutrition counselling	44	13-17 (15.0±1.4)	36.7±6.9	F=35[€] M=9[€]	Black (100%)

Table 2.2. Overview of study characteristics for motivational interviewing-based interventions addressing adolescent obesity (continued)

Study (Year, County)	Study Details				Adolescent Characteristics			
	Main Objective	Design	Intervention: Comparison	Sample Size	Age Range [Mean±SD], y	BMI (kg/m^2)[§]	Sex	Ethnicity (% majority)
Naar-King et al. (2016, USA)	Develop an adaptive behavioural treatment for African American adolescents w/obesity	SMART	Home-based MI + skills vs Office-based MI + skills[†]: None	MI=181	12-17 (14.3±1.4)	38.2±7.5	F=122 M=59	Black (100%)
Neumark-Sztainer et al. (2010, USA)	Evaluate a school-based program aimed at preventing weight-related problems	RCT	MI, PE class, nutrition and self-empowerment: PE class	MI=182	14-16 (15.7±1.1)	25.9±7.1	F=182 M=0	Black (32%)
Pakpour et al. (2015, Iran)	Evaluate and compare the role of parental involvement (PI) in MI interventions	RCT	MI + PI vs MI w/o PI[†]: Assessments only	MI=238	14-18 (15.6±1.3)	33.1±7.4	F=130 M=108	Iranian[¥] (100%)
Resnicow et al. (2005, USA)	Develop and test a culturally tailored intervention for adolescents and their parents	RCT	MI + high-intensity program: MI + moderate-intensity program	MI=53	12-16 (13.6±1.4)	31.9±5.5	F=53 M=0	Black (100%)
Riiser et al. (2014, Norway)	Investigate the short-term effects of an internet intervention in primary care	Controlled trial w/o randomization	MI + online program based on Self-determination Theory: Follow-up w/school nurses	MI=84	13-15 (13.7±NR)	26.6±NR	F=50 M=34	Norwegian[¥] (86%)

Table 2.2. Overview of study characteristics for motivational interviewing-based interventions addressing adolescent obesity (continued)

	Study Details				Adolescent Characteristics			
Study (Year, County)	Main Objective	Design	Intervention: Comparison	Sample Size	Age Range [Mean±SD], y	BMI (kg/m^2)§	Sex	Ethnicity (% majority)
Vallabhan (2015, USA)	Determine the usefulness of MI by primary care providers	RCT	MI: Program w/o MI	MI=227	14-17 (NR)	Overweight/obese	F=254€ M=171€	Hispanic (75%)
Walpole et al. (2013, Canada)	Evaluate the efficacy of MI for promoting self-efficacy and weight loss	RCT	MI: Social skills training	MI=20	10-18 (14.1±1.8)	30.2±2.8	F=14 M=6	Caucasian (95%)
Wilson et al. (2002, USA)	Compare the effects of an SCT + MI vs. only SCT, or education only program	RCT	MI + SCT vs SCT only†: Education only	MI=17	11-15 (NR)	52.0±9.0 weight (kg)	F=9 M=8	Black (100%)

NR: Not Reported; RCT: Randomized Controlled Trial; MI: Motivational Interviewing; CBT: Cognitive Behavioural Therapy; SCT: Social Cognitive Theory; BMI: Body Mass Index; PA: Physical Activity; PE: Physical Education; SWLP: Standard Weight Loss Program; SMART: Sequential Multiple Assignment Randomized Trial

§: When BMI was not reported, similar measures are presented as described (*e.g.,* BMI percentile, BMI Z-Score)

€: Data only reported for full sample size, not MI-based intervention specific sample

¥: Nationality is presented (*e.g.,* Australian) when ethnicity was not reported

†: Intervention groups

Table 2.3. Delivery context of motivational interviewing-based interventions and training

	Features					
Study	Setting	Delivery	Duration	Frequency	Delivered by	Training
Andre & Beguier	Community	In-person	20 min	Twice per week; 16 MI sessions over 8-weeks	Therapist	NR
Ball et al.	Health care	In-person	45-60 min	Weekly; 16 MI sessions over 16-20 weeks	Registered Dietitian; Registered Nurse	2-day training; theoretical and practical
Bean et al.	Health care	In-person	30 min	2 MI sessions at weeks 1 and 10	"Interventionist" (independent from study)	2-day training by a MINT member; 30 hours of practice
Black et al.	Home; Community	In-person	NR	12 MI sessions over 12 weeks	College-enrolled, African-American mentors	40 hours
Brennan et al.	Health care	In-person; Phone	60 min	Weekly: first 10 MI sessions; bi-weekly: remaining 3 MI sessions	Researcher: Postgraduate Psychology student	Trained in MI; didactic and practical
Carcone et al.	Health care; Community	In-person	30-60 min	1 session	3 Weight loss Counsellors: 2 Psychologists, 1 Dietitian	Trained in MI; Members of MINT
Chahal et al.	Health care	In-person	30-45 min	4 MI sessions over 6 months	Nurse Practitioner	Two 3-day advanced MINT workshops; practice sessions
Currie et al.	Health care	Phone; Newsletters	~9 min	7 MI sessions over 7 weeks	Research staff	7 hours
Davis et al.	Health care	In-person	60-90 min	8 MI sessions over 16 weeks; 4 individual + 4 group	Trained research staff	Members of MINT
Flattum et al.	High school	In-person; Phone	20-25 min; 10-15 min	Every 2-3 weeks; 7 MI sessions over 18 weeks	Registered Dietitian; Health Educator	2-day training

Table 2.3. Delivery context of motivational interviewing-based interventions and training (continued)

	Features					
Study	Setting	Delivery	Duration	Frequency	Delivered by	Training
Freira et al.	High school	In-person	30 min	3 MI sessions over 6 months	Pediatrician	80 hours of theoretical and practical training with 2 MINT members
Gourlan et al.	Health care	Phone	20 min	6 MI sessions over 6 months	Doctoral student: Sports and Exercise Sciences	40 hours of reading; 32 hours with the French Association of MI
Irby et al.	Health care	In-person; Phone	30 min	Bi-weekly - monthly over 4 months	Registered Dietitian; Family Counselor; Physical Therapist; Exercise Specialist	3-day training from MINT
Jensen et al.	Health care	In-person; Text	60 min	1 MI session over 6 months	Doctoral student: Clinical Psychology	NR
Kong et al.	Health care (school)	In-person; Phone	~24-47 min	Every 3 weeks; 8 MI sessions over 1 academic year	Nurse Practitioner	2-day training workshop; review of pilot MI sessions
Kose & Yildiz	Health care	In-person	~30 min	8 MI sessions; Twice in 1st and 2nd month; Once in the other months	Researcher	16 hours of training on MI techniques in a certified education program
Love-Osborne et al.	Health care (school)	In-person; Text	NR	1-8 MI sessions (mean=5 MI sessions) bi-weekly, monthly or bi-monthly	Health Educator	1-day training on MI techniques; 2-month follow-up sessions
MacDonell et al.	Health care	In-person	60 min	4 MI sessions over 10 weeks	Registered Dietitian	16 hours of training by a member of MINT
Naar-King et al.	Home; Office	In-person	60 min	Weekly over 3 months	Community Health Worker (Paraprofessional Counsellor)	80 hours didactic training w/MI trainers (Psychologist + Dietitian); 50 hours role-playing; 170 hours individual/interactive training

Table 2.3. Delivery context of motivational interviewing-based interventions and training (continued)

	Features					
Study	Setting	Delivery	Duration	Frequency	Delivered by	Training
Neumark-Sztainer et al.	School	In-person	15-20 min	Every 3-4 weeks; 5-7 MI sessions over 1 year	Registered Dietitian; Health Educator	2-day training in MI techniques by intervention coordinator with MI training
Pakpour et al.	Health care	In-person	~40 min	Weekly; 6 MI sessions over 6 weeks	Registered Dietitian; Exercise Specialist	51 hours and 48 hours, respectively
Resnicow et al.	Church	Phone	20-30 min	4-6 MI sessions over 6 weeks	Counsellors: Masters/Doctoral degree in Psychology or Public Health	16 hours
Riiser et al.	School	Online	NR	Once per week for 12 weeks	Researchers	MI courses and lectures
Vallabhan	Health care (school)	In-person	20 min	16 MI sessions over 2-3 months	1 Physician Assistant; 3 Nurse Practitioners	2-day training by a MINT member; additional 1 week MI practice
Walpole et al.	Health care	In-person	~30 min	5-6 MI sessions over 6 months	Doctoral student: Clinical Psychology	Training from MINT
Wilson et al.	School	In-person	30 min	12 MI sessions; weekly over 12 weeks	Research staff	2-day training

NR: Not Reported; MI: Motivational Interviewing; MINT: Motivational Interviewing Network of Trainers

Table 2.4. Instruments to assess motivation (n=6) and psychometrics

	Motivation-related Instruments		
Study	Instrument	Psychometrics	
	No. of Items/Domains	Validity	Reliability (Internal Consistency)
Brennan et al.	Weight Loss Stages of Change Short Form; ¥ Exercise Stages of Change Short Form; ¥ Exercise Stages of Change Continuous Measure; ¥ Exercise Decisional Balance Scale: 10 items; ¥ Weight Loss Decisional Balance Scale; ¥ Exercise Self-efficacy Scale; ¥ Eating Self-Efficacy Scale;¥ Exercise Processes of Change Scale; ¥ Weight Loss Processes of Change Scale¥	NR	NR
Chahal et al.	Motivational Interviewing Readiness to Change Questionnaire (Adapted): 3 subscales	NR for the adapted instrument; scale adapted from Marcus and Forsyth (2003) Questionnaire categorizes persons into one of the five stages of change: pre-contemplation, contemplation, preparation, decision/action and maintenance	NR

Table 2.4. Instruments to assess motivation (n=6) and psychometrics (continued)

	Motivation-related Instruments		
Study	Instrument	Psychometrics	
	No. of Items/Domains	Validity	Reliability (Internal Consistency)
Gourlan et al.	Behavioural Regulation Exercise Questionnaire (BREQ-2; French version): 20 items	NR; instrument is a combination of amotivation, extrinsic regulation, introjected regulation, identified regulation and intrinsic regulation	NR
MacDonell et al.	Intrinsic motivation for nutrition/eating: 11 items Intrinsic motivation for activity: 11 items	NR; instruments are a combination of self-regulation questionnaires	Nutrition/Eating: 11 items $\alpha = 0.86$ Activity: 11 items $\alpha = 0.87$
Riiser et al.	Behavioural Regulation Exercise Questionnaire (BREQ-2): 19 items	Factorial validity*‡, model fit CFI = 0.94 RMSEA = 0.06 SRMR = 0.07 *Amotivation, Extrinsic/External regulation, Introjected regulation, Identified regulation and Intrinsic regulation	Amotivation: 4 items $\alpha = 0.83$ Extrinsic/External regulation: 4 items $\alpha = 0.76$ Introjected regulation: 3 items $\alpha = 0.78$ Identified regulation: 4 items $\alpha = 0.71$ Intrinsic regulation: 4 items $\alpha = 0.86$

Table 2.4. Instruments to assess motivation (n=6) and psychometrics (continued)

	Motivation-related Instruments		
Study	Instrument	Psychometrics	
	No. of Items/Domains	Validity	Reliability (Internal Consistency)
Wilson et al.	Self-concept Scale (Adapted; for F+V and PA): 12 items	NR for the adapted instruments; scale adapted from Eitel and Friend (1999) and Leake et al. (1999)	Self-concept Scale (F+V): 6 items r = 0.50 Self-concept Scale (PA): 6 items r = 0.71
	Motivational Scale (Adapted; for F+V and PA): 12 items		Motivational Scale (F+V): 6 items r = 0.53 Motivational Scale (PA): 6 items r = 0.78

NR: Not Reported; CFI: Comparative Fit Index; RMSEA: Root Mean Square Error of Approximation; SRMR: Standardized Root Mean Square Residual; F+V: Fruits + Vegetables; PA: Physical Activity;
¥: Validated for use in an adult (18-54 years) population
‡: Factor model NR
α: alpha
r: reliability coefficient

Table 2.5. Study characteristics of participants (n=13) in the stakeholder consultation

	Total (n=13)
Characteristics	N (%)
Age	
Under 25	0
25-34	0
35-44	4 (31)
45-54	7 (54)
55-64	2 (15)
65+	0
Sex	
Female	9 (69)
Male	4 (31)
Country	
Canada	2 (15)
France	1 (8)
USA	10 (77)
Education	
MD	2 (15)
Post-Doc	4 (31)
PhD	6 (46)
Master	1 (8)
Bachelor	0
Position	
Assistant Professor	1 (8)
Associate Professor	5 (38)
Professor	4 (31)
Pediatric Cardiologist	1 (8)
Registered Dietitian	1 (8)
Registered Psychologist	1 (8)

Table 2.6. Evaluation of treatment fidelity strategies in studies (n=26) administering motivational interviewing-based interventions

	Count (%)		
Treatment Fidelity Strategies*	Reported	Not Reported	Not Applicable
Fidelity to Theory[§]			
Steps taken to ensure fidelity			
1. Theoretical review by experts	12 (46.2)	14 (53.8)	
2. Ensure adequate dose of intervention is received	11 (42.3)	14 (53.8)	1 (3.8)
3. Ensure equivalent dose of treatment across condition	11 (42.3)	12 (46.2)	3 (11.5)
How was fidelity assessed?			
1. Documentation of review, comments, suggestions	8 (30.8)	18 (69.2)	
2. Statistics on intervention:			
Number	25 (96.2)	1 (3.8)	
Frequency	26 (100)		
Length of contact	23 (88.5)	3 (11.5)	
3. Show no difference in number, frequency, length, and type of content	20 (76.9)	3 (11.5)	3 (11.5)
Provider Training			
Steps taken to ensure fidelity			
1. Initial training of interventionists	24 (92.3)	2 (7.7)	
2. Test of provider skills	13 (50.0)	13 (50.0)	
3. Ongoing supervision of interventionists	16 (61.5)	10 (38.5)	
4. Periodic retraining to prevent drift	12 (46.2)	14 (53.8)	
How was fidelity assessed?			
1. Training protocols and standardized materials	11 (42.3)	15 (57.7)	
2. Results on post-training test	4 (15.4)	22 (84.6)	
3. Forms used to document supervision	8 (30.8)	18 (69.2)	
4. Schedules and protocol for retraining	8 (30.8)	18 (69.2)	
Treatment Implementation[€]			
Steps taken to ensure fidelity			
1. Standardized intervention protocol	15 (57.7)	11 (42.3)	
2. Provider monitoring (*e.g., video, audio, in-person)*	17 (65.4)	9 (34.6)	

Table 2.6. Evaluation of treatment fidelity strategies in studies (n=26) administering motivational interviewing-based interventions (continued)

	Count (%)		
Treatment Fidelity Strategies*	Reported	Not Reported	Not Applicable
Treatment Implementation (continued)			
3. Participant rating of treatments' credibility	8 (30.8)	18 (69.2)	
4. Minimize treatment contamination	16 (61.5)	9 (34.6)	1 (3.8)
How was fidelity assessed?			
1. Treatment manual or other standard delivery materials	18 (69.2)	8 (30.8)	
2. Individual or aggregate results of monitoring	16 (61.5)	10 (38.5)	
3. Survey of participants' perceptions of treatment	11 (42.3)	15 (57.7)	
4. Methods used to prevent contamination	15 (57.7)	10 (38.5)	1 (3.8)
Treatment Receipt			
Steps taken to ensure fidelity			
1. Check of participants' understanding	6 (23.1)	20 (76.9)	
2. Measure of change in participants' knowledge	6 (23.1)	20 (76.9)	
3. Review of homework completion	6 (23.1)	20 (76.9)	
4. Self-report or diary to measure use of new skills	10 (38.5)	16 (61.5)	
How was fidelity assessed?			
1. Results from participant measures	21 (80.8)	5 (19.2)	
Treatment Enactment£			
Steps taken to ensure fidelity			
1. Success in implementing new behaviours	14 (53.8)	11 (42.3)	1 (3.8)
2. Level of skills in performing new behaviours	3 (11.5)	22 (84.6)	1 (3.8)
How was fidelity assessed?			
1. Lab assessment of actual participant skills/behaviours	5 (19.2)	20 (76.9)	1 (3.8)
2. Self-report or home visit to assess actual skills/behaviours	10 (38.5)	15 (57.7)	1 (3.8)

*: Treatment Fidelity Strategies were not applicable for some studies, so all rows do not sum to 100%
§: Fidelity to Theory not applicable as there were no equivalent dose of treatment across conditions
€: Treatment Implementation not applicable because of study design (*e.g.,* case study)
£: Treatment Enactment not applicable because of study focus (*e.g.,* communication behaviours)

Table 2.7. 'High treatment fidelity' in motivational interviewing-based interventions

	Number of Studies (n=26)
Treatment Fidelity Strategies	N (%)
Fidelity to Theory	10 (38.5)
Provider Training	6 (23.1)
Treatment Implementation	7 (26.9)
Treatment Receipt	5 (19.2)
Treatment Enactment	2 (7.7)
All Strategies	0 (0)

Table 2.8. Knowledge gaps identified by stakeholders

Knowledge Gaps		
Codes	Categories	Exemplar quotes
Tool	Simple, standardized tool to document or measure treatment fidelity that is reliable and valid	*"I think that what your summary and your review tell us is that we need some more standardized way[s] to measure this... As a dietitian too, it's hard to do food that way; It's hard to do physical activity. So, you know, we're going to try to get to the best point we can. But as researchers too, we have to show a consistent and reliable tool."* - Stakeholder #3
Fidelity	Differences in defining, monitoring, and measuring treatment fidelity in MI-based interventions	*"We have multiple definitions of fidelity. So, a lot of people use the MITI but we use our own...Are we focusing on the right variables to measure fidelity? The ones that really predict outcomes."* - Stakeholder #7
Quality of research	Some interventions described as MI-based interventions but only incorporated some principles of MI	*"And we have a pretty strict definition. If you call it MI-inspired or MI-based that's one thing. But if you're calling it MI, (you know,) we believe that (you know,) you have to have a member of MINT (you know,) involved, you have to be coding for confidence, you have to be listening to audio tapes (you know,) for supervision...So I'm always telling people who I supervise (like), if you don't want to go through that process, don't call it an MI intervention call it, you know, uses the principles of MI (or does this, or does that, or you know found) but not don't call it MI."* - Stakeholder #10
Populations	Difficulties engaging lower socioeconomic status populations	*"Our Black populations and our Latino or our lower income, (they're just not,) they're more difficult to engage in research, and it takes a concerted effort to get lower income people who don't have the luxury of time and resources engaged in research. And, I think the literature really reflects that."* - Stakeholder #13

Table 2.8. Knowledge gaps identified by stakeholders (continued)

Knowledge Gaps		
Codes	Categories	Exemplar quotes
Group delivery	Effectiveness of MI-based interventions delivered in a group setting	*"I think one other area might be, there's not much that's known about (sort of) group delivery of these types of interventions. (I think, and) I've actually done a bunch of interventions that used MI in group settings, but I think there's less that's known about effectiveness of group interventions that integrate motivational interviewing approaches."* - Stakeholder #11
Study designs	Limited well-designed MI-based interventions with large sample sizes and a variety of study designs	*"I think we just don't have enough well-designed big studies that really are testing it [MI]."* - Stakeholder #5

MI: Motivational Interviewing; MITI: Motivational Interviewing Treatment Integrity Code; MINT: Motivational Interviewing Network of Trainers

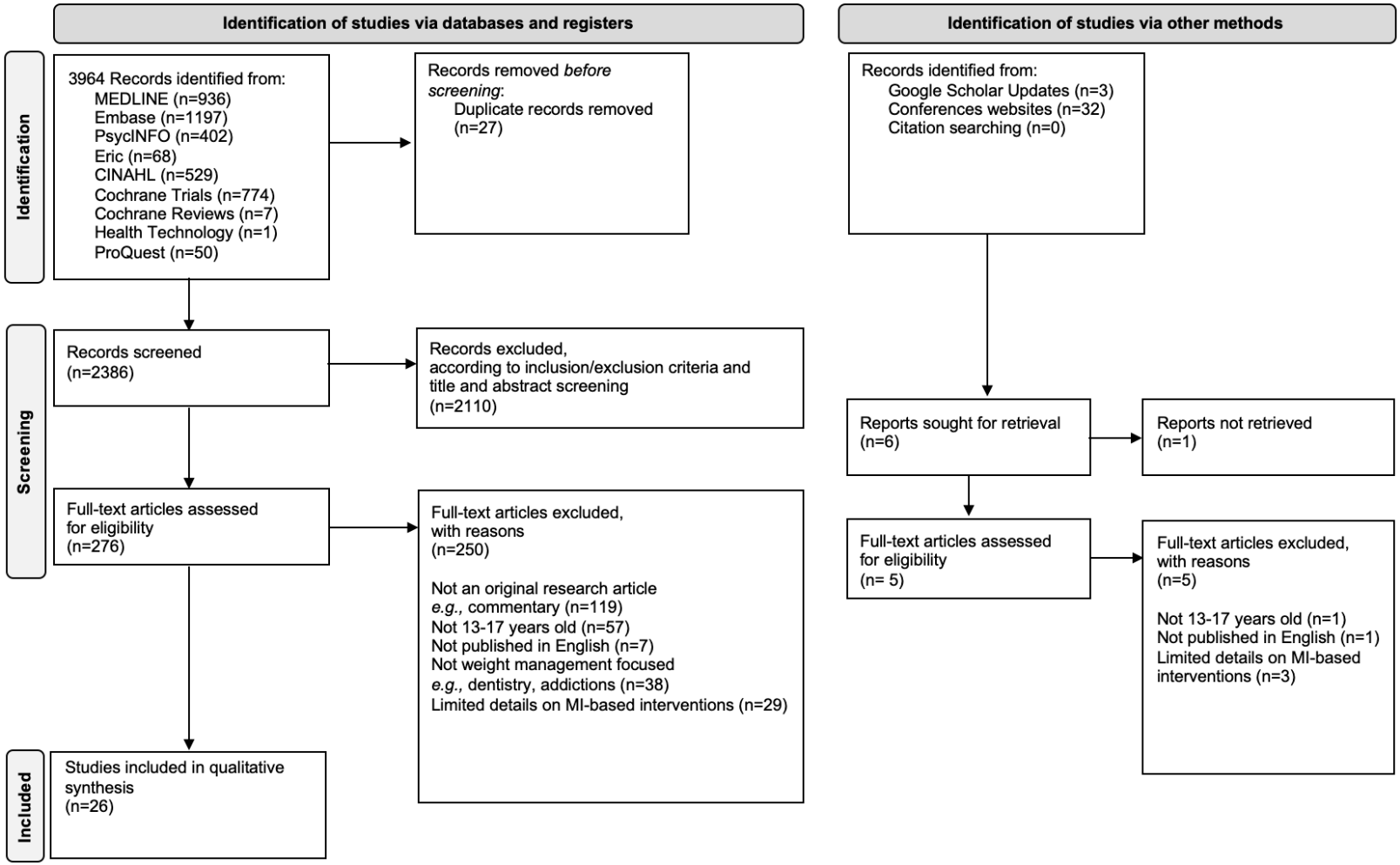

Figure 2.1. Identification, screening and selection of studies included in the review

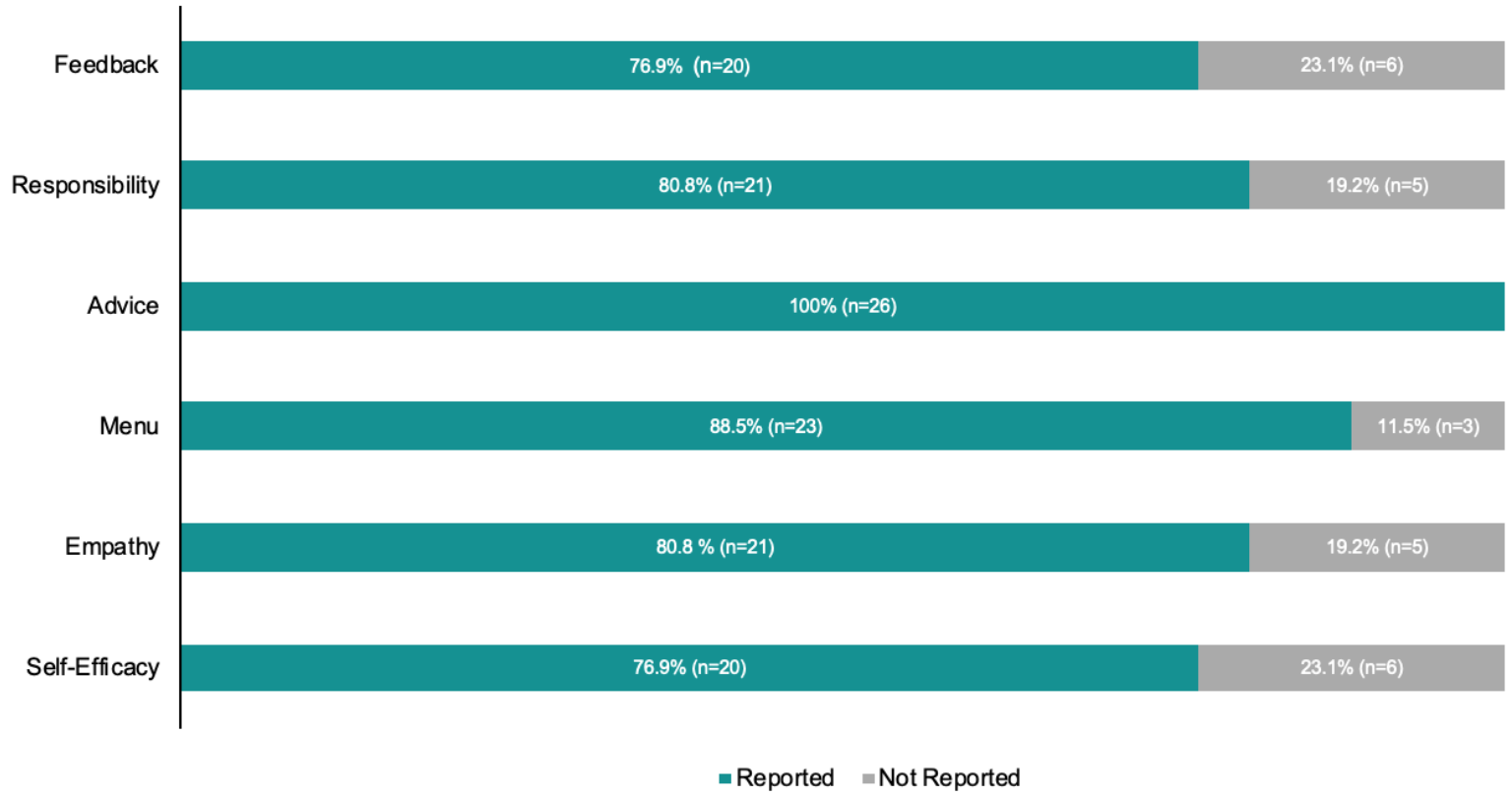

Figure 2.2. Important elements of motivational interviewing-based interventions (n=26) identified as 'reported' or 'not reported' using the FRAMES approach

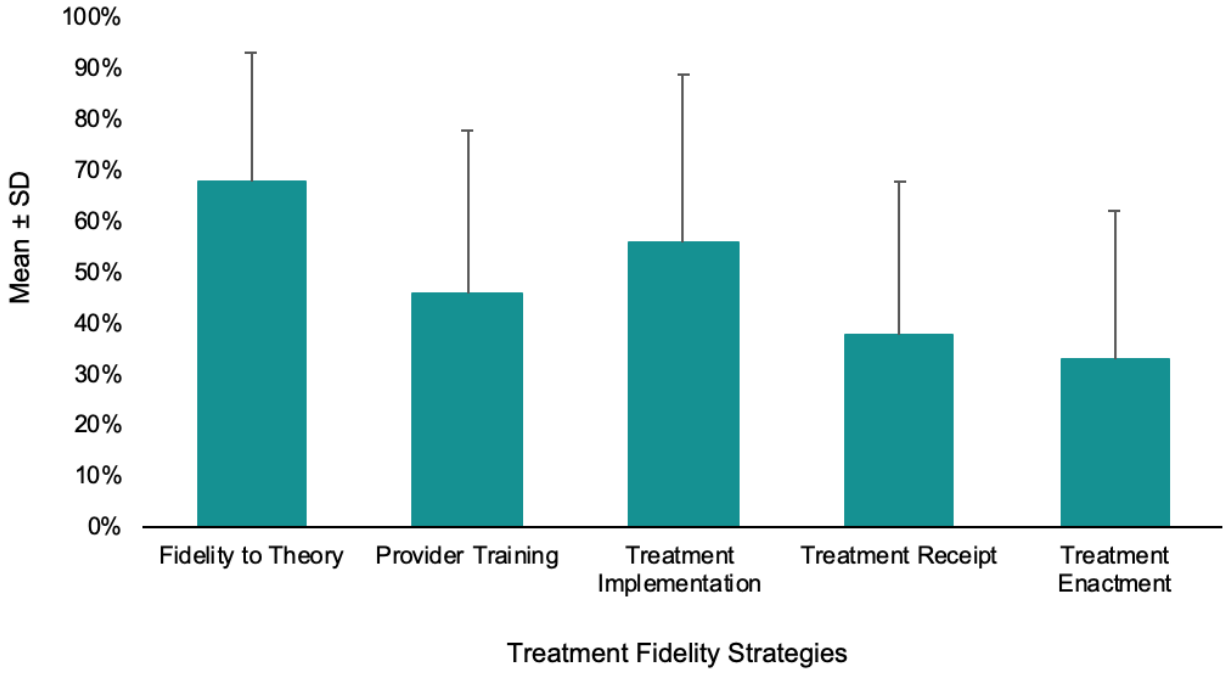

Figure 2.3. Proportion of adherence to treatment fidelity in motivational interviewing-based interventions

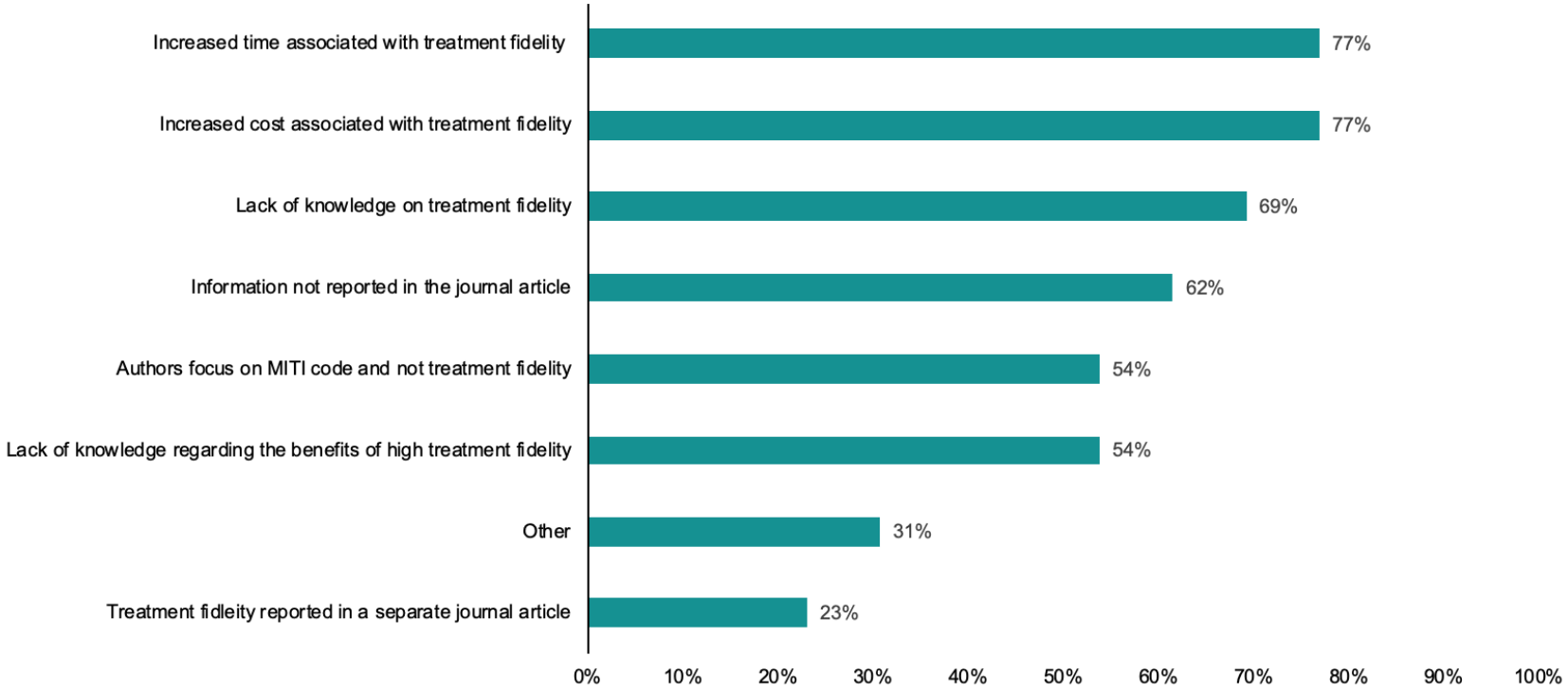

Figure 2.4. Factors affecting 'low treatment fidelity' in motivational interviewing-based interventions

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Chapter 3

Browne NE, Newton AS, Gokiert R, Holt NL, Perez A, Ball GDC, 2023. Adolescents' lived experiences with obesity and changing behavioural habits: An interpretative phenomenological analysis [Manuscript in preparation].

3.1. Summary

Objective: To understand adolescents' experiences living with obesity and behavioural changes while enrolled in pediatric obesity management.

Methods and Design: From November 2021 to April 2022, a qualitative study was conducted using interpretative phenomenological analysis. Data were collected through one-on-one, semi-structured, in-depth, virtual interviews with adolescents with obesity enrolled in a pediatric obesity management clinic in Edmonton, Canada.

Results: Interviewed adolescents with obesity (n=7; BMI ≥97th percentile; 15.6 ± 1.7 years old) were primarily female (n=5) and of white ethnicity (n=5). Three group experiential themes (and eight subthemes) were identified: (1) emotional reactions (positive, neutral, negative) during clinical encounters; (2) fear and apprehension when changing behaviours, which included fear of failure as well as motivational readiness to change nutrition, physical activity, and sleep; and (3) complications regarding behaviour change as making changes was challenging, unexpected circumstances were experienced, and family involvement and interest supported change.

Conclusion: Adolescents in pediatric obesity management differed in how they experienced behavioural changes, which is likely the result of their individual needs, as well as multiple factors such as emotions, apprehension, and difficulties with changing behaviours.

3.2. Introduction

Over the past several decades, the worldwide prevalence of adolescent obesity has increased substantially (Abarca-Gómez et al., 2017). Globally, 124 million five to 19-year-olds with obesity were reported in 2016 as compared to 11 million in 1975 — a tenfold increase over 40 years (Abarca-Gómez et al., 2017). Approximately 13 percent of three to 19-year-olds in Canada have obesity (Carroll et al., 2015). Adolescents with obesity are at high risk of maintaining their excess weight into adulthood and developing other health problems including adverse cardiometabolic (*e.g.,* triglycerides, low-density lipoprotein cholesterol, blood pressure) (Freedman et al., 2007), psychosocial (*e.g.,* bullying, social isolation, weight bias and stigma) (Beck, 2016), and mental health (*e.g.,* depression, anxiety, suicide ideation and attempts) (Carpenter et al., 2000; Halfon et al., 2013) outcomes. As they grow and develop, adolescents gain independence and autonomy, so they represent a group with an increasing ability to make independent choices related to their behavioural habits, which can have a positive impact on their health and well-being.

Behaviour change represents the cornerstone of managing obesity in adolescents. Several systematic reviews (Al-Khudairy et al., 2017; Brown et al., 2019; O'Connor et al., 2016) and clinical practice guidelines (Lau et al., 2007; Styne et al., 2017) have highlighted the beneficial effects of changes in behaviours (*e.g.,* diet, physical activity, sedentary activity, sleep) on obesity and obesity-related consequences in adolescents. When making behavioural changes, motivation, ambivalence, and readiness to change are important considerations (Hampl et al., 2023), as are the degree of controllability, mental health, and social pressures (Kebbe et al., 2018). Although health care professionals often recommend that adolescents with obesity change their behavioural habits (Hampl et al., 2023; Kansra et al., 2021), adolescents' experiences and

decisions related to making changes have not been explored in depth. Gaining insights from adolescents into the enablers and barriers that influence change can help to inform intervention strategies and improve health services to align with adolescents' preferences and needs. Qualitative research can provide rich descriptions of participants' experiences, perceptions, preferences, and needs and gain deeper insights into their behaviour (Miles and Huberman, 1994; Moser and Korstjens, 2017). The objective of this study was to understand adolescents' experiences living with obesity and behavioural changes while enrolled in pediatric obesity management.

3.3. Methods

Design

In this study, we followed a qualitative methodology using Interpretive Phenomenological Analysis (IPA) (Smith et al., 2009) under an interpretative paradigm (Creswell and Poth, 2017; Mayan, 2023). This paradigm includes a relativist ontological view (multiple perceptions of social reality exist that vary among individuals) and a subjectivist epistemological perspective whereby meaning is co-constructed between researchers and participants (Mayan, 2023; Smith et al., 2009). The University of Alberta Health Research Ethics Board approved the study protocol (Pro00112714).

Reflexivity

According to Gentles et al., (2014), reflexivity is "the generalized practice in which researchers strive to make their influence on the research explicit — to themselves, and often to their audience" (p. 1). The first author (NEB) was aware of her personal experiences, views and skills,

which were present from the research design to data analysis. These included being a female, graduate-level researcher (PhD Candidate), Registered Dietitian with a Master's degree, and research team member on a pediatric obesity management study related to readiness and motivation (2015 to 2022; (Ball et al., 2017)) as well as having advanced knowledge in motivational interviewing (MI), obesity management, and IPA. Throughout the study, the first author drew on her experiences (*e.g.,* low self-esteem, bullying, and lack of autonomy) with adolescent obesity. By reflecting on her personal experiences, the first author sought to use her interpersonal and MI skills to foster trusting and caring interviews so that participants felt comfortable sharing their thoughts, and relied on her warm Caribbean personality when building rapport during sensitive issues that emerged during the interviews (*e.g.,* mental health, divorce, and financial insecurity).

Sampling and Criteria

We used purposive homogenous sampling to identify participants with behavioural change experiences related to obesity management health care services. Potential participants were individuals already enrolled in an observational cohort study of readiness and motivation to change behavioural habits within multidisciplinary pediatric obesity management clinics in Alberta (Ball et al., 2017). These individuals were ideal participants because of their shared experiences of being enrolled in a pediatric obesity management clinic and the focus on obesity management to support adolescents in making behavioural changes. Fifty-four adolescent-caregiver dyads were enrolled in the cohort study from 2017 to 2022.

Adolescents were eligible for the qualitative study if they: *(i)* were 13 to 20 years old with a body mass index (BMI) $\geq 97^{th}$ percentile (Dietitians of Canada et al., 2014; Dietitians of

Canada, 2010; WHO Multicentre Growth Reference Study Group and de Onis, 2006), *(ii)* were enrolled in a pediatric obesity management clinic in Edmonton or Calgary, Alberta, Canada for ≥6 months, and *(iii)* spoke and read English fluently. We included adolescents aged 13 to 20 years to provide an accurate representation of the range of individuals who received care at the pediatric obesity management clinics. In total, seven adolescents met the inclusion criteria and participated in this study, a sample size that is appropriate and similar to sample sizes from other IPA studies (Pietkiewicz and Smith, 2014; Smith et al., 2009, 1997).

Recruitment and Enrollment

Adolescents and caregivers were recruited by a research team member via phone, email, or text message to query study interest. The study was explained in detail to those adolescents interested in participating, and an email was sent to them with a link to an electronic consent/assent form in Research Electronic Data Capture (REDCap, which is hosted by the Women and Children's Health Research Institute at the University of Alberta (Edmonton, AB, Canada). Informed consent (caregivers) and assent (adolescents) was obtained through the REDCap e-Consent Framework. After enrollment, participants were provided with a copy of the signed informed consent and/or assent form. See Figure 3.1 for the flow chart of recruitment and enrollment.

Data Collection

Qualitative data

Study data were obtained from one-on-one, semi-structured, in-depth interviews conducted by the first author (see Appendix B for the interview guide). Interview questions explored adolescents' experiences with behaviour change and ambivalence, motivation, and readiness to

change, as well as factors that can affect behaviour change. The interview guide was informed by contemporary literature on adolescent obesity (Hampl et al., 2023; Vallis et al., 2022; Woo and Park, 2020) as well as IPA guides (Smith et al., 2017; Smith and Osborn, 2008, 2003). This interview guide was pre-tested for question clarity, topic sequence, and participant burden by completing pilot interviews with two adolescents (one male, one female) who were not connected with this study. There were no changes made after the pilot interviews. Since these two adolescents didn't meet the study inclusion criteria, their data was not included in the analysis. Interviews (duration: 30 to 120 minutes) were conducted using Google Meet, a secure, online videoconferencing platform and without adolescents' caregiver(s) present to ensure that adolescents had the opportunity to share their lived experiences without the influence of their caregivers.

Sociodemographic and health utilization data

We linked sociodemographic and health utilization data to participants' data collected during their participation in the RMI-Family study to provide context for the qualitative data. These data were date of birth, sex, ethnicity (*e.g.,* Indigenous, white, Black), number of clinic appointments with clinicians and clinician type (*e.g.,* physician, Registered Nurse, Registered Dietitian), length of clinic appointments, and duration of clinic enrollment.

Data Analysis

Prior to analysis, interviews were transcribed verbatim using Tactiq, a browser extension that automatically transcribes for Google Meet; transcript data were checked against the original audio to correct any translation semantic errors (*e.g.,* mistranslation of words due to accent).

Whenever necessary, we used square brackets to provide further context for participants' quotes. Participants were assigned pseudonyms and personal identifying information was removed from each transcript.

Data analysis focused on creating an account that makes sense of what participants mean by their lived experiences (Smith et al., 2009). The new and updated terminology for the analytic process in IPA was applied (Smith et al., 2022). We also applied criteria recommended by Nizza et al. (2021) to achieve quality in the analysis. Each transcript was analyzed individually before proceeding to the next transcript. Analysis involved the following four steps (Smith et al., 2022; Smith and Nizza, 2022): First, transcript #1 was read and reread multiple times for comprehension and familiarization, and exploratory notes were made in the right margin; these notes were translated into experiential statements and recorded in the left margin of the transcript. Exploratory notes may include content that clearly captures the important things and meaning for participants, use of language, particularly metaphors, phrases, and repetitions, and questions intended to increase understanding of the transcript. Second, patterns and relationships between experiential statements were identified, which involved clustering the statements to generate personal experiential themes and subthemes as well as explore connections between experiential statements. Taking a closer look at the key experiential and/or existential meanings embedded in participants' accounts gave the analysis deeper meaning (Nizza et al., 2021). In the third step, subsequent interview transcripts were reviewed using the same process for steps one to two. In the final step, patterns were explored across all transcripts, including participants' convergence and divergence across participant experiences, and group experiential themes were documented in a table. Themes and verbatim extracts (quotes) were translated into a compelling narrative account of participants' experiences (Nizza et al., 2021). During the analytic process,

emerging themes and subthemes were discussed by the co-author group to refine the findings. A reflective journal was also maintained by the first author that included observations and reflections about participants' experiences in relation to her own with journal entries capturing feelings, thoughts, and influences that shaped her lived experiences.

Descriptive, numerical summaries for sociodemographic and health utilization data were analyzed using SPSS (Version 28.0, IBM Corp.). Sociodemographic data were described using means and standard deviations, while health utilization data were described using means and ranges.

3.4. Results

Participants' sociodemographic, health services utilization, and enrollment data are shown in Table 3.1. In general, participants were 15.6 ± 1.7 years old with a BMI ≥97th percentile, primarily female (n=5), and of white ethnicity (n=5). All participants attended a multidisciplinary pediatric obesity management clinic at the Stollery Children's Hospital in Edmonton, AB, Canada.

Three group experiential themes and eight subthemes related to behavioural changes emerged from the analysis (Table 3.2), representing multiple factors that influenced adolescents' experiences with behavioural changes.

Theme 1: Emotional reactions during clinical encounters

This theme referred to the emotional reactions that adolescents had with various clinicians from the pediatric obesity management clinic. These reactions were described as positive, neutral, or negative. Adolescents experienced a range of emotional reactions, which manifested independent

of each other or co-occurred (*e.g.,* positive and negative reactions, neutral and negative reactions).

Positive reactions

Participants experienced various positive reactions. Penelope shared, "I think it was a really positive experience. They [*e.g.,* Registered Nurse, Registered Dietitian, exercise specialist], were all really nice. Um, I didn't feel judged at all..." She continued, "I think I was optimistic. Because it kind of finally felt like I was maybe getting a little more direction into the care I was receiving." Monroe expressed, "...it was good to talk to the psychologist a few times." While Leia had some concerns about the visit with the Registered Dietitian, she thought the other clinician visits were positive: "All their help was pretty good, except the dietitian, but everything else is good." Mia also experienced some positive emotional reactions, "...They tried to make you feel as comfortable as possible." When adolescents feel comfortable with clinicians during obesity management, it can result in positive emotional reactions. Isaac shared, "I was happy to join it [pediatric obesity management clinic]. Yeah, it was good to be there."

Neutral reactions

These emotional reactions were neither positive nor negative and had no impact on adolescents. When reflecting on her experiences with a physician, Monroe said, "the doctor didn't really make an impact. It [attending appointments] was just something I had to do." Ayana shared her experience of going to the pediatric obesity management clinic, "um, it didn't feel like too much of a change from like going to the normal doctor... like there wasn't much of a difference so it wasn't that bad." Taan thought the Exercise Specialist and Registered Psychologist didn't make

an impact. Perhaps this was because "...the psychologist one, I think she just said, you're good. Like there's nothing wrong..."

Negative reactions

Some participants recalled negative emotional reactions with specific clinicians, such as conflicting emotions, confusion, and feeling insecure as well as uncomfortable. Penelope mentioned, "I've kind of discontinued my meetings with her [Registered Psychologist] just because it wasn't really pertaining to my journey..." Some adolescents attributed reactions to the approaches used by their clinicians, which resulted in a lack of engagement in behavioural changes. In this regard, Taan said, "I don't know. I was pretty confused. I didn't really know what was happening." Mia shared that the initial four-hour multidisciplinary appointment at the pediatric obesity management clinic, made her feel "…a little bit uncomfortable just because of the whole situation... But again, it just made me feel insecure." Leia described her experience meeting with the Registered Dietitian and hearing her recommendations. She said:

> We did meet with the dietitian there, but I didn't really like what she had to say or what she wanted me to do. Because like she wanted me to eat like six meals per day so you'd have like a snack for breakfast and you'd have like actual breakfast. Like, that's just not something that I do.

Theme 2: Fear and apprehension when changing behaviours

At times, some adolescents who sought to change their behavioural habits experienced fear and apprehension. Common experiences were described as fear of failure, and motivational readiness to change nutrition, physical activity, and sleep behaviours.

Fear of failure

Penelope was "...a little hesitant at first to commit to something like an actual program, or like clinic" due to fear of failure. Penelope said "...I was really almost scared initially of fully committing to it [weight loss journey] because if I failed, if I like wasn't able to actually keep up with it, I think I'd be really disappointed in myself." Leia mentioned that hockey training was part of her behaviour change. She said that her apprehension to change started when she was training for hockey, "...when I started training, like I was afraid. Well, not really afraid; didn't want to put in the work." Likewise, Leia expressed that her apprehension was related to fear of failure, "not because I didn't want to see change, more like, because I didn't want to like, do all this stuff and not achieve anything from it. So, it's a little difficult." Mia mentioned that her apprehension was because of "pretty bad anxiety on a daily." Consequently, Mia felt uncomfortable and anxious engaging in physical activity:

> ...I don't like people seeing me do it. If there's anybody around me, and I feel like they're looking at me, or if they're laughing around me while I'm doing it, I feel like they're laughing at me, and that makes me uncomfortable and anxious and not want to be in that situation, so I'll just stop and find the place where there's no people.

Apprehension towards behaviour change was important to emphasize since it was common among participants. Like Penelope said, "...you think a lot about weight and body image and trying to make positive changes, but then, you know, it spirals into something that's actually really unhealthy, rather than making positive change." A positive attitude alone isn't enough to cope with apprehension around behaviour change and adolescent obesity. For adolescents, the tools and resources offered at pediatric obesity management clinics (*e.g.,* clinicians' advice,

referrals, and information) can help them to change their behaviour. Through the pediatric obesity management clinic, Ayana registered for a program that provided free bicycles, which she said was beneficial because "it just got me to do more physical activity."

Motivational readiness to change nutrition, physical activity, and sleep

Participants reported motivational readiness to change behavioural habits including nutrition, physical activity, and sleep. Being fearful and apprehensive about the ability to successfully change behaviour can affect adolescents' motivational readiness. As a result of these feelings, it appeared that participants focused on motivational readiness to change behavioural habits. This motivational readiness to change was framed within a broad context as well as within a specific context. According to Leia, the pediatric obesity management clinic reduced her apprehension, leading to an improvement in her motivational readiness for sleep and physical activity:

> Um, yeah, like my sleep was pretty bad and then also my activity... Yeah, just not like at the very beginning, more like further in after we started going [to the clinic], not at the start.

Taan also experienced apprehension in anticipation of changing behavioural habits, which led to a delay in changing his eating habits. He described his readiness to change as attempting to figure out where he could fit in behaviour change. He said:

> ...I've been trying for the past, I think two, three weeks. I've been seeing where I could fit it and see what I can do. Something is going to change soon, but, I just gotta wait it out and see when.

Monroe shared that she was ready to change her unhealthy behavioural habits with encouragement from health care professionals at the pediatric obesity management clinic; however, Monroe's fear and apprehension led to limited physical activity, unhealthy eating habits, and reduced hours of sleep. Monroe mentioned "...I'd be ready to change my lifestyle. I just know it's kind of a long road and hard to do." Additionally, to alleviate her fear and apprehension, which led to difficulties engaging in physical activity, Mia would have appreciated:

> ...[clinicians] checking in every couple of weeks to see how everything's going or just to listen to any food struggles that I was having. And tell me how or help me figure out what I could do to solve them or come up with a solution to help with the issue.

In Isaac's case, he expressed how changing unhealthy behavioural habits requires both intrinsic and extrinsic motivation:

> Having a better future, maybe, and like not having problems because you're doing those kinds of things [unhealthy behavioural habits]... Maybe like seeing other people, after they do something... Like if you see somebody else go from not being in a happy life and then they work to become happier, then like it makes me want to do that too... I picture myself in the future and see what I know I could be.

Mia was driven to change unhealthy behavioural habits by her intrinsic motivation. She mentioned that "being able to decide that I wanna go for a walk instead of somebody trying to force me to do it, it's a lot easier. And it makes me wanna do it more." Taan, in contrast, despite

his fear and apprehension that hindered his nutrition and physical activity, was motivated extrinsically:

> One night I was just watching this Michael B. Jordan interview, and then I just saw how he does stuff in a day. And I just kind of, I guess, switched something in my head; like why I need to start, this is getting too much, right? And then the next day, I went out and worked out three times and I did it again and again for about a week. And then it just became a habit for three to four months.

Theme 3: Complications regarding behaviour change

Behaviour change was experienced as non-linear, and adolescents described their experiences as challenging and requiring adaptation to unexpected circumstances. Moreover, adolescents highlighted the importance of support.

Making changes was challenging

Adolescents expressed that changing and maintaining behaviour was challenging. Monroe said:

> ...I usually didn't feel great most of the time. I felt kind of sick because I was only eating like 1200 calories. And I was trying to like work out quite a bit too so it didn't feel great... Um, I lost some weight, but I just didn't, it wasn't really sustainable just because I was so hungry and felt so sick all the time.

Although Mia was trying to create new behavioural habits based on suggestions by a clinician, she noted, "I felt like I wasn't making as much progress in losing weight as I was hoping to." Mia was "...sad that it wasn't happening faster." Overall, Mia acknowledged that the experience

taught her "that it takes time and you shouldn't expect results right away, because then you're just gonna upset yourself." When Penelope reflected on her experiences at the pediatric obesity management clinic for obesity management, she said:

> In the beginning, I was really resisted to it. Like I really didn't want to put any effort into it because I was just like, well, this is the way that everything's been going and like it's not that big of a deal. Like it's not because I don't want to eat, it's just because it makes me sick.

As she discussed her experiences with behaviour change, Penelope emphasized the importance of maintaining healthy behaviours despite the difficulty:

> ...It's hard but it's supposed to be hard. So, it's worth it in the end, I guess. As long as you can remember that. But there is no end; also is the hard part. It's kind of this like forever thing.

Unexpected circumstances were experienced

Most adolescents found it difficult to adapt to certain unexpected circumstances during obesity management. For these adolescents, pediatric obesity management clinic participation occurred during the start of the COVID-19 pandemic. Taan and Penelope described difficulties achieving change during the mandatory public health restrictions such as virtual schooling and social distancing:

> At that time, it was just like, how am I going to do everything that they're telling me? Because like COVID had just started at the moment and like we couldn't go outside, we

> couldn't go to the gym, and you couldn't really go to the supermarket either because everything was shut down... (Taan)

> ...it had a lot of effect on I think my sedentary activity... by the end of it [quarantine], I was just lying in bed. Like, I was just doing this all day; like, that was it. So, I think that like, kind of negatively affected my health because I wasn't getting out of the house very much. (Penelope)

Leia also struggled with maintaining behaviour change during COVID-19. She said, "hockey was shut down and I didn't do anything. I just sat at home, did school, and that was it." Moreover, Leia's mental health was affected, "I got sad because hockey was shut down then I couldn't do anything really." "I was going through a really, really hard time. And then I started training with my personal trainer and I felt a lot better." Because of changes in Leia's schedule when school commenced, she mentioned how committed she was to changing her behaviour:

> ...I got a gym membership and then I was trying to go, and trying, and it wasn't really working out. And then at the start of this month, I went every single day for two weeks. And I felt amazing.

Family involvement and interest supported change

Adolescents expressed gratitude for the support of their families, particularly their mom, aunt, and grandparents. With Taan's mother's support through participation, he began changing his behavioural habits: "she started doing it with me as well. And she'll be like, we'll do it together." Leia's mother also played a role in her behaviour change through tangible support:

> ...my mom, like, helped me like to start with my personal trainer and then she helped me go buy a membership at our gym to go during the summer, like during school. So, she had a lot, a lot to do with it. [My mom] helped me a lot, too.

Further, Mia said that having a supportive aunt influenced her experience with change:

> My aunt is very supportive and very positive. She tells me that she notices how much I've changed and how much confident I look and how I act... having that esteem support is one of the biggest things that has helped me in the last couple of years.

Penelope provided nutrition education to her grandparents during family visits, and their support enabled her to maintain change:

> I think it's just an awareness thing. I'm pretty close with my grandparents. So, during the summer, sometimes I like to go stay out there. And there's been a good couple moments where I'm like, okay, well we can't have pasta every single night of the week; that's not healthy. And they're like, what? You need carbs to live. I'm like, yeah, but not that many. So, I think it's been a little bit of an, like an educating moment... But I think they've also been really supportive.

3.5. Discussion

In this study, three themes were identified through an exploration of adolescents' behavioural changes and experiences living with obesity while enrolled in pediatric obesity management: 1) emotional reactions during clinical encounters; 2) fear and apprehension when changing behaviours; and 3) complications regarding behaviour change. The data highlighted the

opportunities and challenges adolescents encountered when participating in a clinical program for managing pediatric obesity, emphasizing what clinicians and families need to offer adolescents to provide understanding and optimal support when behavioural changes are desired.

We found that adolescents had positive, neutral, or negative emotional reactions during clinical encounters at the pediatric obesity management clinic. Participants reported positive emotional reactions such as being optimistic about the direction of individualized care and feeling happy. Further, negative reactions during obesity management seem to be related to clinician engagement with adolescents, unclear and ineffective communication, increased number of clinician appointments resulting in dropout, and poorly tailored health care services. In addition, eating behaviour and weight problems in pediatric obesity are affected by psychological factors, including negative emotions (Kang and Kwack, 2020). Therefore, it is important to manage these negative emotions in realistic, motivating, and reinforcing ways (Vallis and Macklin, 2021). In addition, Gouveia et al., (2019), found success when adolescents build greater self-compassion and mindfulness, as they are more likely to respond better to emotional distress and develop healthier eating behaviours.

By drawing on recent guidelines pertaining to family engagement (Hampl et al., 2023), we can enhance how clinicians engage with adolescents to facilitate more positive interactions. The findings suggest that the pediatric obesity management clinic may benefit by applying strategies that enhance engagement to facilitate positive interactions such as reasons for referral to the pediatric obesity management clinic, detailed goals for obesity management, and autonomy support. An integrative review also found that one of the most common reasons for attrition in pediatric obesity management programs was the failure to meet families' needs (Dhaliwal et al., 2014). Overall, to ensure a better understanding of adolescent engagement and

their needs, it is critical to address family engagement and the consequences of failing to meet family needs in pediatric obesity management.

The adolescents in this study who are trying to change their behavioural habits experienced fear and apprehension about failure. More specifically, fear of failure and apprehension around being inconsistent with changing their behavioural habits and an inability to achieve improved health-related results. In this study, we also found that participants described their apprehension as anxiety. Research has shown that obesity is associated with anxiety and depression in children and adolescents, and this is particularly pronounced in girls (Lindberg et al., 2020). Due to adolescents' fear of failure, they may be ambivalent about behavioural changes (Killick and Allen, 1997). Motivational interviewing (MI), a counselling approach, may be useful when assessing adolescents' ambivalence and readiness to change (Miller and Rollnick, 2012). In this study, adolescents discussed their readiness to change behavioural habits (*i.e.,* nutrition, physical activity, and sleep) and the influence of intrinsic and extrinsic motivation. Using MI, health care professionals can positively affect changes in these behavioural habits (Armenta and James, 2021). Importantly, exploring ambivalence and readiness to change during pediatric obesity management may increase rapport and collaboration between adolescents and clinicians, strengthening motivation to change and facilitating future behavioural changes (Killick and Allen, 1997; Rollnick et al., 1992). A systematic review by (Silva et al., 2018) found that the main motivation for change among adolescents with obesity is improved health. By exploring ambivalence and enhancing readiness to change, clinicians can more effectively tailor their health services for adolescents with obesity.

Adolescents in this study described their perspectives on changing behavioural habits in relation to facilitators (*e.g.,* support) for behaviour change and constraints (*e.g.,* COVID-19

pandemic) to behaviour change. Previous research found that family support plays a crucial role in managing obesity in adolescents (Chatham and Mixer, 2020; Gruber and Haldeman, 2009; Kaufman et al., 2020; Kulik et al., 2016), especially with respect to enhancing motivation (Gruber and Haldeman, 2009). Among adolescents, support from their friends may also be important (Kulik et al., 2016). In a relevant study, (Eg et al., 2019) found that participants felt kinship and commonality after meeting adolescents facing similar obesity management challenges. Behaviour change can be challenging, so having support from peers with similar lived experiences can be beneficial. Moreover, there is limited evidence related to adolescents and their ability to adapt to setbacks (*e.g.,* personal injuries) during pediatric obesity management. The literature mainly focused on adaptations to various behavioural interventions during obesity management (Chambers et al., 2013; Dishion and Kavanagh, 2003; Powell et al., 2015).

Limitations

This study has some limitations that would benefit from future research. First, all of the interviews were conducted virtually because of COVID restrictions. This could have impacted rapport building and the depth of sharing that adolescents were willing to provide. However, NEB incorporated her MI skills, which included using probes, reflections, and expressing empathy. Second, adolescents with obesity were only enrolled from one pediatric obesity management clinic in Edmonton, AB, Canada. While enrolling adolescents from the pediatric obesity management clinic in Calgary, AB, Canada, may have been beneficial for a broader provincial scope, no adolescents enrolled despite recruitment efforts. Third, the majority of participants in this study identified as white. There are important aspects of ethnicity and culture

that need to be integrated into pediatric obesity management to improve health care delivery. While recruitment is challenging, we would encourage future researchers to engage participants that reflect the diversity of Alberta's ethnicity and culture. Last, based on conversations with adolescents and their caregivers, several factors hindered recruitment and enrollment, including time constraints, no longer being interested in research studies, and mental health concerns. Although this limitation affected the final sample size (n=7), we realized that being flexible in data collection to accommodate adolescents' schedules (*e.g.,* conducting interviews in the evenings between 6 and 8 pm) was critically important and should be considered in future research.

3.6. Conclusions

The findings indicated that clinicians and families need to pay particular attention to the experiences of adolescents as they engage in a pediatric obesity management clinic. Participants in this study highlighted their emotional reactions during clinical encounters, fear and apprehension when changing behaviours, and complications regarding behaviour change. The findings also highlighted the need for more support during obesity management and the importance of tailored health care services for adolescents with obesity.

Table 3.1. Participant characteristics and clinical encounters (n=7)

Characteristics						
				Interactions with Clinicians for Obesity Management*		
Adolescent	Age *(years)*	Sex	Ethnicity	Clinic appointments *(n)*	Time spent *(hours)*	Enrollment duration *(months)*
1. Monroe	13	Female	white	18[a, c-e]	23	7.4
2. Penelope	16	Female	white	20[a-e]	20.5	10.4
3. Leia	16	Female	white	45[a-f]	41	48.7
4. Ayana	14	Female	white + Black	11[a, c-e]	12.5	33.4
5. Isaac	15	Male	white	28[a, c-e]	27.5	33.4
6. Taan	17	Male	South Asian	5[a-e]	5	2[§]
7. Mia	18	Female	white	3[b, d]	3	1.5[§]
	Mean±SD			**Mean [Range]**	**Mean [Range]**	**Mean [Range]**
	15.6±1.7			19 [3-45]	18.9 [3-41]	19.5 [1.5-48.7]

N: number; SD: Standard Deviation
*: Includes both in-person and virtual clinical care
§: Most recent enrollment duration. Adolescent previously attended clinic but we no longer have access to that system.
a: Physician
b: Registered Nurse
c: Registered Psychologist
d: Registered Dietitian
e: Exercise Specialist
f: Social Worker

Table 3.2. Group experiential themes and subthemes identified in interpretative phenomenological analysis

Group Experiential Themes	Subthemes
1. Emotional reactions during clinical encounters	1.1 Positive reactions 1.2 Neutral reactions 1.3 Negative reactions
2. Fear and apprehension when changing behaviours	2.1 Fear of failure 2.2 Motivational readiness to change nutrition, physical activity, and sleep
3. Complications regarding behaviour change	3.1 Making changes was challenging 3.2 Unexpected circumstances were experienced 3.3 Family involvement and interest supported change

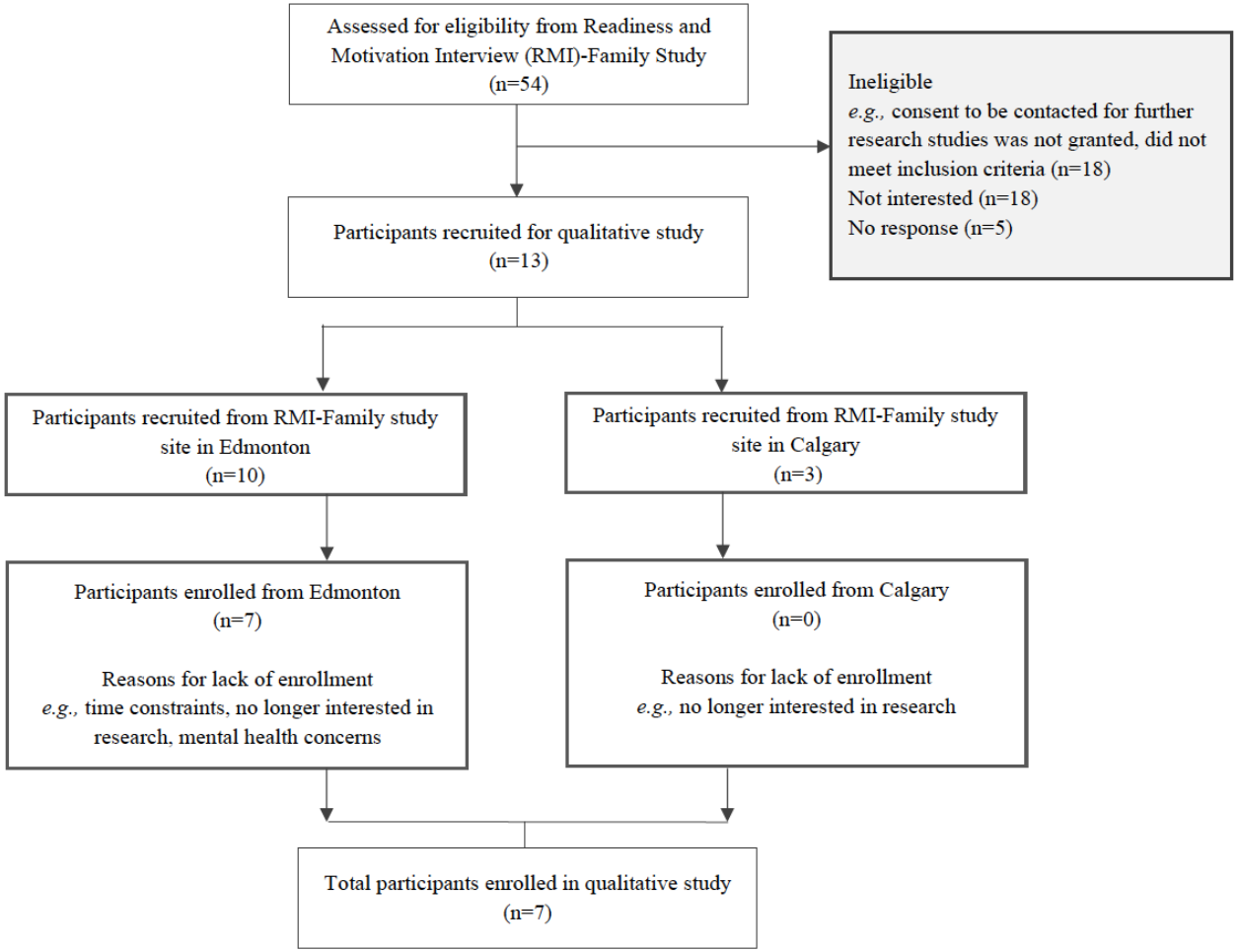

Figure 3.1. Flow chart of participant recruitment

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Chapter 4

Browne NE, Gokiert R, Newton A, Holt NL, Spence N, Mâsse LC, Geller J, Ho J, Ball GDC; and the RMI-Family Study Team, 2023. Measuring Adolescents' and Parents' Readiness for Behaviour Change in Managing Adolescent Obesity: Psychometric Properties of the *Readiness to Change Ruler* [Manuscript in preparation].

4.1. Summary

Objective: Evaluate the scores and psychometric properties of the *Readiness to Change Ruler* and examine how sociodemographic and personal health history variables relate to readiness to change.

Methods: A secondary analysis of data collected for the Readiness and Motivation Interview for Families study conducted at pediatric obesity management clinics in Alberta, Canada. Participants were adolescents with obesity and their parents. Psychometrics for the 5-item *Readiness to Change Ruler* (baseline, 6-, and 12-months follow-up) were determined using Cronbach's α coefficients, intraclass correlation coefficients (ICCs), and exploratory factor analysis (EFA). Associations between readiness to change with sociodemographics and personal health data were calculated using generalized linear models.

Results: Adolescents (n=54) were 15.1±1.3 years old and their parents (n=54) were primarily biological (n=50, 92.6%). Across the three time points, Cronbach's α coefficients were ≥0.8 and mean ICCs were ≥0.7. The EFA identified one factor (all factor loadings ≥0.3) for adolescents at all three time points and at 6- and 12-month follow-up for parents. No family history of chronic diseases was positively associated with parents' readiness to change their adolescents' behaviours (β=0.416, $p<0.001$).

Conclusions and Implications: The *Readiness to Change Ruler* is psychometrically reliable and provides evidence that it is a valid measure for assessing readiness to change in adolescents with obesity and their parents. In addition, parents with no family history of chronic diseases had higher levels of readiness to change for their adolescents.

4.2. Introduction

Obesity is a complex, chronic disease, and is a serious public health challenge. Worldwide, the prevalence of obesity among children and adolescents increased more than 10-fold, from 11 million in 1975 to 124 million in 2016 (Abarca-Gómez et al., 2017). Obesity that occurs during adolescence is more likely to persist in adulthood (Guo et al., 2002). Without obesity management strategies in place, adolescents are at risk for negative health impacts including dyslipidemia, prediabetes and type 2 diabetes, nonalcoholic fatty liver disease, hypertension, obstructive sleep apnea, polycystic ovarian syndrome (PCOS), and depression (Hampl et al., 2023).

Readiness to change is a key component of behaviour change in adolescent obesity. An individual's readiness is dependent on their capability for change and confidence in achieving change (Geller et al., 2001). To make appropriate treatment recommendations for adolescents with obesity, health care practitioners (HCPs) are encouraged to assess adolescents' and their parents' readiness to change (Hampl et al., 2023). Although it can be a challenge to determine whether the level of readiness will be sufficient to sustain a commitment to change, assessing readiness to change can help tailor intervention strategies for HCPs, leading to better treatment outcomes for adolescents with obesity (Berg-Smith et al., 1999; Prochaska et al., 1992; Prochaska and DiClemente, 1986). *Readiness to Change Ruler*s are measures, based on the transtheoretical model of behaviour change (Prochaska et al., 2002; Prochaska and DiClemente, 2005), that can be used to assess readiness to change across behavioural constructs that influence energy balance and body weight (Ceccarini et al., 2015; Rollnick et al., 1992). While studies have shown that assessing readiness to change can help adults with physical activity (Marcus et al., 1998) and eating disorders (Geller and Dunn, 2011), there is limited evidence on the use of

Readiness to Change Rulers in pediatric obesity management (Dhuper et al., 2021; Steele et al., 2012) and psychometric properties based on this clinical population.

The literature on the relationship between sociodemographics (*i.e.,* age, sex, ethnicity, annual household income) and personal health history (*i.e.,* weight-related co-morbidities and family history of chronic disease) and readiness to change offers a variety of findings. Rhee *et al.* (2005) found that the age of the child with obesity (≥8 years old) was positively associated with parental readiness to make changes; parents are more ready to change when their child is older. O'Hea *et al.* (2003) presented mixed evidence regarding the relationship between sex and readiness to change behavioural habits such as smoking cessation, exercise, and dietary fat. This study suggests that females may be more ready to change their dietary fat behaviours, while other studies have shown that males are more ready to change their exercise habits (O'Hea et al., 2003). When examining ethnicity, Cobb (2011) found that parent readiness to change was higher in African American parents than European Americans. Further, Hampl *et al* (2023) suggested that readiness to change can be affected by socioeconomic (*e.g.,* annual household income) and familial (*e.g.,* family history of chronic diseases) factors. Emmanuel and Musa (2015) sought to determine the predictors of readiness to change among individuals with obesity. There were no significant ($p<0.05$) relationships between readiness to change and the predictor variables, including illness presentation like hypertension and diabetes. Understanding predictors of readiness to change can help address health disparities, develop evidence-informed interventions targeted at specific populations, and guide future research in adolescent obesity management.

The objectives of this study were to evaluate the scores and psychometric properties of the *Readiness to Change Ruler* using a sample of adolescents enrolled in pediatric obesity

management (POM) programs and their parents, and examine how sociodemographics and personal health history of adolescents and their parents relate to readiness to change.

4.3. Methods

Study Design

The current study is based on a prospective cohort design and includes secondary analyses of data collected from the Readiness and Motivation Interview for Families (RMI-Family) study, which was also a prospective cohort design that was conducted from November 2017 to March 2022 at Alberta-based POM clinics located in the Stollery Children's Hospital (Edmonton) and Alberta Children's Hospital (Calgary). The RMI-Family study was designed to examine the role of motivation in obesity management for adolescents and their parents (Ball et al., 2017). Ethics approval for the study was provided by the Health Research Ethics Board at the University of Alberta (Pro00051447) and the Conjoint Health Research Ethics Board at the University of Calgary (REB14-2316). Written informed assent and consent were obtained from adolescents with obesity and their parents, respectively to collect primary data.

Participants

All adolescents and parents that participated in the RMI-Family study were eligible for inclusion in this sub-study. The inclusion criteria were as follows: *(i)* adolescent is aged 13-17 years with an age- and sex- adjusted body mass index (BMI) $\geq 97^{th}$ percentile (Dietitians of Canada, 2010) with no documented cognitive impairments (based on medical record documentation), *(ii)* parent self-identified as the primary caregiver of the adolescent, and *(iii)* both the adolescent and parent fluently spoke and read English.

Study Data

Included in this study were baseline data on adolescent and parent sociodemographics (*i.e.,* date of birth, sex, ethnicity, annual household income, and parental relationship to adolescent) and adolescent and parent health history (*i.e.,* weight, height, BMI, weight-related co-morbidities, and family history of chronic diseases). This sub-study incorporated sex-based data which was consistent with the demographic information collected for the RMI-Family study (see Appendix C for demographic form). Adolescents and their parents selected their ethnic background from a list of ethnicity categories (see Appendix C). Annual household income categories (see Appendix C) were provided to parents to self-report; based on the categorization, we minimized this to less than or equal to $100,000 and over $100,000. Parents also identified themselves as biological, adoptive, or guardian. Weight-related co-morbidities and family history of chronic diseases including physical (*e.g.,* hypertension, stroke, asthma) and mental health (*e.g.,* bulimia, depression, anxiety) variables were also collected. *Readiness to Change Ruler* data have been reported previously for the RMI-Family study (see Ball et al., 2017), and were collected using adolescent and parent versions of the tool. The tool consists of five rulers that assess readiness across five items — physical activity, screen time, treat foods, overeating, and eating when not hungry. Adolescents were asked about their readiness to change and parents were asked about their readiness to change their child's habits across the five items. Individuals assigned ratings along a continuum from 0 to 10 (0-2 'definitely not ready to change'; 3-5 'unsure'; 6-8 'ready to change'; 9-10 'definitely ready to change'). Readiness data were collected at baseline, 6-, and 12-months follow-up (see Appendix C; Geller, unpublished).

Statistical Analysis

Continuous and categorical sociodemographic and personal health data were summarized descriptively using means, standard deviations (SD), and proportions. For each participant, a total score for readiness to change at baseline, 6-, and 12-months was calculated by summing the scores from the five rulers and then dividing the total by the number of items. Spearman's rank-order correlations were calculated to determine the relationship between adolescents' and parents' readiness to change scores, and Friedman's Test to assess the difference in mean change scores over baseline, 6-, and 12-months, followed by a post-hoc Wilcoxon Signed Ranks Test with a Bonferroni correction. We used the Wilcoxon Signed Ranks Test to assess the difference in mean changes in scores between adolescent-parent dyads across the same timepoints.

Cronbach's alpha (α) was calculated to determine the internal consistency of the adolescent and parent versions of the ruler at all three study timepoints, including whether consistency changed when each of the five items was individually removed from the ruler. Recommendations from Gokiert *et al.* (2014) were used to interpret the findings, and Cronbach's $\alpha \geq 0.8$ was considered 'good'.

Intraclass Correlation Coefficients (ICCs) with 95% confidence intervals were calculated to determine the levels of agreement between an adolescent and their parent (dyad) for readiness to change using a mean-rating (k=2), absolute-agreement, and 2-way mixed-effects model. ICCs ≥ 0.7 were considered 'good' (Gokiert et al., 2014).

Construct validity was assessed using Exploratory Factor Analysis (EFA). Preliminary analysis of the dataset was conducted to assess the appropriateness of EFA, including: (1) Spearman correlations at each study time point indicated the data were intercorrelated, so there is a relationship between the items (Hair et al., 2010), (2) Kaiser-Meyer-Olkin (KMO) values in the

correlation matrix were ≥0.6, indicating that variables were correlated (Kaiser, 1974), and (3) Bartlett's test of sphericity indicated statistical significance of the correlation matrix (Bartlett, 1950; Watkins, 2018). All analyses were for adolescent and parent ruler scores at baseline, 6-, and 12-months follow-up. For adolescents, the KMO measures at baseline, 6-, and 12-months follow-up were 0.78, 0.70, and 0.76, respectively. Bartlett's tests of sphericity were significant ($\chi^2[10]=97.43$, $\chi^2[10]=107.52$, and $\chi^2[10]=52.37$; all $p<0.001$). For parents, the KMO measures at the same three time points were 0.59, 0.81, and 0.82, respectively. Bartlett's tests of sphericity were significant ($\chi^2[10]=134.09$, $\chi^2[10]=145.58$, and $\chi^2[10]=126.46$; all $p<0.001$), so the correlation matrix was deemed appropriate for factor analysis. Items with a shared variance (a communality value ≥0.2) were included in the analysis (Child, 2006). Since most of the readiness to change scores were negatively skewed, principal axis factoring was used for factor extraction (Costello and Osborne, 2005). Further, factor loadings ≥0.3 were retained (Samuels, 2017).

The relationship between sociodemographics (*i.e.,* age, sex, ethnicity, annual household income, and personal health history [weight-related co-morbidities] and [family history of chronic diseases]) and adolescent and parent ruler scores for each of the five items were assessed. Based on the literature, we hypothesized that sociodemographics and personal health history may be associated with adolescent and parent ruler scores. Generalized linear modelling (GLM) was used to identify predictors of readiness to change ruler scores since the data did not meet the assumptions of normal linear regression (McCullagh and Nelder, 1989). We examined the omnibus test and tests of the model effects to determine if the overall model and the predictors were statistically significant. Assumptions were tested for each statistical test.

All analyses were performed using SPSS (Version 29.0, IBM Corp.). A p-value <0.05 was considered statistically significant for all related analyses.

4.4. Results

Study Participants

Fifty-four adolescent-parent dyads (n=108) enrolled in the RMI-Family study with 40 and 32 dyads retained at 6- and 12-months follow-up, respectively. Data from these dyads at each timepoint were included in this sub-study. Adolescents were 15.1±1.3 years old, mostly female (n=29; 53.7%) and 50% identified as white (n=27). Parents were 43.1±9.8 years old, mainly biological (n=50; 92.6%) and female (n=48; 88.9%). More parents (n=29; 55.6%) reported household incomes <$100,000 CDN (Table 4.1).

Participant Readiness to Change

At baseline, adolescents and parents differed in their overall readiness to change scores (Z= -4.262, p<0.001). At the 50th percentile, median scores for adolescent and parent readiness to change were 7.2 and 8.8, respectively (Figure 4.1). While adolescents' readiness to change scores did not change over time (χ^2[2]=1.948, p<0.378), parents' scores did (χ^2[2]=15.945, p<0.001) with differences between baseline and 6-months (Z= -3.504, p<0.001) and baseline and 12-months (Z= -3.766, p<0.001). For adolescents, the item scores were positively correlated at all three time points; similar patterns were observed for parents (all correlations p<0.05; see Appendix C).

Psychometric Properties of the Readiness to Change Ruler

The 5-item *Readiness to Change Ruler* had good internal consistency over time for adolescents and parents with Cronbach's α coefficients ≥0.8 (range: 0.8-0.9) (Table 4.2). At baseline, when each item was removed one at a time from the *Readiness to Change Ruler* for adolescents, Cronbach's α were lower; for parents, it was lower at all three time points (Table 4.3). When screen time was deleted from the *Readiness to Change Ruler* at 6-months (α=0.86 to α=0.87) and 12-months (α=0.80 to α=0.82), it did not lead to a substantial increase in Cronbach's α for adolescents. This item was highlighted since it was the only one with a Cronbach's α higher than the *Readiness to Change Ruler* at 6- and 12-months.

A low degree of reliability was found between readiness to change scores in adolescent-parent dyads across all analyses (Table 4.4). Adolescent-parent mean ICCs were <0.7 at all three time points, indicating poor levels of agreement for the individual items. For the total scale, a high degree of reliability was found between readiness to change scores in adolescent-parent dyads across all analyses. Adolescent-parent mean ICCs were ≥0.7 at all three time points, indicating good levels of agreement for the total scale.

At baseline, 6-, and 12-months follow-up, EFA revealed that all five items on the *Readiness to Change Ruler* for adolescents and parents should be evaluated overall since all the items loaded onto one factor (Table 4.5). At baseline, none of the five items loaded in the EFA for parents, suggesting that the items did not load well together due to failure to converge or lower correlations with the factor.

Relationship Between Sociodemographics and Personal Health History with Readiness to Change

Among adolescents, at baseline, 6-, and 12-months, there were no statistically significant associations between sociodemographics and personal health history with readiness to change (all $p>0.05$). Among parents, baseline readiness to change (across all items) was positively associated with no family history of chronic diseases ($\beta=0.416$, $p<0.001$). Analyses for readiness to change at 6- and 12-months did not reveal any statistically significant associations (all $p>0.05$).

4.5. Discussion

The scores and psychometric properties of the *Readiness to Change Ruler* in adolescent obesity management, and how sociodemographic and personal health history variables are related to readiness to change in adolescents with obesity and their parents enrolled in POM clinics were examined. Several important findings were identified. First, the 5-item *Readiness to Change Ruler* is psychometrically reliable since it indicated good internal consistency and levels of agreement within adolescent-parent dyads. Second, evidence of validity was supported by an exploratory factor analysis (EFA), which identified a one-factor structure for the 5-item *Readiness to Change Ruler*. Third, no family history of chronic diseases, including physical (*e.g.,* hypertension, stroke, asthma) and mental health (*e.g.,* bulimia, depression, anxiety), was positively related to parents' readiness to change their adolescents' behaviour. These findings highlight the potential clinical utility of the *Readiness to Change Ruler* in determining readiness to change within families, ultimately resulting in improvements in families with a history of chronic diseases.

Prior studies noted the importance of assessing adolescents' and adults' readiness to change for weight management (Ceccarini et al., 2015) and obesity prevention (Grewal et al., 2023) to create tailored interventions based on individual readiness, which can reduce ambivalence regarding change. We found that the *Readiness to Change Ruler* was reliable and provides evidence that the measure was valid for assessing readiness in adolescents with obesity and their parents across items, including physical activity, nutrition, and screen time. When we evaluated the agreement between adolescents and parents for the *Readiness to Change Ruler* (total scale), a high degree of reliability was found between readiness to change scores in adolescent-parent dyads. Collectively, item analyses suggest that none of the items should be removed from the 5-item *Readiness to Change Ruler* to optimize internal consistency. Overall, the *Readiness to Change Ruler* indicated good internal consistency. This finding is consistent with Grewal *et al.* (2023) and Ceccarini e*t al.* (2015) who showed good internal consistency for similar tools used to assess readiness. Therefore, during clinical visits, HCPs should address the five items (*i.e.,* physical activity, screen time, treat foods, overeating, and eating when not hungry) together since they are all highly correlated. The *Readiness to Change Ruler* supported a one-factor structure for the five items, indicating that it measures a predefined domain, readiness to change. These findings are novel and represent a valuable contribution to the field of obesity management. To our knowledge, there is no *Readiness to Change Ruler* specifically designed to assess readiness in families (adolescents with obesity and their parents) for the management of adolescent obesity.

No family history of chronic health conditions was a predictor of readiness to change among parents. Parents with no family history of chronic diseases had higher levels of readiness to change for their adolescents, possibly due to their personal health history (Cockerham et al.,

2017) and positive intergenerational relationships with their family. As past literature suggests, this can include healthy family interactions (*e.g.,* shared balanced family meals, engaging in family physical activities) (Loth et al., 2019; Manalel et al., 2019; Rainham et al., 2022) and healthy parental supervision (*e.g.,* limited screen time, autonomy support) (Fuller et al., 2019; Michaelson et al., 2021). In addition, these parents are more likely to avoid stigma and bias related to living without a family history of chronic diseases (Stangl et al., 2019), which may make them more ready to change their adolescents' physical activity, nutrition, and screen time behaviours. Recent clinical practice guidelines for evaluating and treating children and adolescents with obesity from the American Academy of Pediatrics (Hampl et al., 2023) highlighted that family factors influence readiness to change, but details were lacking regarding assessing and using readiness to change data to guide clinical care. While we also found conflicting evidence (*i.e.,* many sociodemographic and personal health history variables are not predictors of readiness to change), the findings demonstrate the complexity of behaviour change and the need for further research into the predictors of adolescents' and parents' readiness to change. A better understanding of readiness to change may help HCPs tailor care to individual family needs, values and preferences, priorities, and personal circumstances.

Although adolescents and their parents were at different levels of readiness when they enrolled in our research study, they were generally ready for behaviour change. Across all items, parents reported higher readiness scores compared to adolescents. Perhaps parents' scores were higher than adolescents' because they recognized their adolescents were living with obesity and were willing to help them make healthy behaviour changes. In addition, it was assumed that a parent with a healthy weight may be more ready to help their adolescent make positive changes related to physical activity, nutrition, and screen time behaviours. Further, it was noteworthy that

parents' readiness to change scores tended to decrease over the study period. Possible explanations for this change might be due to HCPs comments about their child's weight, the child's age, parents' belief that their child's weight is a health concern, parents' perception that they are overweight, and failed experiences with diets and exercise programs (Rhee et al., 2005). In addition, parents' readiness to change may also be affected by their adolescents being enrolled in a POM clinic and receiving behavioural change interventions for managing adolescent obesity (Rhee et al., 2005). Other studies, both adolescent and adult, have shown that readiness to change decreases over time in several areas, including weight control (Jakubowski et al., 2012), workplace health promotion practices (Helfrich et al., 2018), and alcohol and drug use (Maisto et al., 2011).

Limitations and Future Directions

It is important to highlight the limitations of this study and areas for future research. First, since studies have often examined test-retest reliability when evaluating the psychometric properties of tools (Dozois et al., 2004; Grewal et al., 2023), it would have been beneficial to conduct this analysis for the individual items (Matheson, 2019) on the *Readiness to Change Ruler*. However, this was not feasible in our study, since the *Readiness to Change Ruler* was administered at baseline, 6-, and 12-months follow-up, and test-retest reliability tends to decrease with increasing time intervals (Polit, 2014). Many research studies have recommended that a sub-sample of the target population should be retested within a relatively short period, such as one to three weeks after the initial assessment (Bardhoshi and Erford, 2017; Deyo et al., 1991; Streiner et al., 2014; Wyse, 2021). Although the retest intervals can be modified to take the items and research aims into consideration, adolescents included in our study were enrolled in a POM clinic; therefore,

they were likely to be affected by behavioural interventions aimed at managing adolescent obesity. Second, due to our small sample size, an EFA was conducted. Typically, EFA is used to explore the relationships among items on a tool (scale) and does not have a predetermined number of domains. Considering the *Readiness to Change Ruler* was used to verify responses from the RMI-Family interview, which focused on physical activity and nutrition habits, we would expect two domains (*i.e.,* physical activity and nutrition) to be present; however, this was not the case. This issue could be addressed in future research by conducting a confirmatory factor analysis using a larger sample size, and with additional items within each ruler. Third, total readiness to change ruler scores were skewed and mostly concentrated in the higher ranges for the tool. It is necessary to conduct additional studies in POM clinics with a larger sample size to determine if the lower ranges (0-2 'definitely not ready to change'; 3-5 'unsure') are used by families or if the range from our study findings (6-8 'ready to change') is unique to the study population. Fourth, non-response bias may occur from the observational cohort design if study participants differed from those who did not enroll, leading to a non-representative sample. For example, the association between parents with no family history of chronic diseases and readiness to change may be overestimated if those without a family history of chronic diseases are more likely to participate if they are ready for their adolescents to change. Fifth, while we recognize the importance of considering sex and gender in obesity research, our study did not incorporate gender-based data, which may lead to gender bias. Since sex and gender influence susceptibility to obesity, incorporation of sex-based and gender-based analysis in research could potentially improve the management of obesity in adolescents (Knebusch et al., 2021; Shah et al., 2020). For gender-based analysis to provide meaningful insights, it is crucial to include participants from gender-diverse identities in research studies (Diaz-Thomas et al., 2023).

4.6. Implications for Research and Practice

Overall, the *Readiness to Change Ruler* is an appropriate and reliable tool which provides evidence that it is a valid measure for assessing readiness to change in adolescents with obesity and their parents in POM clinics/interventions. As the *Readiness to Change Ruler* was tested in a clinical setting, they may be beneficial to HCPs for use in clinical settings to determine the readiness of families to change behaviour. Family involvement, especially parents, is crucial for adolescents who want to initiate and maintain healthy behaviour changes to manage obesity. It is important for HCPs to assess readiness to change so that intervention strategies can be tailored over time to meet the needs of adolescents with obesity and their parents varying levels of readiness, which can result in better treatment outcomes. When tailoring these interventions, HCPs should take into consideration that adolescents and their parents may be at different levels of readiness to change. It is also relevant to understand the family context, including sociodemographic (*e.g.,* ethnicity) and personal health history (*e.g.,* family history of chronic diseases) predictors of readiness for behaviour change, to determine how to best tailor interventions.

Table 4.1. Characteristics of study participants at baseline.

	Adolescents (n=54)		Parents (n=54)	
	Mean ± SD	**N**	**Mean**	**N**
Variables				
Age (y)	15.1 ± 1.3	54	43.1 ± 9.8	54
Anthropometry				
Height (cm)	169.4 ± 10.5	53	166.6 ± 6.6	52
Weight (kg)	98.2 ± 21.0	53	89.8 ± 20.9	51
BMI (kg/m^2)	34.0 ± 5.4	53	32.2 ± 6.3	51
BMI percentile	98.9 ± 2.7	53	-	-
BMI z-score	2.9 ± 0.8	53	-	-
	N	**%**	**N**	**%**
Sex				
Female	29	53.7	48	88.9
Male	25	46.3	6	11.1
Ethnicity				
white	27	50	28	51.9
Non-white	27	50	26	48.1
Parental Relationship				
Biological	-	-	50	92.6
Adoptive	-	-	2	3.7
Guardian	-	-	2	3.7
Annual Household Income				
≤$100,000 CDN	-	-	29	55.6
>$100,000 CDN	-	-	20	37.0
Don’t know/Prefer not to say	-	-	4	7.4

Table 4.2. Internal consistency of readiness to change ruler scores in adolescent-parent dyads.

	Adolescents			**Parents**		
	Baseline	6-months	12-months	Baseline	6-months	12-months
Total Scale*, α	0.8	0.8	0.8	0.8	0.9	0.9

*5-item scale with physical activity, screen time, treat foods, overeating, and eating when not hungry items.

Table 4.3. Tables showing Cronbach's Alpha if item deleted for adolescents and parents at baseline, 6-months, and 12-months.

Adolescents: Baseline

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Physical activity	28.29	42.052	.603	.527	.803
Screen time	30.24	45.104	.563	.335	.812
Treat foods	28.24	39.664	.726	.608	.764
Overeating	27.08	47.914	.541	.398	.817
Eating when not hungry	27.33	43.547	.713	.536	.772

Adolescents: 6-months

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Physical activity	28.90	49.374	.646	.538	.837
Screen time	30.17	48.969	.535	.417	.872
Treat foods	28.62	48.394	.781	.673	.806
Overeating	27.75	46.705	.828	.744	.793
Eating when not hungry	27.75	48.859	.639	.706	.839

Adolescents: 12-months

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Physical activity	28.71	41.280	.612	.447	.763
Screen time	30.66	36.390	.435	.206	.815
Treat foods	28.47	33.749	.631	.464	.741
Overeating	27.40	34.607	.591	.529	.755
Eating when not hungry	27.27	35.197	.725	.620	.716

Table 4.3. Tables showing Cronbach's Alpha if item deleted for adolescents and parents at baseline, 6-months, and 12-months. (continued)

Parents: Baseline

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Physical activity	33.96	36.438	.568	.735	.759
Screen time	34.31	33.300	.621	.757	.742
Treat foods	33.88	39.826	.446	.425	.794
Overeating	33.88	36.626	.617	.588	.745
Eating when not hungry	34.08	33.074	.636	.685	.736

Parents: 6-months

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Physical activity	29.18	76.783	.696	.579	.908
Screen time	29.67	74.281	.715	.609	.904
Treat foods	29.05	72.734	.738	.655	.900
Overeating	29.21	65.062	.900	.857	.865
Eating when not hungry	29.36	63.762	.843	.799	.879

Parents: 12-months

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Physical activity	27.00	97.226	.713	.609	.922
Screen time	28.03	90.031	.782	.669	.910
Treat foods	27.13	92.565	.814	.786	.903
Overeating	27.25	94.645	.820	.740	.902
Eating when not hungry	27.09	90.733	.880	.856	.890

Table 4.4. Levels of agreement within adolescent-parent dyads for readiness to change ruler scores.

	Baseline			**6-months**			**12-months**		
Scale Items	ICC‡	95% CI	F-value	ICC‡	95% CI	F-value	ICC‡	95% CI	F-value
Physical activity	-0.3	-1.01 - 0.22	0.74	-0.1	-1.04 - 0.45	0.95	0.2	-1.07 - 0.53	1.02
Screen time	0.2	-0.17 - 0.47	1.56	0.1	-0.49 - 0.52	1.19	-0.2	-1.26 - 0.40	0.83
Treat foods	0.3	-0.13 - 0.58	1.57	-0.2	-1.28 - 0.39	0.85	0.1	-0.99 - 0.56	1.08
Overeating	0.1	-0.61 - 0.48	1.10	0.3	-0.34 - 0.61	1.39	0.5	0.04 - 0.76	2.24
Eating when not hungry	0.1	-0.61 - 0.48	1.09	0.1	-0.61 - 0.53	1.15	0.3	-0.31 - 0.65	1.50
Total Scale	0.7	0.58 - 0.82	4.55	0.8	0.66 - 0.87	4.99	0.8	0.67 - 0.89	5.79

‡For individual items, ICCs were $p>0.05$; total scale ICCs, $p<0.001$

Table 4.5. Exploratory factor analysis of items on adolescent and parent *Readiness to Change Rulers.*

Adolescents		Parents	
Item	Factor 1	Item	Factor 1
Baseline		**Baseline**[a]	
Treat foods	0.813		
Eating when not hungry	0.805		
Physical activity	0.673		
Screen time	0.623		
Overeating	0.609		
6-months		**6-months**	
Overeating	0.914	Overeating	0.963
Treat foods	0.846	Eating when not hungry	0.897
Eating when not hungry	0.739	Treat foods	0.777
Physical activity	0.696	Screen time	0.747
Screen time	0.576	Physical activity	0.723
12-months		**12-months**	
Eating when not hungry	0.846	Eating when not hungry	0.94
Treat foods	0.735	Overeating	0.867
Overeating	0.687	Treat foods	0.865
Physical activity	0.679	Screen time	0.807
Screen time	0.482	Physical activity	0.732

[a]No factor loadings at baseline

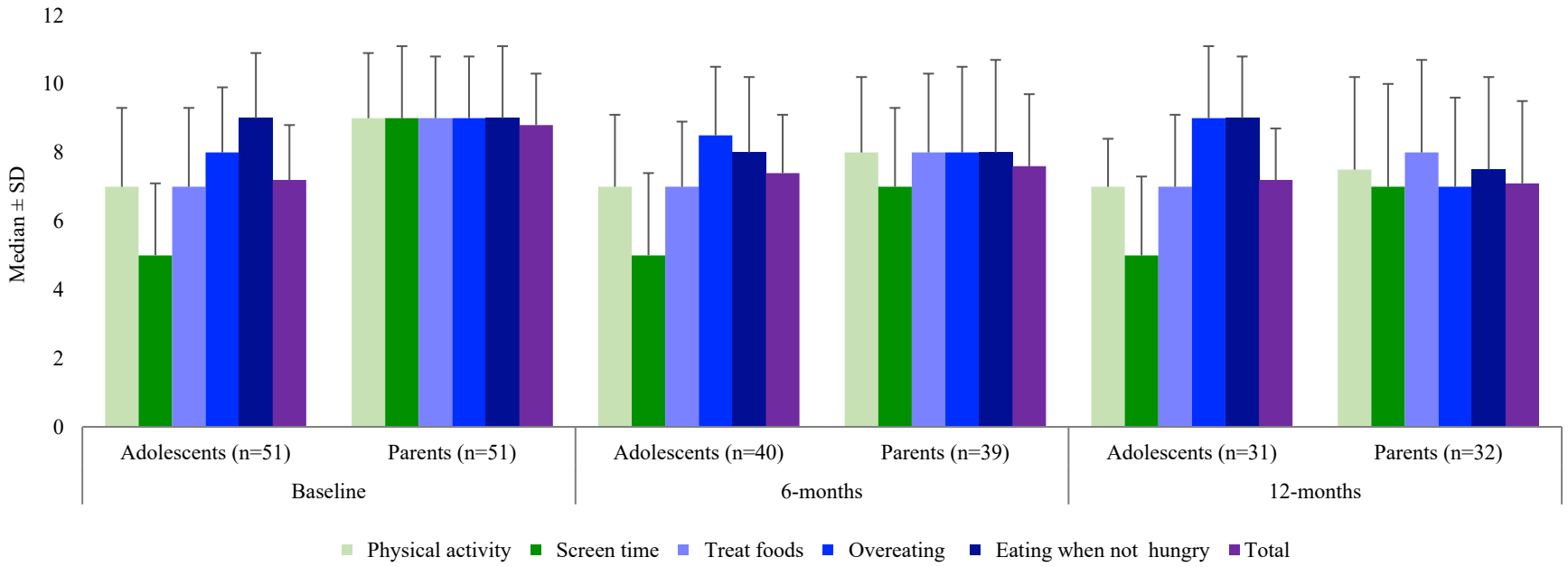

Figure 4.1. Readiness to change scores (scale: 0 – 10) for adolescents and parents.

4.7. References

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Chapter 5

General Discussion

5.1. Overview of Findings

This dissertation focused on motivation and readiness to change in the context of adolescent obesity management. The three studies included in this dissertation provide novel evidence on motivation and readiness to change in the context of managing obesity in adolescents.

Study 1 was a scoping review of the literature on fidelity and key elements of MI-based interventions for adolescent obesity and examined the reporting of these interventions, and included a stakeholder consultation with clinician-scientists and researchers experienced in MI and obesity management. Key findings from this review included MI-based interventions having 'low treatment fidelity', and none of the studies having 'high treatment fidelity' across the five domains of interest — theory, training, implementation, treatment receipt, and treatment enactment. Across studies, the highest mean proportion of adherence to fidelity strategies was for theory, while the lowest was for treatment enactment. According to stakeholders, 'low treatment fidelity' could be attributed to increased time to complete fidelity assessments and increased cost associated with treatment fidelity. Stakeholders also identified key knowledge gaps regarding fidelity, including the need to better define, monitor, and measure treatment fidelity in MI-based interventions.

Study 2 was conducted with adolescents living with obesity to understand their experiences living with obesity and behavioural changes while enrolled in POM clinics. Findings from this study highlighted important factors that contribute to adolescents' experiences and changes in behaviour: *(i)* emotional reactions during clinical encounters, including positive, neutral, or negative reactions; *(ii)* fear and apprehension when changing behaviours, particularly

fear of failure and motivational readiness to change nutrition, physical activity, and sleep habits; and *(iii)* behaviour change complications that included unexpected circumstances (*e.g.,* COVID-19 pandemic) and required family involvement and interest. Adolescents experienced both opportunities and challenges regarding making behavioural changes when participating in a POM clinic. A key take-away message from these results is that it is critical that clinicians and families pay attention to adolescents' experiences, particularly their motivation and readiness to engage in POM.

In Study 3, adolescents with obesity enrolled in POM clinics and their parents completed the 5-item *Readiness to Change Ruler* during the RMI-Family study, to verify RMI-Family interview responses, as well as assess readiness to change behaviours across items with a focus on physical activity, nutrition, and screen time. The psychometric properties of the 5-item *Readiness to Change Ruler* were evaluated among families at baseline, 6-, and 12-months follow-up. In addition, this study examined how sociodemographic and personal health history predictors influenced readiness to change in adolescents with obesity and their parents over time. Adolescents' and parents' readiness to change scores were different at baseline — parents typically reported higher readiness to change than adolescents. Also, at baseline, parents' readiness to change was positively associated with no family history of chronic diseases. Overall, the *Readiness to Change Ruler* provides evidence that it is a reliable and valid measure for assessing readiness to change in obesity management.

Collectively, the findings of this dissertation contribute to the comprehensive exploration of key aspects relevant to evidence-based, effective interventions and highlight the potential value of targeted and tailored health care services for managing adolescent obesity, particularly with respect to motivation and readiness to change. These findings emphasize the importance of

'high treatment fidelity' in MI-based interventions, evaluating readiness to change behavioural habits and their relationships with key variables, and understanding the experiences of adolescents living with obesity.

Behavioural interventions have played a crucial role in managing adolescent obesity; however, to understand how and for whom interventions are effective, detailed information on treatment fidelity is needed (JaKa et al., 2016). A systematic review of MI-based interventions in adults reported that researchers dedicate minimal attention to measuring and reporting treatment fidelity (Barnes and Ivezaj, 2015). An initial approach to improving treatment fidelity in managing adolescent obesity involves identifying commonly measured and reported strategies, including fidelity to theory and treatment implementation (JaKa et al., 2016). Without information on treatment fidelity, it is difficult to determine if an intervention was delivered as intended and whether the intervention is responsible for any observed improvements (or lack of improvements) in health outcomes.

Data were generated suggesting that the *Readiness to Change Ruler* possesses evidence of reliability and validity as a measure of readiness to change behavioural habits in adolescents with obesity and their parents, serving as a practical assessment tool, for intervention providers and researchers in managing adolescent obesity. These initial findings were promising, but gaps remain in the psychometric properties of the *Readiness to Change Ruler*. For example, it is necessary to determine whether, and how ready, families are for changing behavioural habits in obesity management interventions before adolescents and their parents start an intervention, as well as during the course of an intervention (Ceccarini et al., 2015; Hampl et al., 2023; Vallis et al., 2013). Although relationships were explored between readiness to change scores and key predictor variables, most of the associations were not statistically significant. These findings may

be explained by several factors, including a lack of statistical power (*i.e.,* small sample size) and inclusion of additional predictor variables that may be more proximally related to readiness to change (*e.g.,* objectively measured physical activity and sedentary activity) that were not included in these analyses, which relied on data form the existing RMI-Family study. These data highlight the need for future research to better understand predictors of readiness to change, including (and beyond) sociodemographic and personal health history (Hampl et al., 2023).

With a better understanding of adolescents' lived experiences while enrolled in a POM clinic, HCPs can be more aware of adolescents' individual needs, emotions, apprehension, and difficulties with changing behaviours. Based on the findings, applying strategies that enhance engagement to facilitate positive interactions, including detailed goals for obesity management and autonomy support, may help meet adolescents' needs. Failure to meet families' needs is one of the most common reasons for attrition in POM programs (Dhaliwal et al., 2014). Adolescents described their anxiety as apprehension, so it is important for HCPs to identify and support adolescents who experience anxiety. Children and adolescents with obesity are more likely to experience anxiety and depression due to weight stigma and bias (Hampl et al., 2023; Lindberg et al., 2020). Understanding adolescents' needs and emotions allows HCPs to appropriately tailor interventions for adolescents' evolving needs when delivering health care services (Hampl et al., 2023), thereby fostering sustained behavioural changes (Vallis et al., 2020).

There were limitations to my research. First, there was limited stakeholder and ethnic diversity in the studies. Considering that most of the stakeholders in Study 1 lived in the United States and Canada, and the majority of adolescents with obesity and their parents identified as white in Studies 2 and 3, the research may not have captured a diverse range of perspectives and

experiences. Cultural, socioeconomic, and environmental factors vary considerably across countries and ethnicities. Therefore, the findings may not accurately reflect the challenges and barriers encountered by stakeholders in Europe, Asia, and Australia, as well as families from other ethnic groups (*e.g.,* Black, Indigenous). This highlights the need for greater diversity and inclusion in future research. Second, gender-based analysis was not included. While sex-based analysis acknowledges biological differences, it does not consider the experiences and needs of gender-diverse adolescents with obesity enrolled in POM, including those from the lesbian, gay, bisexual, transgender, queer, intersex, and asexual (LGBTQIA) populations. The LGBTQIA populations may face unique health challenges (*e.g.,* anxiety, depression) that require tailored research approaches and behavioural interventions. Third, recruitment challenges related to COVID restrictions may have resulted in smaller than planned sample sizes. Although Study 2 and some aspects of Study 3 were virtual, stay-at-home orders could have limited participation by adolescents with obesity and their parents. This may have affected trust and rapport building, resulting in adolescents being reluctant to share, increased attrition, and difficulties maintaining participant engagement over time.

5.2. Recommendations and Lessons Learned

5.2.1. Overview

Over the course of my doctoral research, I learned valuable lessons related to obesity interventions and research on MI as well as clinical practice applications. For the effective management of adolescent obesity, I provide recommendations that incorporate the relevant lessons learned, which include strategies to improve MI-based interventions, increase treatment

fidelity, inform recruitment, and tailor behavioural change interventions to adolescents' needs and readiness.

5.2.2. Obesity Interventions and Research on MI

5.2.2.1. Researchers should design and implement group-based interventions to facilitate positive behavioural changes among adolescents with obesity.

There is limited research on MI-based interventions delivered in a group setting for managing adolescent obesity. Research has shown that group-based interventions can improve health and behavioural outcomes in a variety of populations (Gu et al., 2020; Millstein et al., 2020; Paul-Ebhohimhen and Avenell, 2009). An overburdened health care system has led to increased wait times for health services, increased frustration and stress, and reduced health-related quality of life for Canadians (Marshall et al., 2023). Through group-based interventions, more adolescents with obesity can receive interventions simultaneously (Kalavainen et al., 2007; Weigel et al., 2008), which can reduce the burden on the health care system. More importantly, this delivery approach has the potential to overcome time constraints, facilitate peer support, and foster collaborative relationships among health care practitioners, adolescents, and their parents (Hayes et al., 2015; Swancutt et al., 2019). While group-based interventions can be effective in promoting behaviour change, they also have some drawbacks. Individuals may feel pressure to conform within groups, which may result in the suppression of their personalities and the inability to fully express themselves (Laursen and Faur, 2022). In addition, conflicts among group members and unequal participation can compromise the cohesion needed for positive outcomes (Ezhumalai et al., 2018; Forsyth, 2018). To overcome these shortcomings, there are several strategies to consider, including establishing clear expectations within groups,

encouraging open communication, and fostering safe, supportive group-based interventions. For a more efficient health care system, additional evidence is needed on the effectiveness of MI-based interventions delivered in a group setting. Policymakers can use the evidence gathered from this novel research for developing policies and implementing evidence-based programs to meet the health care needs of Canadians.

5.2.2.2. Published research and protocols for MI-based interventions should include details on assessing, monitoring, and reporting treatment fidelity for informed decision-making.

MI has the potential to help adolescents with behavioural changes when it is offered by individuals with adequate provider training, including theoretical and practical (Browne et al., 2022). There is evidence that MI can also be effective for individuals, including adolescents, in areas such as substance use, body weight, and sedentary behaviour, even when providers have limited training (Baer et al., 2008; Lundahl et al., 2013). However, optimal outcomes are typically achieved when providers receive comprehensive training and ongoing supervision (Miller and Rollnick, 2013). Whether or not an MI-based intervention is effective, high fidelity allows us to be confident in the results because we know the intervention was delivered as planned and in a consistent manner (Armstrong et al., 2011; Borrelli, 2011; Carroll et al., 2007). As such, published evidence on the fidelity of MI-based interventions in adolescents with obesity is important for health care services, policy development, and program design and delivery to facilitate improved health outcomes. If health care practitioners fail to implement MI-based interventions according to research protocols, it may negatively affect adolescents' health and well-being if outcomes fail to improve over the course of an intervention. To help establish a gold standard, published research evidence should describe the type of fidelity assessment

followed in MI-based interventions for managing adolescent obesity, which will enable researchers to identify whether studies have 'low' or 'high' treatment fidelity. The findings from Study 1 in this dissertation also indicate that treatment fidelity is a neglected area in the literature on MI-based interventions. In MI-based interventions, treatment fidelity was defined, monitored, and measured differently (Browne et al., 2022). During interviews with stakeholders, I discovered that while some researchers assessed and monitored treatment fidelity, there were substantial differences in their approaches and a lack of evidence-informed approaches such as the National Institutes of Health Behavioral Change Consortium treatment fidelity framework (Bellg et al., 2004; Borrelli et al., 2005). Since adherence to the principles of MI is an important aspect of MI-based interventions, a reliable and valid tool that is simple, standardized, and specific to MI is necessary for researchers to document and measure treatment fidelity. Ideally, a tool should be developed to integrate the five treatment fidelity domains — theory, training, implementation, treatment receipt, and treatment enactment (Bellg et al., 2004), as well as the perspectives of clinician-scientists and researchers with experience in MI and managing adolescent obesity. Protocols should clearly outline how the tool will be used, along with how issues related to researchers' awareness, values, priorities, and resources will be addressed and strategies for overcoming fidelity limitations (*e.g.,* including treatment fidelity as supplementary material in publications).

5.2.2.3. Intervention research should use diverse qualitative research approaches for an in-depth understanding of adolescents' lived experiences and needs while enrolled in POM clinics.

Study 1 in this dissertation demonstrated that quantitative research was mostly used in MI-based interventions to address adolescent obesity and behaviour change. By carefully considering the

research question, researchers can determine the most appropriate methodology to address the research problem. Researchers can address questions that focus on exploring beliefs and expectations, understanding lived experiences, and describing shared patterns among a cultural group. Therefore, qualitative research might be useful for answering these questions. Using interpretative phenomenological analysis, Study 2 explored the lived experiences of adolescents with obesity and their behavioural changes. The findings revealed that adolescents' behaviour change experiences within POM are multi-factorial, requiring individualized interventions informed by a comprehensive understanding of their lived experiences. The knowledge gained from this qualitative research provided insights into the fear and apprehension experienced by adolescents when changing behaviours; this information can be used for tailoring interventions aimed at enhancing adolescents' experiences with obesity management within POM clinics. To understand adolescents' specific fears (*e.g.,* fear of failure) and needs, strategies can be incorporated, including providing an empathetic environment, applying motivational interviewing techniques, and offering resources (*e.g.,* specialist/program referrals) to support adolescents with their behavioural changes. Moreover, diverse qualitative research approaches such as phenomenology, ethnography, and narrative research (Creswell and Poth, 2024) can be used to provide insight into the complexity of adolescents' lived experiences with obesity. Common qualitative research approaches, such as those mentioned above, are valuable, as they can help researchers explore and develop a deeper understanding of problems, including health and social inequalities that contribute to intergenerational obesity. In addition, these insights can be applied to patient-oriented research in which adolescents with obesity, health care practitioners, and researchers co-design interventions to address gaps, encourage positive behavioural changes, and facilitate shared decision-making. Multiple research approaches also

allow for triangulation of data, enriching the depth and validity of research findings (Carter et al., 2014; Patton, 1999).

5.2.2.4. More well-designed MI-based interventions using a variety of study designs and larger sample sizes are needed for adolescents with obesity.

For my thesis, I conducted a scoping review on the application and reporting of motivational interviewing in managing adolescent obesity, with an emphasis on the key elements of MI-based interventions and reporting of treatment fidelity. Based on the findings, it was evident that there were only a few well-designed MI-based interventions among the included studies. It was apparent that some behavioural change interventions were referred to as MI-based interventions but only incorporated a few principles of MI (Browne et al., 2022). Using an approach such as FRAMES (Feedback, Responsibility, Advice, Menu, Empathy, and Self-Efficacy) can enhance the design and ensure the key elements of MI are included in MI-based interventions (Miller and Sanchez, 1994). Further, in many MI-based interventions, there were more contact hours between providers and participants in the intervention than in the comparison group (Browne et al., 2022). Consequently, using 'attention-matched' (*i.e.,* the comparison group receives the same dose of interactions as the intervention group, but without any intervention) comparison groups can help to determine whether the intervention benefits adolescents with obesity beyond the comparison group (Aycock et al., 2018; Pagoto et al., 2013). Future MI-based studies also require larger sample sizes since they are more representative of the population (Andrade, 2020). As most study designs were quantitative (*i.e.,* randomized control trials) in Study 1, this suggests that there is a need for more rigorous quantitative studies, as this would allow for better-designed

randomized control trials. In addition, incorporating qualitative studies could provide a more comprehensive perspective on managing adolescent obesity.

5.2.2.5. Develop a recruitment plan targeted at families (adolescents with obesity and their parents) with lower socioeconomic status to participate in intervention research for managing adolescent obesity.

All of the studies in this dissertation revealed difficulties engaging families living in low-income households and the lack of diversity among adolescents and their parents in research. Research diversity can include Black, Indigenous, and People of Colour (BIPOC), immigrants, refugees, and newcomers. Participants in Studies 2 and 3 were recruited through physician referrals to POM clinics; however, many adolescents with obesity may not be referred to POM clinics or fail to initiate the intervention due to barriers to accessing health care (*e.g.,* geographical distance) (Imoisili et al., 2018; Tully et al., 2022). Further, Studies 2 and 3 employed several recruitment and retention strategies, but they were not specific to low-income and BIPOC families, immigrants, refugees, and newcomers. For future research, recruitment efforts can be improved with culturally appropriate messages, incentives to overcome barriers to engagement, and outreach strategies that incorporate the perspectives of families and organizations from minority populations (Hampl et al., 2023; Thakur et al., 2021). Recruitment and data quality can also be enhanced if researchers engage with BIPOC, immigrants, refugees, and newcomers at various stages — before, during, and after the research. I learned that developing a connection with adolescents with obesity requires establishing rapport and trust at an early stage; this information should inform future recruitment plans. Further, awareness and inclusion of socioeconomic and diversity (*e.g.,* BIPOC, immigrants, refugees, and newcomers) among research populations are

critical for more generalizability of the findings and scientific advances in health care services. Since most of the research I conducted recruited adolescents with obesity and their parents from health care settings, it will be beneficial to consider recruitment from faith-, community-based, and social service organizations (Hampl et al., 2023; Han et al., 2021; Hippolyte et al., 2013). Efforts should also be made to collaborate more effectively with health care practitioners in health care settings as well as the previously mentioned non-profit organizations.

5.2.3. Clinical Practice Applications

5.2.3.1. Readiness to change should be assessed in families for tailoring intervention strategies to their specific needs.

Assessing readiness to change in adolescents with obesity and their parents is necessary for tailoring interventions to families' readiness in POM (Hampl et al., 2023). In Study 3, families' readiness to change scores varied over time for the physical activity, nutrition, and screen time rulers; further, differences were observed between adolescents' and their parents' readiness to change scores at baseline whereby parents tended to report higher levels of readiness to change than adolescents. The findings indicate the need for health care practitioners to assess readiness to change in families at treatment onset and reassess throughout interventions due to their different levels of readiness to change. By doing so, behaviour change goals can be adjusted appropriately. Initial and follow-up appointments with families must integrate assessments for adolescents as well as their parents' readiness to change since it can help predict behavioural outcomes. Embedding these assessments within the existing health care system, particularly obesity management clinics in Alberta, facilitates the implementation of evidence-based interventions. Integrating assessments into the existing health care system can be challenged by

numerous barriers and enablers. Some of these barriers can include resistance of health care practitioners to change, concerns about increased workload, and inadequate resources (*e.g.,* human, financial) (Gabutti et al., 2023). Conversely, engaged leadership, change management support, and the provision of adequate training and resources, can be enablers for the successful integration of assessments (Creasey and Taylor, 2014; Greenhalgh et al., 2004).

The AAP clinical practice guideline suggests the addition of MI to a comprehensive approach for obesity management and highlights the importance of provider training to effectively encourage behavioural changes within families, particularly in areas such as physical activity and nutrition (Hampl et al., 2023). This recommendation is also due to the potential benefits of MI in engaging adolescents with obesity and their parents as well as assessing readiness to change. To use MI effectively, health care practitioners who work with adolescents with obesity should undergo MI training from the Motivational Interviewing Network of Trainers since they adhere to established standards. This initial training in MI should be supplemented by ongoing mentorship and support to strengthen adherence to MI principles and practices. Some barriers to MI training may include increased time and cost, negative attitudes to the approach, and management in the health care system (Bell and Roomaney, 2020; Browne et al., 2022). Facilitators may include health care practitioners who demonstrate motivation to learn and master MI skills, relevant educational and professional training, and a background in counselling (Bell and Roomaney, 2020; Foldal et al., 2021). While counselling approaches such as MI are often used during clinician visits, some health care practitioners are unable to continue their education in this area after initial training (Lukaschek et al., 2019). As part of their professional continuing education, health care practitioners should require ongoing training to maintain proficiency and knowledge in MI.

5.2.3.2. Evidence-informed behavioural interventions that incorporate a reliable and valid readiness to change ruler can be beneficial to health care practitioners.

A *Readiness to Change Ruler* can be used as a practical tool to measure families' readiness to change specific behaviours (*e.g.,* nutrition, physical activity, screen time) while enrolled in POM clinics. Since adolescents with obesity and their parents may differ in their readiness to change behaviours, it would be beneficial for health care practitioners who work with adolescents living with obesity, to incorporate an assessment tool. This tool can be similar to the *Readiness to Change Ruler* used in Study 3, since it provides evidence that the measure is reliable and valid. The effectiveness of a *Readiness to Change Ruler* largely depends on the reliability and validity of the tool as this ensures accurate assessments to inform decision-making for health interventions. Assessing families' readiness to change allows health care practitioners to better determine whether adolescents and their parents can benefit from behavioural interventions and tailor these interventions to their individual needs. This is particularly important since a one-size-fits-all approach is not effective for managing adolescent obesity (Hampl et al., 2023; Motevalli et al., 2021). Since readiness to change is dynamic, assessing families' readiness to change also enables health care practitioners and families to collaboratively set behaviour goals to overcome barriers (*e.g.,* lack of engagement) and improve health outcomes over time. Study 2 revealed that families enrolled in POM clinics may not actively engage in interventions because of their low readiness. As such, interventions should be designed to adapt to families' readiness to change over time. For example, if an adolescent with obesity is not ready to make behavioural changes during their initial appointment, it is important for health care practitioners to show respect and understanding towards their readiness. Getting parents involved in the discussion about the potential health risks associated with adolescent obesity is an ideal starting point and can

encourage adolescents to begin thinking about behaviour change. During a follow-up appointment, if the adolescent is ambivalent about change, health care practitioners can consider using MI skills (*e.g.,* change talk, rolling with resistance) to address their ambivalence. This may be helpful, as it provides an opportunity for families to share their reasons for change as well as address any concerns. Several uncertainties remain so further research in these areas (*i.e.,* reliability, validity) is needed, including a larger sample size and strategies to reduce attrition. However, clinicians may choose to utilize the *Readiness to Change Ruler* in the meantime, but they should exercise caution when interpreting the findings. Health care practitioners may find the *Readiness to Change Ruler* useful for generating discussion within families and estimating readiness until further evidence is available (*e.g.,* test-retest reliability).

Future efforts can focus on determining the most appropriate ways to advocate for the integration of the *Readiness to Change Ruler* into POM clinics. Given the widespread use of technology among adolescents, leveraging electronic (e)-health platforms has the potential to improve health care services (Erku et al., 2023). More specifically, a mobile medical application (Maaß et al., 2022) for the *Readiness to Change Ruler* that can be applied to adolescents with obesity and their parents, to measure readiness to change behaviours across items with a focus on physical activity, nutrition, screen time, and sleep, could be beneficial. In addition to providing health care practitioners with a convenient way to incorporate behaviour change strategies, such as collaborative goal setting based on adolescents' motivation and readiness to change, using a mobile medical application is also a valuable way to engage adolescents in behaviour change (Yan et al., 2021). Due to a lack of published evidence on an e-version of the *Readiness to Change Ruler*, I envision conducting multiple-methods research employing a patient-centered approach. This enables families to indicate their preferred format (*e.g.,* paper-based, electronic)

for the administration of the *Readiness to Change Ruler* and identify the most appropriate environment (*e.g.,* waiting room, home setting) for completing the assessment.

5.2.3.3. Virtual care offers a convenient way to increase the accessibility and availability of health services for adolescents with obesity.

While conducting interviews for Study 2, it became evident that frequent and consistent follow-up was necessary with health care practitioners to help adolescents with obesity make and sustain positive behavioural changes. Health service delivery should implement care models that integrate virtual care (*e.g.,* videoconference, telephone, texting) into existing health care delivery models. This can be more convenient and accessible for adolescents with obesity, especially those in rural and remote communities (Baylak, 2020; LeBlanc et al., 2020). Increasing accessibility and reducing barriers to virtual care, can lead to earlier interventions, which may decrease the risk of obesity-related co-morbidities. Through virtual care, a variety of educational resources can be offered, including interactive education classes and support groups. It is also important to consider the time needed for adolescents to achieve health behavioural goals when scheduling virtual follow-up appointments. With virtual care, health care practitioners can continue to provide patient-centered care, which enhances patient engagement and prioritizes adolescents' needs (Abid et al., 2020; Shaw et al., 2018; Zhang et al., 2022). Moreover, virtual care allows for tailored interventions that align with adolescents' goals, values, and culture. Virtual care can complement (*e.g.,* hybrid care model) or eliminate in-person visits, relieving families of some of their burdens, while saving time and money and making it easier for adolescents to receive the support they need. To provide comprehensive care for adolescents with obesity using virtual care, a multidisciplinary, team-based approach (*e.g.,* physicians,

Registered Dietitians, and Registered Psychologists in primary care) is encouraged, as it may lead to improved patient outcomes (Martin et al., 2022). When a team-based approach is not available, individual health care practitioners can refer adolescents to external health care practitioners through established referral networks, and interact regularly with these professionals to improve their health and well-being. While virtual care may be beneficial for managing adolescent obesity, not all adolescents have access to the necessary technology and/or reliable access to the internet. Socioeconomic disparities can exacerbate this problem, leading to inequalities in access to health care services and widening health inequities.

5.2.3.4. Focusing on health behaviour change interventions that are culturally tailored to the needs of adolescents with obesity is critical for managing obesity.

Adolescents with obesity come from diverse cultural backgrounds with varying needs and challenges. As discussed in Studies 1 and 2, it is particularly important to encourage the adaptation of interventions so they are more culturally relevant and provide care that is tailored to adolescents' individual needs. Further, to tailor interventions that resonate with adolescents' lived experiences, beliefs and values, and needs, it is crucial to understand their diverse cultural backgrounds. Using a culturally relevant approach can improve the effectiveness of behaviour change interventions and improve health outcomes in adolescents with obesity (Joo and Liu, 2021; Nair and Adetayo, 2019). Culturally tailored interventions can facilitate better communication between health care practitioners and adolescents living with obesity by acknowledging and respecting their cultures. By doing so, trust, understanding, and respect are fostered, which are important for obesity management. It is also possible to improve adolescents' engagement in obesity management through culturally relevant interventions (Lau, 2006;

Wagner et al., 2015). For example, health care practitioners can become familiar with culturally relevant foods specific to BIPOC populations, and use this knowledge to promote the inclusion of traditional foods in adolescents' meals, while providing guidance on portion sizes. It is crucial to conduct research to identify potential barriers and facilitators to the implementation of culturally tailored interventions. Cultural beliefs and norms should also be explored to understand the behavioural habits of adolescents with obesity. Research collaborations with community leaders, organizations, and stakeholders can ensure that interventions are tailored and targeted to the needs of the population. By incorporating appropriate cultural aspects into interventions for managing obesity in adolescents, health care practitioners can better address their unique needs and support sustainable behavioural changes.

5.3. Future Directions

5.3.1. Future Research Directions

My doctoral research has revealed several potential directions for future adolescent obesity research. First, recruiting and enrolling different target populations is an essential next step. Therefore, it is important to consider how we recruit different types of adolescents with obesity and their parents.

Adolescents from the lesbian, gay, bisexual, transgender, queer, intersex, and asexual populations. Adolescents from these target populations are not well represented in obesity research and face considerable health care disparities due to systemic barriers like limited culturally competent health care. It would be beneficial to replicate my qualitative and quantitative studies among adolescents with obesity who identify as LGBTQIA, with a focus on

long-term follow-up (*e.g.,* four years) and sustained behavioural changes. Using a longitudinal cohort study design enables researchers to identify factors (*e.g.,* social determinants of health) associated with adolescent obesity in LGBTQIA populations. By employing culturally sensitive and inclusive recruitment strategies, researchers can better engage adolescents from LGBTQIA populations in health behavioural change interventions for a long period; this can foster improved health outcomes and equity in health care delivery.

Adolescents with French as their first official language. Since I used secondary data from, and recruited adolescents with obesity enrolled in the RMI-Family study, my research excluded adolescents who did not speak and read English fluently. As Canada has two official languages, English and French, it is worthwhile including French-speaking adolescents with obesity, as this acknowledges language diversity and can enhance interventions within diverse populations. It is also appropriate to consider translating recruitment materials (*e.g.,* information sheets, assent and consent forms) into the native language of adolescents and their parents from diverse populations. By doing so, it can promote cultural sensitivity, improve communication, and enhance understanding of the research. In addition, these materials should be tailored to the primary language (*e.g.,* Mandarin, Punjabi) spoken by the target population.

Adolescents with cognitive or physical impairments. My research excluded adolescents with cognitive impairments to avoid any potential communication and capacity issues. Adolescents with physical impairments were not included in my research; however, their inclusion would have been important, given their increased susceptibility to obesity (McPherson et al., 2016). Since these impairments can affect the clinical utility of findings, researchers need guidance on

how to respect individuals' autonomy in decision-making and make suitable accommodations to facilitate their participation in interventions (DeCormier Plosky et al., 2022). Adolescents with cognitive and physical impairments may have different experiences with changing behaviour habits during POM. Therefore, participation in research is necessary for these adolescents to benefit from the associated health benefits (McDonald et al., 2022; McPherson et al., 2016).

Parents of adolescents with obesity. An area of my research (*i.e.,* Study 2) excluded parents of adolescents with obesity. Parents play a crucial role in shaping their children's health behaviours, including nutrition and physical activity. Parental involvement in research can enhance understanding of adolescents' behavioural changes during obesity management and may lead to more effective interventions (Tomayko et al., 2021; Van Der Kruk et al., 2013). Further, parental involvement can provide valuable insights into family dynamics, parenting styles, and adolescent behaviours which are likely to influence adolescent obesity management.

Second, while quantitative studies have provided evidence on the prevalence and associated factors of adolescent obesity, there is a noteworthy gap regarding pharmacotherapy and bariatric surgery. There should be more research questions which explore the lived experiences of adolescents, related to *(i)* using pharmacotherapy and *(ii)* undergoing bariatric surgery for managing obesity. Qualitative research is a good method for answering such research questions since it necessitates delving beyond the scope of behavioural interventions to enable a deeper understanding of the benefits, challenges, and risks on adolescents' health and well-being, as well as their coping strategies. To date, limited research is available on adolescents' experiences of pharmacotherapy (White et al., 2015) and bariatric surgery (Müssener et al., 2022). Future

research should also explore the lived experiences of adolescents with obesity who incorporate various interventions, including pharmacological, bariatric surgical, and behavioural, for long-term obesity management, as part of a comprehensive approach to obesity management (Hampl et al., 2023).

5.4. Conclusions

The three studies that comprise my dissertation present novel insights based on multiple, complementary research methodologies that deepen our understanding of adolescent obesity management, particularly in terms of motivation and readiness to change. Study 1 established a foundation with a scoping review, synthesizing existing literature on MI-based interventions for managing adolescent obesity. This scoping review also incorporated stakeholder consultations with experienced clinician-scientists and researchers, providing insights into treatment fidelity, key elements, and reporting of MI-based interventions. This study contributes to a better understanding of the research evidence on treatment fidelity and highlights several knowledge gaps for future research. Study 2 built upon Study 1 by delving into the lived experiences of adolescents with obesity who were enrolled in POM, seeking to understand their experiences in trying to make and maintain changes in behaviours related to obesity management. By exploring adolescents' behavioural changes and experiences living with obesity during pediatric obesity management, this qualitative study identified three themes: *(i)* emotional reactions during clinical encounters; *(ii)* fear and apprehension when changing behaviours; and *(iii)* complications regarding behaviour change. Study 3, a quantitative study, extended this inquiry into adolescent obesity management, by evaluating a commonly-used tool — the *Readiness to Change Ruler* — to evaluate readiness to change behaviours in families (adolescents with obesity and their

parents). The *Readiness to Change Ruler* is psychometrically reliable (*i.e.,* good internal consistency and levels of agreement) and provides evidence that it is a valid measure (*i.e.,* a one-factor structure) for assessing readiness to change in adolescents with obesity and their parents. This study provided evidence of the potential utility of this practical tool for intervention providers and researchers to assess readiness to change with a focus on behaviours, including physical activity, nutrition, and screen time.

Collectively, these three studies provide HCPs and researchers with the much-needed evidence for targeting and tailoring interventions for managing adolescent obesity, including measuring families' motivation and readiness, evaluating a practical, evidenced-based assessment tool, and deepening understandings of adolescents' lived experiences with obesity. Data from these studies have practical relevance and can be used to guide the design, delivery, and evaluation of future interventions for managing adolescent obesity, improving our understanding of the roles of motivation and readiness to change and, ultimately, health outcomes for adolescents and their families.

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Appendices

Appendix A.

Chapter 2: Study 1

This appendix contains documents used for the scoping review and stakeholder consultation, including:

1. *Search Strategy for MEDLINE*
2. *Interview Guide for Stakeholder Consultation*
3. *Key Elements of Motivational Interviewing-based Interventions (n=26) Identified using the FRAMES Approach*
4. *Stakeholder Consultation Invitation Email*
5. *Stakeholder Consultation Oral Consent Script*

Search Strategy for MEDLINE

No.	Searches
1	Motivational Interviewing/
2	motivational interview*.mp.
3	1 or 2
4	exp Obesity/
5	body weight/ or exp overweight/
6	body weight changes/ or weight gain/ or weight loss/
7	Body Mass Index/
8	(obes* or over weight or overweight or weight management or overeat* or body mass index or bmi or (weight adj1 change*) or (over adj1 reat*)).mp.
9	(weight adj2 loss).mp.
10	(weight status or weight improv*).mp.
11	lifestyle intervention*.mp.
12	exp Diet/ or exp Nutrition Therapy/ or exp Exercise/
13	(physical activity or exercise or diet or nutrition).mp.
14	or/4-13
15	3 and 14
16	limit 15 to "all child (0 to 18 years)"
17	(p?ediatric* or youth* or teen* or adolescen* or child* or minor? or student*).mp.
18	(family or families or parent* or school*).mp.
19	17 or 18
20	15 and 19
21	16 or 20
22	exp adaptation, psychological/ or exp attitude/ or health behavior/ or patient compliance/ or medication adherence/ or no-show patients/ or patient dropouts/ or treatment refusal/ or illness behavior/
23	Patient-Centered Care/
24	(retention or loss to follow up or adher* or comply or compliance or attrition).mp.
25	(family adj3 engag*).mp.
26	(patient adj3 (engag* or activation or participation or oriented or centre* or center*)).mp.
27	or/22-26

Interview Guide for Stakeholder Consultation

Interview Questions

Interview Script

Let me thank you again for participating in the Stakeholder Consultation phase of my study. If at any point during the interview you want me to stop the recording to keep something off the record, please let me know.

Do you have any questions before we begin?

Demographic Characteristics

1. Contact Information
    a. Name *(First Name, Last Name):* _____
    b. Email Address: _____
    c. Telephone Number: _____

2. Age
    a. Under 25
    b. 25-34
    c. 35-44
    d. 45-54
    e. 55-64
    f. 65+

3. Gender
    a. Male
    b. Female
    c. Other (*e.g.,* gender variant/non-conforming) : _____

4. Country of Residence
    a. Please indicate: _____

5. Education (highest level achieved; check all that apply)
    a. Bachelor's degree
    b. Master's degree
    c. Doctoral degree
    d. Post-doctoral fellowship
    e. Doctor of Medicine
    f. Other, please specify: _____

6. Current Position
    a. Please specify: _____

Scoping Review Results

Before we begin the next section of the interview, please click on the chat and download the file to review the initial findings (if needed) from our scoping review.

Warm-Up

1. So, tell me a bit about your experience working with adolescents with obesity.
2a. Can you tell me about your experience in managing obesity in adolescents using MI?
2b. Do you still use the MI skills you learned?

Interview Guide for Stakeholder Consultation (continued)

Interview Questions

Warm-Up (continued)

3. How do you define treatment fidelity?

Next, I will ask you some questions about the results of our scoping review.

According to Borrelli (2011): *Treatment fidelity is the ongoing assessment, monitoring, and enhancement of the reliability and internal validity of a study.* With this definition in mind, please answer the following questions.

Stakeholder Consultation

1. Based on our findings, we identified that the documentation of *treatment fidelity* in MI-based interventions was inconsistent and not well-done. Based on your experience, can you identify any additional knowledge gaps in our scoping review on MI-based interventions and adolescent obesity?

2. From your experience, how does the context in which MI-based interventions are delivered (*e.g.,* setting, delivery, duration, frequency, delivered by and training) for managing adolescent obesity contribute to varying outcomes?

3. In your opinion, what factors could account for 'low treatment fidelity' in MI-based interventions (please indicate all that apply)?

a. Increased time associated with treatment fidelity
b. Increased cost associated with treatment fidelity
c. Information not reported in the journal article
d. Treatment fidelity reported in a separate journal article
e. Authors focus on Motivational Interviewing Treatment Integrity (MITI) code and not treatment fidelity
f. Lack of knowledge on treatment fidelity
g. Lack of knowledge regarding the benefits of 'high treatment fidelity'
h. Other: _____

Definitions are provided below for the 5 treatment fidelity strategies. Please use these definitions to help you answer questions 4-6.

> ***Fidelity to Theory*** relates to the study design and applicable theoretical actions.
>
> ***Treatment Implementation*** assesses and monitors if the intervention was effectively delivered.
>
> ***Provider Training*** examines training between various providers. It ensures that providers are adequately trained and their skills monitored and maintained.
>
> ***Treatment Receipt*** evaluates whether the participant received the treatment *i.e.,* Did the participant understand the treatment? Did the participant demonstrate knowledge of learnt skills?
>
> ***Treatment Enactment*** assesses the participant learnt skills in real-life settings.

Interview Guide for Stakeholder Consultation (continued)

Interview Questions
Stakeholder Consultation (continued)
4. From our results, three (out of 27; 11%) studies had 'high treatment fidelity' to certain strategies (*i.e.,* Fidelity to Theory, Provider Training and Treatment Implementation). Based on our findings and your experience, can you say something about researchers considering the importance of treatment fidelity for MI-based interventions?
5. What are your thoughts on the proportion of adherence to treatment fidelity in MI-based interventions? The least adhered to strategy was *Treatment Enactment* while the most adhered to strategy was *Fidelity to Theory*.
6. What did you think of the results for the proportion of adherence?
7. Based on our overall initial findings, can you tell me if there is anything you would do differently now when conducting or reporting an MI-based intervention?
FRAMES is an acronym for *Feedback, Responsibility, Advice, Menu, Empathy and Self-Efficacy.* The FRAMES approach summarizes the most effective components of MI-based interventions. Using the FRAMES approach, please answer questions 8-9.
8. In regards to MI-based interventions for managing adolescent obesity, from your experience, can you say something about if any of the FRAMES components is more important than any other?
9. For the FRAMES component(s) documented as 'Not Reported', can you confirm if the findings were (if not applicable, please move on to question 10). a. Not done (scoping review results are accurate) b. Done, not reported in the journal article
Before we continue, a reminder that *treatment fidelity is the ongoing assessment, monitoring, and enhancement of the reliability and internal validity of a study* Borrelli (2011). With this definition in mind, please answer questions 10-11.
10. For the Treatment Fidelity Strategies documented as 'Not Reported', can you confirm if the findings were (if not applicable, please move on to question 11). a. Not done (scoping review results are accurate) b. Done, not reported in the journal article
11. What are your perspectives on the potential limitations of MI-based interventions for adolescent obesity relative to treatment fidelity practices?
12. Did you encounter any challenges while implementing and conducting your MI-based intervention?
13. What have you learned from conducting your MI-based intervention?
14. Do you have any final comments to share?
Thank you very much for completing this video interview and for participating in this research.

Key Elements of Motivational Interviewing-based Interventions (n=26) Identified using the FRAMES Approach

	FRAMES Components					
Study	Feedback	Responsibility	Advice	Menu	Empathy	Self-Efficacy
Andre & Beguier	✓	✓	✓	✓	✓	✓
Ball et al.	✓	✓	✓	✓	✓	✗
Bean et al.	✓	✓	✓	✓	✓	✓
Black et al.	✗	✗	✓	✓	✗	✗
Brennan et al.	✓	✓	✓	✓	✓	✓
Carcone et al.	✓	✓	✓	✓	✓	✓
Chahal et al.	✓	✓	✓	✓	✓	✓
Currie et al.	✓	✓	✓	✓	✓	✓
Davis et al.	✓	✓	✓	✓	✓	✓
Flattum et al.	✗	✓	✓	✓	✓	✓
Freira et al.	✓	✓	✓	✓	✓	✓
Gourlan et al.	✓	✓	✓	✓	✗	✓
Irby et al.	✓	✓	✓	✓	✓	✓
Jensen et al.	✓	✓	✓	✓	✓	✓
Kong et al.	✓	✗	✓	✓	✗	✗
Kose & Yildiz	✗	✗	✓	✗	✓	✗
Love-Osborne et al.	✓	✗	✓	✓	✗	✗
MacDonell et al.	✓	✓	✓	✓	✓	✓
Naar-King et al.	✓	✓	✓	✓	✓	✓
Neumark-Sztainer et al.	✗	✗	✓	✓	✓	✓
Pakpour et al.	✗	✓	✓	✗	✓	✓
Resnicow et al.	✓	✓	✓	✓	✓	✓
Riiser et al.	✗	✓	✓	✓	✓	✗
Vallabhan	✓	✓	✓	✓	✓	✓
Walpole et al.	✓	✓	✓	✓	✓	✓
Wilson et al.	✓	✓	✓	✗	✗	✓

✓: Yes, element reported; ✗: No, element not reported

Stakeholder Consultation Invitation Email

Dear <insert name here>:

My name is Nadia Browne and I am a PhD Candidate in the Department of Pediatrics at the University of Alberta (UAlberta) in Edmonton, Canada. As part of my thesis, I conducted a scoping review to examine the application and reporting of motivational interviewing (MI) in managing adolescent obesity. To complement the review, I am consulting with stakeholders (like you!) to gain additional perspectives. Your contact information was obtained from a publication (included in our scoping review) in which you were indicated as a corresponding author. Because of your experience in this area, I am inviting you to participate in a virtual one-on-one video interview using Google Meet.

The results from my scoping review will be shared with you before the interview. Interviews will include questions on the findings, which will take 45-60 minutes. You will receive a $25 e-gift card (*e.g.,* Amazon, Starbucks) as a token of our appreciation. There is no more than minimal risk to you. While you will receive no direct benefit by participating, you will make a valuable contribution to research regarding MI-based interventions. All the information we receive from you (*e.g.,* name, email address) will remain confidential and stored on an industry-standard, secure cloud located in Canada and maintained by Compute Canada. However, if you wish to be acknowledged publicly for participating in this study, your name and affiliation(s) can be included in my dissertation and the *Acknowledgements* section of any academic presentation or manuscript that results from this research. Information from this consultation will be kept for a minimum of 5 years and results will be presented publicly (*e.g.,* peer-reviewed publication).

If you decide to participate, your interview will take place between now and May 31, 2022. Your verbal consent (after an oral consent script is read to you) will indicate that you agree to participate. Please answer questions as honestly and completely as possible, although there are no 'right' or 'wrong' responses. Your participation is voluntary and you may discontinue your participation at any time during the interview. If you wish to have your responses withdrawn following your interview, please contact me within 4 weeks of your interview date so I may accommodate your request.

If you require additional information or have questions about this study, please feel free to contact me at 1-780-729-0556 or nbrowne@ualberta.ca or Dr. Geoff Ball (Faculty Supervisor, Professor, Department of Pediatrics) at 1-780-492-8727 or gdball@ualberta.ca. Any concerns about this study (UAlberta Ethics ID: Pro000100039) or questions about your rights as a participant can be addressed by Kim Kordov at the University of Alberta Health Research Ethics Board at 1-780-492-2615 or kim.kordov@ualberta.ca. The HREB is not involved in this study.

Thank-you very much for considering my invitation to participate in this study.

Regards,
Nadia

STAKEHOLDER CONSULTATION ORAL CONSENT SCRIPT

Motivational Interviewing in Managing Adolescent Obesity: A Stakeholder Consultation

Graduate Researcher: Ms. Nadia Browne (University of Alberta); 1-780-729-0556 (p); nbrowne@ualberta.ca
Principal Investigator: Dr. Geoff Ball (University of Alberta); 1-780-492-8727 (p); gdball@ualberta.ca

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Hi <insert name here>, my name is Nadia Browne and I'm a graduate researcher at the University of Alberta working with Dr. Geoff Ball (Professor, Department of Pediatrics).

Purpose

The purpose of this interview is to conduct a stakeholder consultation to complement our recently-completed scoping review on the application and reporting of motivational interviewing (MI) in managing adolescent obesity. This consultation aims to *(i)* verify and validate findings, *(ii)* gain perspectives on the limitations of MI-based interventions, *(iii)* fill in knowledge gaps not identified by our review, and *(iv)* address questions on MI and treatment fidelity assessment.

The interview will take 45-60 minutes to complete.

Voluntary Participation

Your participation is completely voluntary. You are under no obligation to participate and if you choose to participate, you may refuse to answer questions that you do not want to answer. However, please answer any questions as completely and honestly as possible. Should you choose to discontinue your participation midway, you may also have your responses withdrawn.

Privacy and Consent

Our conversation will be video recorded then transcribed. All the information you provide in this online interview will remain confidential. Compute Canada, a cloud-based service located in Canada, will be used to store the recording and transcript. Please note that information from this stakeholder consultation will be kept for a minimum of 5 years.

Ethics Approval

Research ethics approval for this study (Pro00100039) was obtained on January 21, 2021, from the Health Research Ethics Board at the University of Alberta, Edmonton, Canada.

Your verbal consent (after this oral consent script is read to you) will indicate that you agree to participate.

Contact Information

If you have any questions or require more information about this study, please contact us using the numbers mentioned above. If you have any questions about your rights as a research participant, please contact the University of Alberta Health Research Ethics Board at 1-780-492-2615 or kim.kordov@ualberta.ca. This office is independent of the researchers.

Gift Card Acknowledgment

I, <state your name>, acknowledge receipt of a $25 e-gift card (*e.g.,* Amazon, Starbucks) from the University of Alberta.

What is your e-gift card preference? □ Amazon □ Starbucks

Date:

Appendix B.

Chapter 3: Study 2

This appendix contains documents used for the interpretative phenomenological analysis, including:

1. *Information Sheet and Assent Form (For 13-14 Year Olds)*
2. *Information Sheet and Consent Form (For 15-20 Year Olds)*
3. *Information Sheet and Consent Form (For Caregivers)*
4. *Interview Guide*

UNIVERSITY OF ALBERTA

INFORMATION SHEET AND ASSENT FORM (FOR 13 – 14 YEAR OLDS)

Title of Study: The Lived Experiences of Changing Lifestyle Habits in Adolescents with Obesity: An Interpretative Phenomenological Analysis

Principal Investigator: Dr. Geoff Ball (University of Alberta)
1-780-278-3272 (p) | gdball@ualberta.ca

Graduate Student: Ms. Nadia Browne (University of Alberta
1-780-729-0556 (p) | nbrowne@ualberta.ca

Why are you being asked to be part of this research study?

A research study is a way to find out new information about something. You are being asked to take part in this research study because we are trying to learn about how teens with obesity experience making changes to their lifestyle habits (*e.g.,* diet, physical activity, sleep) while attending a pediatric weight management (PWM) clinic. We will also look at factors (*e.g.,* social, environmental) that influence teens to change their lifestyle habits. We are asking you to be in the study because you can give us important information about how you experience making behaviour changes.

If you join the study, what will happen?

If you decide to take part in this study, here are some things that will happen:

- We will ask you questions about your experiences making changes to your lifestyle habits. Our questions and your answers will take about 90 minutes.
- We will ask you questions using Google Meet. You can turn off your camera in Google Meet at any time.
- The person asking you questions will take notes and use a recorder to document your answers.
- We will look at your medical chart and RMI-Family study records to collect some background information, including details like age, date of birth, gender, ethnicity and years enrolled in the PWM clinic.

Will any part of the study hurt?

None of the measurements will hurt you. Some of the questions we ask in your interview might be hard to answer. We will give you lots of time to think. There are no wrong answers. We just want to know about your thoughts and experiences.

Will the study help others?

This study should help our research team to understand teens' experiences and decisions regarding how they make changes to their lifestyle habits.

What do you get for being in the study?

You will receive a gift card (worth $25) for participating even if you withdraw early from the study.

Do you have to be in the study?

You do not have to be in the study. It's up to you. No one will be upset if you don't want to do this study. If you join the study, you can change your mind and stop being part of it at any time. All you have to do is tell us. It's okay, the researchers and your parents won't be upset.

Do your parents know about this study?

This study was explained to your parents and they said that we could ask if you want to be in it. You can talk this over with them before you decide.

Who will see the information collected about you?

The information collected about you during this study will be kept safely locked up. Nobody will know it except the people doing the research. The study information about you will not be given to your parents. The researchers will not tell your friends or anyone else.

What if I have any questions?

You can ask any questions that you may have about the study. If you have a question later that you didn't think of now, either you can call or have your parents call Dr. Geoff Ball (780-278-3272; gdball@ualberta.ca) or Nadia Browne (780-729-0556; nbrowne@ualberta.ca). Both of them know about this study.

Would you like to be in this research study?

If you decide to be in the study, please print and sign your name below. You will be given a copy of this form to keep.

☐ **Yes, I want to enroll in this research study.** ☐ **No, I don't want to enroll in this study.**

_____
Name of Participant

_____ _____
Signature of Participant Date

Signature of Person Obtaining Assent

_____
Name of Person who received assent

_____ _____
Signature of Person who received assent Date

UNIVERSITY OF ALBERTA

INFORMATION SHEET AND CONSENT FORM (FOR 15 – 20 YEAR OLDS)

Title of Study: The Lived Experiences of Changing Lifestyle Habits in Adolescents with Obesity: An Interpretative Phenomenological Analysis

Principal Investigator: Dr. Geoff Ball (University of Alberta)
1-780-278-3272 (p) | gdball@ualberta.ca

Graduate Student: Ms. Nadia Browne (University of Alberta)
1-780-729-0556 (p) | nbrowne@ualberta.ca

Why am I being asked to take part in this research study?

You are being asked to be in this study because you *(i)* currently attend or previously attended appointments at the Pediatric Centre for Weight and Health (PCWH) in Edmonton or Calgary and *(ii)* agreed to participate in the RMI-Family study.

Before you make a decision, one of the researchers will go over this form with you. You are encouraged to ask questions if you feel anything needs to be made clearer. You will be given a copy of this form for your records.

What is the reason for doing the study?

The purpose of our study is to learn more about how teens experience making changes to their lifestyle habits (*e.g.,* diet, physical activity, sedentary activity, sleep) while attending a pediatric weight management (PWM) clinic. We will also explore factors that influence teens decisions to make changes to their lifestyle habits.

What will I be asked to do?

We will conduct virtual one-on-one video interviews. Interviews will be conducted using Google Meet and will take ~90 minutes to complete. At any time during the interview, you can turn off your camera in Google Meet. Also, interviews will be conducted with teens who are either currently or were previously enrolled at a PWM clinic in Edmonton or Calgary and agreed to participate in the RMI-Family study. The interview will questions focusing on your experiences making behavioural changes while attending a PWM clinic, as well as factors known to influence teens making changes to their lifestyle habits. Interviews will be video and audio recorded then transcribed into text.

Other information collected for this study will be taken from your medical chart and the RMI-Family study records. This is done to save you time and is done for descriptive purposes only. This includes the following: your age, date of birth, gender, ethnicity and years enrolled in the PWM clinic.

What are the risks and discomforts?

There is no physical risk to participating in this study. Interviews require concentration and can result in mental fatigue for some people. You may stop at any time if you feel uncomfortable.

What are the benefits to me?

There may be no direct benefit to you for participating in this study. However, results from this study will help us to learn about the experiences that helped you make changes to your lifestyle habits while at a PWM clinic and if there were factors that made it easier to change your behaviour.

Do I have to take part in the study?

Being in this study is your choice. If you decide to be in the study, you can change your mind and stop being in the study at any time. Withdrawing from this study will not affect your care. You do not have to answer any questions from the interview that you are not comfortable with.

If you choose to stop being in the study, you can withdraw your data up to 4 weeks after the initial interview. If you wish to withdraw, you can contact Dr. Geoff Ball (780-278-3272; gdball@ualberta.ca) or Nadia Browne (780-729-0556; nbrowne@ualberta.ca).

Will I be paid to be in the research?

As a token of our appreciation, you will receive a $25 gift card (*e.g.,* Amazon, Starbucks, Tim Hortons). If you choose to withdraw from the study, you will still receive the gift card.

Will my information be kept private?

Throughout the study, we will collect information about you. We will make sure that your information is kept private. No data relating to this study that includes your name will be released outside of the researcher's office or published by the researchers. Any information on a computer will be protected with a password. All paper copies of your information will be stored in a locked filing cabinet. Sometimes, by law, we may have to release your information with your name so we cannot guarantee absolute privacy. However, we will make every legal effort to make sure that your information is kept private.

During research studies it is important that the data we get is accurate. For this reason your health data, including your name, may be looked at by people from our research team and the Health Research Ethics Board. Our research team will need to look at your personal health records as well as RMI-Family research records. Any personal information that we get from these records will used for this study only. By signing this consent form, you agree that it is okay for the study team to collect, use and disclose information about you from your personal health records and RMI-Family research records as described above.

The results of this study may be published in a scientific journal or presented at a conference. No names or identifying information will be published.

At the University of Alberta, we keep data stored for a minimum of 5 years after the end of the study. If you leave the study, we will not collect new health information about you, but unless you ask us to remove it, we will keep the data that we have already collected.

What if I have questions?

If you have any questions or require more information about this study, please contact us using the numbers mentioned above. If you have any questions about your rights as a research participant, please contact the University of Alberta Health Research Ethics Board at 1-780-492-2615 or kim.kordov@ualberta.ca. This office is independent of the researchers.

UNIVERSITY OF ALBERTA

ADOLESCENT CONSENT FORM

Title of study: The Lived Experiences of Changing Lifestyle Habits in Adolescents with Obesity: An Interpretative Phenomenological Analysis

Principal Investigator: Dr. Geoff Ball (University of Alberta)
1-780-278-3272 (p) | gdball@ualberta.ca

Graduate Student: Ms. Nadia Browne (University of Alberta)
1-780-729-0556 (p) | nbrowne@ualberta.ca

Please circle your answers:

Do you understand that you have been asked to be in a research study?	Yes	No
Have you received and read a copy of the attached Information Sheet?	Yes	No
Do you understand the benefits and risks involved in taking part in this research study?	Yes	No
Have you had a chance to ask questions and discuss this study with the researchers?	Yes	No
Do you understand that you are free to leave the study at any time without having to give a reason and without affecting your future medical care?	Yes	No
Has the issue of confidentiality been explained to you?	Yes	No
Do you understand who will have access to your study records, including personally identifiable health information?	Yes	No

Who explained this study to you? _____

I agree to take part in this study	**Yes**	**No**

_____
Name of Participant

_____ _____
Signature of Participant Date

I believe that the person signing this form understands what is involved in the study and voluntarily agrees to participate.

Signature of Investigator or Designee: _____ Date: _____

UNIVERSITY OF ALBERTA

INFORMATION SHEET AND CONSENT FORM (FOR CAREGIVERS)

Title of Study: The Lived Experiences of Changing Lifestyle Habits in Adolescents with Obesity: An Interpretative Phenomenological Analysis

Principal Investigator: Dr. Geoff Ball (University of Alberta)
1-780-278-3272 (p) | gdball@ualberta.ca

Graduate Student: Ms. Nadia Browne (University of Alberta)
1-780-729-0556 (p) | nbrowne@ualberta.ca

Why am I being asked to consider this research study?

You are being asked to allow your child to be in this study because you currently attend or previously attended the Pediatric Centre for Weight and Health (PCWH) in Edmonton with your child.

Before you make a decision, one of the researchers will go over this form with you. You are encouraged to ask questions if you feel anything needs to be made clearer. You will be given a copy of this form for your records.

What is the reason for doing the study?

The purpose of our study is to learn more about how adolescents experience making changes to their lifestyle habits (*e.g.,* diet, physical activity, sedentary activity, sleep) while attending a pediatric weight management (PWM) clinic. We will also explore factors that influenced adolescents in how they make changes to their lifestyle habits.

What will my child be asked to do?

To learn from adolescents and their experiences, we will conduct virtual one-on-one video interviews. Interviews will be conducted using Google Meet and will take ~90 minutes to complete. At any time during the interview, you can turn off your camera in Google Meet. Also, interviews will be conducted with adolescents who are either currently or were previously enrolled at a PWM clinic in Edmonton or Calgary and participated in the RMI-Family study. The interview includes questions about adolescents' experiences making behavioural changes while attending a PWM clinic, as well as factors known to influence adolescent changes to their lifestyle habits for managing adolescent obesity. Interviews will be video and audio recorded then transcribed.

Other information collected for this study will be taken from your child's medical chart and the RMI-Family study records. This is done to save time and is done for descriptive purposes only. We will include information including child age, date of birth, gender, ethnicity and years enrolled in the PWM clinic.

What are the potential risks and discomforts?

There is no physical risk to participating in this study. Interviews require concentration and can result in mental fatigue for some people. Your child may stop at any time if they feel uncomfortable.

What are the benefits to my child?

There may be no direct benefit to your child for participating. However, results from this study will help us to learn about the experiences that helped your child make changes to their lifestyle habits while at a PWM clinic. We also want to know if there were factors that made it easier for your child to change their behaviour.

Do I have to take part in the study?

No, you are not required to participate in this study. If you decide to allow your child to be in the study, you can change your mind and stop your child from being in the study at any time, and it will in no way affect the care that your child is entitled to. Your child does not have to answer any questions from the interview that they are not comfortable with.

If you choose for your child to stop being in the study, you can withdraw your child's data up to 4 weeks after the initial interview. If you wish to withdraw, you can contact Dr. Geoff Ball (780-278-3272; gdball@ualberta.ca) or Nadia Browne (780-729-0556; nbrowne@ualberta.ca).

Will I be paid to be in the research?

Participants in this study will be offered a $25 gift card (*e.g.,* Amazon, Starbucks, Tim Hortons) as a token of our appreciation. Participants who withdraw from the study are still entitled to receive a gift card.

Will my information be kept private?

Throughout the study, we will collect data about your child. We will ensure your child's data remains private. No data relating to this study that includes your child's name will be released outside of the researcher's office or published by the researchers. Any information on a computer will be protected with a password. All paper copies of your child's information will be stored in a locked filing cabinet. Sometimes, by law, we may have to release your information with your child's name so we cannot guarantee absolute privacy. However, we will make every legal effort to make sure that your child's information is kept private.

During research studies it is important that the data we get is accurate. For this reason your child's health data, including their name, may be looked at by people from our research team and the Health Research Ethics Board. Our research team will need to look at your child's personal health records and the RMI-Family study records. Any personal health information that we get from these records will be only what is needed for the study. By signing this consent form, you agree for the study team to collect, use and disclose information about you from your personal health records and the RMI-Family study records as described above.

The results of this study may be published in a scientific journal or presented at a conference. No names or identifying information will be published.

At the University of Alberta, we keep data stored for a minimum of 5 years after the end of the study. If your child leaves the study, we will not collect new health information about your child, but unless you ask us to remove it, we will keep the data that we have already collected.

What if I have questions?

If you have any questions or require more information about this study, please contact Dr. Geoff Ball (780-278-3272; gdball@ualberta.ca) or Nadia Browne (780-729-0556; nbrowne@ualberta.ca). If you have any questions about your child's rights as a research participant, please contact the University of Alberta Health Research Ethics Board at 1-780-492-2615 or kim.kordov@ualberta.ca. This office has no affiliation with the study investigators.

UNIVERSITY OF ALBERTA

PARENT/GUARDIAN CONSENT FORM ON BEHALF OF ADOLESCENT PARTICIPANT

Title of study: The Lived Experiences of Changing Lifestyle Habits in Adolescents with Obesity: An Interpretative Phenomenological Analysis

Principal Investigator: Dr. Geoff Ball (University of Alberta)
1-780-278-3272 (p) | gdball@ualberta.ca

Graduate Student: Ms. Nadia Browne (University of Alberta)
1-780-729-0556 (p) | nbrowne@ualberta.ca

Do you understand that you have been asked to allow your child to be in a research study?	Yes	No
Have you received and read a copy of the attached Information Sheet?	Yes	No
Do you understand the benefits and risks involved in taking part in this research study?	Yes	No
Have you had a chance to ask questions and discuss this study with the researchers?	Yes	No
Do you understand that your child is free to leave the study at any time without having to give a reason and without affecting his/her future medical care?	Yes	No
Has the issue of confidentiality been explained to you?	Yes	No
Do you understand who will have access to your child's study records, including personally identifiable health information?	Yes	No

Who explained this study to you? _____

I agree to allow my child _____ to take part in this study.
(Child's name)

I have the legal authority to give this consent.

_____
Name of Parent/Guardian

_____ _____
Signature of Parent/Guardian Date

I believe that the person signing this form understands what is involved in the study.

Signature of Investigator or Designee: _____ Date: _____

Interview Guide

Interview Questions

Interview script

Hi <insert name>, I'm Nadia, a graduate student at the University of Alberta. I would like to talk to you about your experiences with changing lifestyle habits (*e.g.,* diet, physical activity, sedentary activity, sleep) since you started attending the Pediatric Centre for Weight and Health.

The purpose of this interview is to understand what changing health behaviour means to you and to get a sense of your experiences with making (or trying to make) change. To understand your experiences, I want to talk with you about some factors that might have led to changes to your lifestyle habits. I'd like you to talk as freely as possible about anything that is important to you. The more information you can provide about your experiences, the better. Keep in mind that there are no right or wrong answers and all of the information you share with me will remain private.

Do you have any questions before we begin?

Demographic and Behaviour Change

1. Contact Information
    a. Name *(First Name, Last Name)*: _____
    b. Email Address: _____
    c. Telephone Number: _____
2. Date of interview: _____
3. Date of birth: _____
4. Age: _____
5. Sex: □ Male □ Female
6. Ethnicity: _____
7. Date of initial clinic visit: _____
8. Date of most recent clinic visit: _____
9. Total number of in-person and distance interactions with clinicians: _____
10. Total in-person and distance time spent (minutes) with clinicians: _____

Preamble

1. What brought you to the Pediatric Centre for Weight and Health?
    Prompts: *Can you give me a brief history of your unhealthy weight problems? Can you please tell me what happens during your clinic appointments? What health care professionals did you meet with? Can you recall how you felt, and what you thought at that time? What were your expectations? Who was with you during your clinic visits?*

Experiences with behaviour change and ambivalence

2. What does behaviour change mean to you?
    Prompts: *How do you define it? Can you give me an example?*

Interview Guide (continued)

Interview Questions
3. Can you tell me about an experience (time) when you improved your unhealthy lifestyle behaviours? ***Prompts:*** *Tell me more about that experience? If you could say anything about that experience, what would it be? Can you describe these changes? How did the changes occur? What were your reasons for making this change? How did you feel after making that change? What feelings (e.g., happy, sad, surprise) and thoughts did you experience? How did your behaviour change over time?*
4. Now, can you tell me about an experience (time) when you DID NOT improve your unhealthy lifestyle behaviours? ***Prompts:*** *Tell me more about that experience? If you could say anything about that experience, what would it be? What were your reasons for not making a change? How did you feel after not making that change? What feelings (e.g., happy, sad, surprise) and thoughts did you experience? How did your behaviour change over time?*
5. Let's talk about ambivalence. Ambivalence involves being pulled in opposite directions. Sometimes, it's described as being undecided, like part of you wants to make a change, but the other part of you is afraid of changing. Have you ever experienced ambivalence? ***Prompts:*** *Please tell me more about your experience(s) with ambivalence? What worries you about changing your lifestyle behaviours (habits)? Have you faced any difficulties in changing your lifestyle habits? If so, what difficulties? Have you recently recognized that you have a health behaviour that you need to change? Why do you want to change? If so, what would be the advantage(s) of making that change? What would encourage you to make that change? Is there anything preventing you from changing your lifestyle habits? If so, what?*
Motivation and readiness to change
6. What does motivation mean to you? ***Prompts:*** *How do you define it?*
7. Has motivation (something inside you that makes you want to do things and finish them) made a difference in helping to change your unhealthy lifestyle behaviours? ***Prompts:*** *If so, how do you motivate yourself? How did your motivation change over time? When do you feel the most motivated to change? How do you feel when you're motivated (e.g., proud, focused, hopeful)? When do you feel unmotivated (unexcited) to change? Can you tell me about your readiness (preparation) to change your lifestyle habits?*
Factors affecting behaviour change
Intra-personal 8. What influenced your decision to seek help for making changes to your lifestyle habits (*e.g.,* diet, physical activity, sedentary activity, sleep)? ***Prompts:*** *Did any of these factors: age, sex, socioeconomic status, race, ethnicity, disability, psychosocial, knowledge and skills, and food preferences also contribute to you making changes? How did they contribute?*
9. What lifestyle habits (if any) did you hope to get help with changing when you enrolled in this clinic? ***Probes:*** *Think about your diet, physical activity, sedentary activity and sleep. Were you ready to change any of these lifestyle habits? If "yes", which lifestyle habits?* ***Prompts:*** *Where there any habits you DID NOT want to change? If "yes", which lifestyle habits?*

Interview Guide (continued)

Interview Questions
Inter-personal 10. What role (if any) did your _____ play in helping with your behaviour change? ***Prompts:*** *Parents? Siblings? Extended family members? Friends? Other important adults (e.g., teachers). Who (if anyone) motivates you to make changes to your behaviour? If anyone, how?*
Sectors (Health care) 11. What influence (if any) did the clinic have on your lifestyle habits (*e.g.,* diet, physical activity, sedentary activity, sleep)? ***Prompts:*** *What changes in your behaviour have you experienced since enrolling in this clinic?*
12. Which aspects (if any) of the clinic did you find beneficial in helping you to change your health behaviours? ***Probes:*** *Think about your appointments with the different health care professionals (e.g., doctor, dietitian). Were there any educational tools or information they shared with you that were useful?*
13. What help would you have liked from the weight management clinic (if any)? ***Prompts:*** *What could have made a difference?*
Settings, Social and Cultural Norms, Environment and Values 14. What other influences (*e.g.,* social, cultural, environmental, values) impacted on your experience of changing lifestyle habits (*e.g.,* diet, physical activity, sedentary activity, sleep) since enrollment in the weight management clinic? ***Prompts:*** *In what ways has _____ impacted on your experience of changing lifestyle habits? Home (connection with family? Impact on family?), school, recreational facilities, foodservice and retail establishments, other community settings, belief systems, traditions, heritage, religion, priorities, lifestyle, body image.*
15. Can you tell me about your experience with changing lifestyle habits (*e.g.,* diet, physical activity, sedentary activity, sleep) since the COVID-19 pandemic? ***Probes:*** *Think about your diet, physical activity, sedentary activity and sleep <u>BEFORE</u> the COVID-19 pandemic, <u>DURING</u> the COVID-19 pandemic and <u>NOW</u>. What, if any, setbacks did (do) you have? How did you cope?*
Closing 16. What has been the impact of behaviour change on your life?
17. Would you recommend changing unhealthy lifestyle habits to other adolescents? ***Prompts:*** *If "yes", why? If "no", why not?*
18. Before we end the interview, is there anything else you would like to add about behaviour change or any other topic?
Thank you very much for completing this interview and participating in this research.

Appendix C.

Chapter 4: Study 3

This appendix contains documents from the quantitative study and forms used for the RMI-Family study, including:

1. *Readiness to Change Ruler (Adolescent and Parent Versions)*
2. *Correlation Matrices for Adolescents and Parents (Baseline, 6-months, and 12-months)*
3. *Youth Information Sheet and Assent Form*
4. *Parent Information Sheet and Consent Form*
5. *RMI-Family Study Demographic Form for Adolescents and Parents*
    a. *Sociodemographics*
    b. *Personal Health History*
        i. *Weight-related co-morbidities*
        ii. *Family history of chronic diseases*

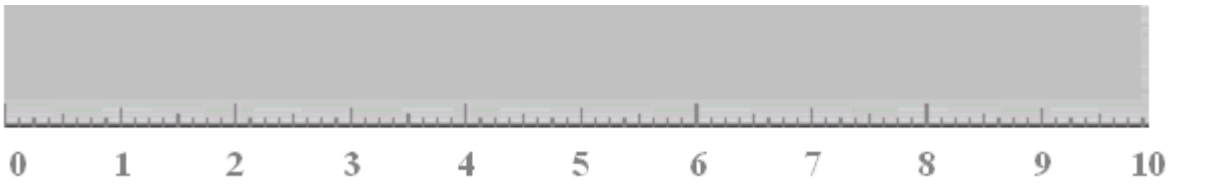
Readiness to Change Ruler **(Adolescent Version)**

Readiness to change lifestyle habits related to your bodyweight can vary depending on other things that are happening in your life. Sometimes it helps to talk about where you are in terms of these decisions, because you know what is right for you right now and how ready you are to make any changes.

I am going to ask you to look at the readiness to change rulers below and tell me on a scale from 0 to 10, how ready you are to change your lifestyle habits associated with bodyweight, where 10 is definitely ready to change and 0 is definitely not ready to change.

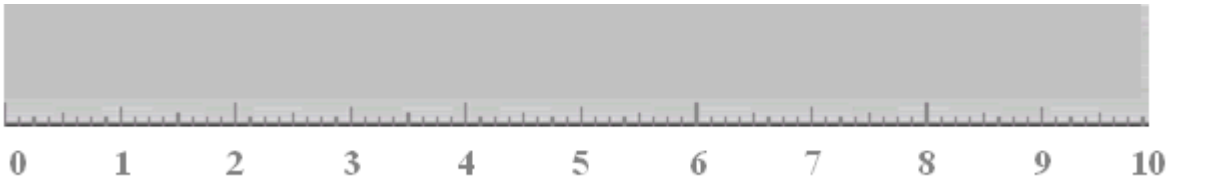
Please circle the number (from 0 to 10) on each of the rulers that best fits with how you are feeling right now.

1. How ready are you to change your physical activity time (including active video games)?



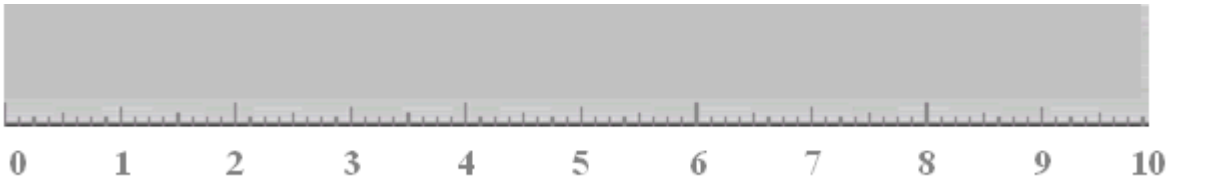
(Definitely not ready) (Definitely ready)

2. How ready are you to change your screen time (*e.g.,* TV, computer games, anything you do with a screen for fun [not homework]?



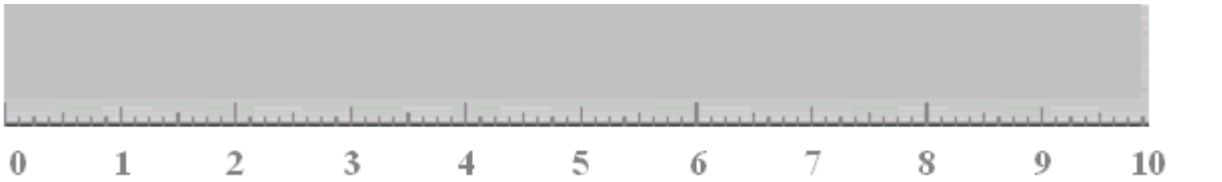
(Definitely not ready) (Definitely ready)

3. How ready are you to change the amount of 'treat' food (*e.g.,* fast food, candy, chips, chocolate, pizza, pop) that you eat?



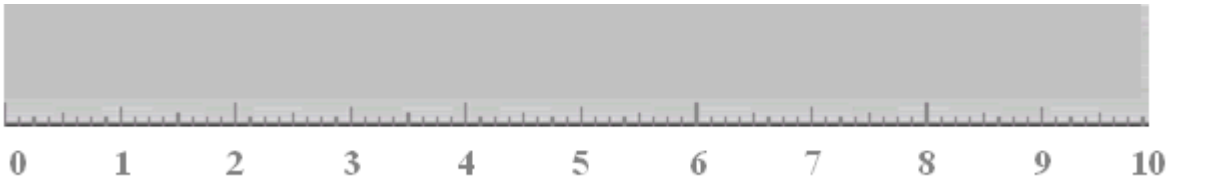
(Definitely not ready) (Definitely ready)

4. How ready are you to change the amount of overeating (eating too much food; eating more than is normal for you; wished you hadn't eaten that much; feeling uncomfortably full; felt you can't stop eating) you do?



(Definitely not ready) (Definitely ready)

5. How ready are you to change eating when you are not hungry (*e.g.,* eating for reasons other than hunger)?



(Definitely not ready) (Definitely ready)

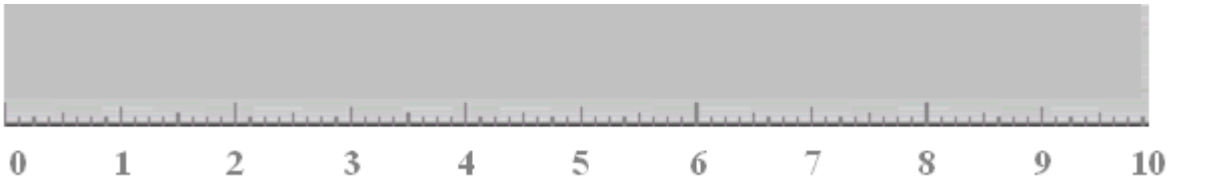
Readiness to Change Ruler **(Parent Version)**

Readiness to change lifestyle habits related to your son's/daughter's bodyweight can vary depending on other things that are happening in your lives. Sometimes it helps to talk about where you are in terms of these decisions, because you know what is right for your son/daughter right now and how ready you are to make any changes.

I am going to ask you to look at the readiness to change rulers below and tell me on a scale from 0 to 10, how ready you are to change your son's/daughter's lifestyle habits associated with bodyweight, where 10 is definitely ready to change ready and 0 is definitely not ready to change.

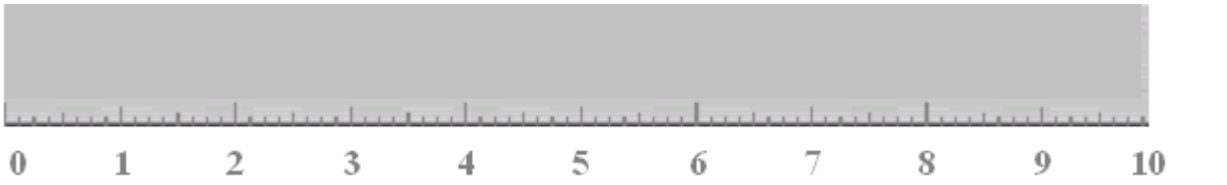
Please circle the number (from 0 to 10) on each of the rulers that best fits with how you are feeling right now.

1. How ready are you to change your son's/daughter's physical activity time (including active video games)?



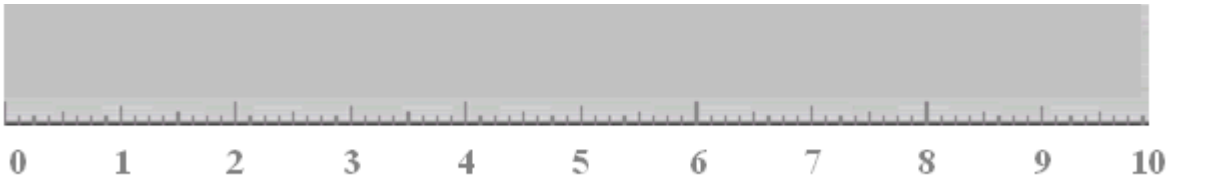
(Definitely not ready) (Definitely ready)

2. How ready are you to change your son's/daughter's screen time (*e.g.,* TV, computer games, anything they do with a screen for fun [not homework])?



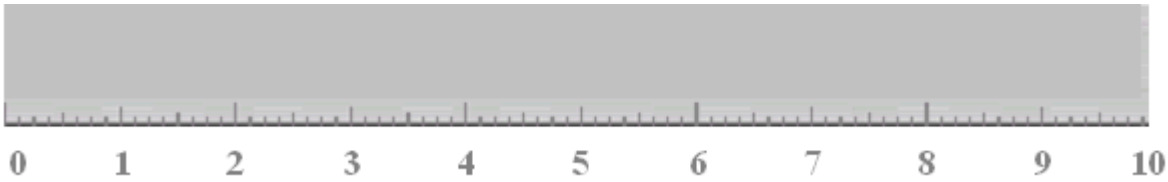
(Definitely not ready) (Definitely ready)

3. How ready are you to change the amount of 'treat' food (*e.g.,* fast food, candy, chips, chocolate, pizza, pop) that your son/daughter eats?



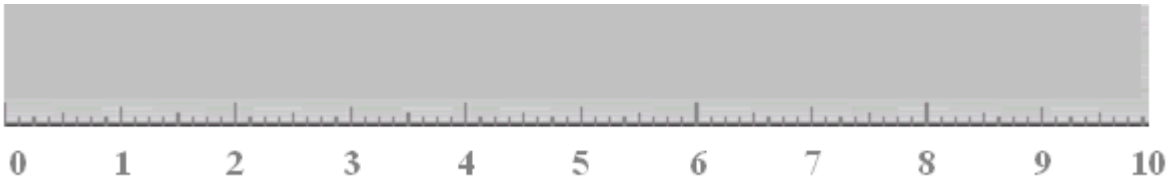
(Definitely not ready) (Definitely ready)

4. How ready are you to change the amount of overeating (eating too much food; eating more than is normal for him/her; wished they hadn't eaten that much; feeling uncomfortably full; felt they can't stop eating) done by your son/daughter?



(Definitely not ready) (Definitely ready)

5. How ready are you to change your son's/daughter's consumption of food when they are not hungry (*e.g.,* eating for reasons other than hunger)?



(Definitely not ready) (Definitely ready)

Correlation Matrices for Adolescents and Parents at Baseline, 6-months, and 12-months

Adolescents: Baseline

			Physical activity	Screen time	Treat foods	Over-eating	Eating when not hungry
Spearman's rho	Physical activity	Correlation Coefficient	1.000				
		Sig. (2-tailed)	.				
		N	51				
	Screen time	Correlation Coefficient	.367**	1.000			
		Sig. (2-tailed)	.008	.			
		N	51	51			
	Treat foods	Correlation Coefficient	.661**	.416**	1.000		
		Sig. (2-tailed)	<.001	.002	.		
		N	51	51	51		
	Overeating	Correlation Coefficient	.307*	.365**	.448**	1.000	
		Sig. (2-tailed)	.029	.008	<.001	.	
		N	51	51	51	51	
	Eating when not hungry	Correlation Coefficient	.387**	.435**	.537**	.486**	1.000
		Sig. (2-tailed)	.005	.001	<.001	<.001	.
		N	51	51	51	51	51

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Adolescents: 6-months

			Physical activity	Screen time	Treat foods	Over-eating	Eating when not hungry
Spearman's rho	Physical activity	Correlation Coefficient	1.000				
		Sig. (2-tailed)	.				
		N	40				
	Screen time	Correlation Coefficient	.567**	1.000			
		Sig. (2-tailed)	<.001	.			
		N	40	40			
	Treat foods	Correlation Coefficient	.438**	.541**	1.000		
		Sig. (2-tailed)	.005	<.001	.		
		N	40	40	40		
	Overeating	Correlation Coefficient	.618**	.607**	.617**	1.000	
		Sig. (2-tailed)	<.001	<.001	<.001	.	
		N	40	40	40	40	
	Eating when not hungry	Correlation Coefficient	.475**	.565**	.727**	.783**	1.000
		Sig. (2-tailed)	.002	<.001	<.001	<.001	.
		N	40	40	40	40	40

**. Correlation is significant at the 0.01 level (2-tailed).

Adolescents: 12-months

			Physical activity	Screen time	Treat foods	Over-eating	Eating when not hungry
Spearman's rho	Physical activity	Correlation Coefficient	1.000				
		Sig. (2-tailed)	.				
		N	31				
	Screen time	Correlation Coefficient	.447*	1.000			
		Sig. (2-tailed)	.012	.			
		N	31	31			
	Treat foods	Correlation Coefficient	.630**	.448*	1.000		
		Sig. (2-tailed)	<.001	.012	.		
		N	31	31	31		
	Overeating	Correlation Coefficient	.416*	.421*	.560**	1.000	
		Sig. (2-tailed)	.020	.018	.001	.	
		N	31	31	31	31	
	Eating when not hungry	Correlation Coefficient	.398*	.440*	.649**	.773**	1.000
		Sig. (2-tailed)	.026	.013	<.001	<.001	.
		N	31	31	31	31	31

**. Correlation is significant at the 0.01 level (2-tailed).

Parents: Baseline

			Physical activity	Screen time	Treat foods	Over-eating	Eating when not hungry
Spearman's rho	Physical activity	Correlation Coefficient	1.000				
		Sig. (2-tailed)	.				
		N	51				
	Screen time	Correlation Coefficient	.824**	1.000			
		Sig. (2-tailed)	<.001	.			
		N	51	51			
	Treat foods	Correlation Coefficient	.475**	.552**	1.000		
		Sig. (2-tailed)	<.001	<.001	.		
		N	51	51	51		
	Overeating	Correlation Coefficient	.577**	.640**	.629**	1.000	
		Sig. (2-tailed)	<.001	<.001	<.001	.	
		N	51	51	51	51	
	Eating when not hungry	Correlation Coefficient	.650**	.690**	.678**	.780**	1.000
		Sig. (2-tailed)	<.001	<.001	<.001	<.001	.
		N	51	51	51	51	51

**. Correlation is significant at the 0.01 level (2-tailed).

Parents: 6-months

			Physical activity	Screen time	Treat foods	Over-eating	Eating when not hungry
Spearman's rho	Physical activity	Correlation Coefficient	1.000				
		Sig. (2-tailed)	.				
		N	39				
	Screen time	Correlation Coefficient	.730**	1.000			
		Sig. (2-tailed)	<.001	.			
		N	39	39			
	Treat foods	Correlation Coefficient	.636**	.672**	1.000		
		Sig. (2-tailed)	<.001	<.001	.		
		N	39	39	39		
	Overeating	Correlation Coefficient	.717**	.707**	.837**	1.000	
		Sig. (2-tailed)	<.001	<.001	<.001	.	
		N	39	39	39	39	
	Eating when not hungry	Correlation Coefficient	.702**	.670**	.752**	.928**	1.000
		Sig. (2-tailed)	<.001	<.001	<.001	<.001	.
		N	39	39	39	39	39

**. Correlation is significant at the 0.01 level (2-tailed).

Parents: 12-months

			Physical activity	Screen time	Treat foods	Over-eating	Eating when not hungry
Spearman's rho	Physical activity	Correlation Coefficient	1.000				
		Sig. (2-tailed)	.				
		N	32				
	Screen time	Correlation Coefficient	.647**	1.000			
		Sig. (2-tailed)	<.001	.			
		N	32	32			
	Treat foods	Correlation Coefficient	.517**	.681**	1.000		
		Sig. (2-tailed)	.002	<.001	.		
		N	32	32	32		
	Overeating	Correlation Coefficient	.574**	.597**	.746**	1.000	
		Sig. (2-tailed)	<.001	<.001	<.001	.	
		N	32	32	32	32	
	Eating when not hungry	Correlation Coefficient	.561**	.712**	.846**	.831**	1.000
		Sig. (2-tailed)	<.001	<.001	<.001	<.001	.
		N	32	32	32	32	32

**. Correlation is significant at the 0.01 level (2-tailed).

UNIVERSITY OF ALBERTA

YOUTH INFORMATION SHEET AND ASSENT FORM

Title of Project:	**The Readiness and Motivation Interview for Families**	
Principal Investigator:	Dr. Geoff Ball (University of Alberta)	Phone: 780-492-8727
Research Coordinator:	Ms. Nadia Browne (University of Alberta)	Phone: 780-729-0556

What is this study about?

For this study, we will talk with youth and parents to learn about their diet and health. This will help us to make our clinic the best it can be for other boys, girls, and their families.

What do I have to do?

Information for this study will be collected at the Pediatric Centre for Weight and Health (PCWH). We will meet with you and your parent a few times – (1) when you first start attending the clinic (baseline), (2) 1-2 weeks after you start at the clinic (optional visit), (3) 6 months after you start at the clinic (6-months), and (4) about one year after you start at the clinic (12-months). Each of these visits will be 1-3 hours long as you complete an interview and some questionnaires.

We will ask you and your parent to fill out some questionnaires about yourselves, such as your date of birth, how you feel about your diet and activity, and your relationship with people in your family. Some of these questionnaires will be completed online. Also, we will collect information about your weight, height, food, activity, and sleep. We may get some of this information from your medical chart at the PCWH.

We want to learn about how you and your parent think about your lifestyle habits, such as your diet, activity, and sleep. We will interview you both separately. Some of the questions include:

"What do you do in your free time? Hobbies? Sports? Activities?"
"How much do you care about the amount of time you spend viewing a screen?"
"What are some of your favorite treat foods?"

The interviews will be recorded (audio only). The person interviewing you may also write notes during your interview to help stay organized.

Will any measurements or tests hurt me?

None of the measurements will hurt you. Some of the questions we ask in your interview might be hard to answer. We will give you lots of time to think. There are no wrong answers. We just want to know about your thoughts and experiences.

Can I quit the study?

You don't have to sign up for this study. You can quit at any time. No one will be mad at you if you decide you don't want to do this, or if you decide to stop part way through.

Will my information be private?

We will give every person in the study a number to keep track of their information. Names will be changed before the information from your interview is analyzed. What you tell us will be shared with the research team and may be shared with the PCWH staff. We will not share your interview answers with other study volunteers or with your parents. We will not use any names when we publish our results. This way, no one will know who you are.

Do I get any money for being in this study?

At each visit, you and your family will receive a gift card (worth $75) and a gift bag for you (worth $10). If you complete all 3 study visits, you and your family will receive 3 gift cards and 1 gift bag (total value: ~$235). If you complete the optional visit, you will receive another $75 gift card (total value: ~$310).

Do I have to autograph anything?

If you agree to participate in this study, you will need to sign this form with your mom and dad. Also, your mom or dad will sign another form. This paperwork needs to be completed so that both of you agree to be in the study.

What if I have questions about this study?

You can ask your mom or dad about anything you don't understand. You can also talk to the researchers. They can answer any questions you have about the study. You can contact Dr. Geoff Ball (780-492-8727; gdball@ualberta.ca) or Nadia Browne (780-729-0556; nbrowne@ualberta.ca). Both of them know about this study.

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I agree to take part in this study.

Name of Child: _____ Date (DD/MM/YYYY): ____/_____/_____

Signature of Parent: _____ Date (DD/MM/YYYY): ____/_____/_____

Signature of Researcher: _____ Date (DD/MM/YYYY): ____/_____/_____

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PARENT INFORMATION SHEET AND CONSENT FORM

Title of Project:	**The Readiness and Motivation Study for Families**	
Principal Investigator:	Dr. Geoff Ball (University of Alberta)	Phone: 780-492-8727
Research Coordinator:	Ms. Nadia Browne (University of Alberta)	Phone: 780-729-0556

What is the purpose of this study?

This research will help us to get a better understanding of families' (youth and parent) feelings, opinions, and motivations about lifestyle habits and health. By interviewing youth and parents, we will learn about families' thoughts, feelings, and behaviours, which can help health professionals to provide the best weight management services possible for families.

Why is this study happening?

Weight management is often unsuccessful when family members disagree on what they would like to change (or even if they're ready, willing, and able to change). For example, some parents feel their son or daughter is not active enough while some youth believe they are active enough already. In this study, we hope to better understand the views and experiences of parents and youth regarding lifestyle habits.

What information is collected? How is it being collected?

Information for this study will be collected at the Pediatric Centre for Weight and Health (PCWH) a few times – (1) when you first enrol in the clinic (baseline), (2) 1-2 weeks after your child starts at the clinic (optional visit), (3) 6 months after baseline (6-months), and (4) 12 months after baseline (12-months). The time commitment for each visit is 1-3 hours. All interviews and measurements will occur in private rooms at the PCWH.

We will collect demographic (for example, date of birth and parent education) and health (for example, weight and family medical history) information from you and your son or daughter. When possible, some of this information may be collected from your child's medical chart at the PCWH. For accuracy and completeness, we may confirm some of these details with you in person.

We will collect lifestyle information about your child. Diet will be measured over the previous 24 hours using a self-administered, web-based program. It will take 5-10 minutes to complete. Physical activity, sedentary time, and sleep will be measured over 7 days using an accelerometer. These units

are safe, small (2.5cm^2), light (19g), and water-resistant. They are worn all-day and all-night (24 hours/day) on an adjustable elastic belt around the waist. They do not affect day-to-day activities.

Questionnaires will be completed by you and your child. Some of these surveys will be completed using self-administered, web-based programs. These surveys cover topics including lifestyle habits, emotional well-being, relationships, coping, and motivation.

To learn about the perceptions you and your child have about lifestyle habits, you will complete separate interviews. Some examples of questions we will ask are:

"What does your teen do in their spare time?
"What do you think your teen's physical activity level is a problem?"
"What kinds of screen time activities does your teen participate in for fun?"
"How much influence do you have over the amount of 'treat' foods your teen eats?"

Interviews will be 45-60 minutes long and will be digitally-recorded (audio only). During the interviews, we may write down some notes to help us stay organized.

Are there any possible benefits of this study?

This study will help us to better understand families' motivation, especially as it relates to changing lifestyle habits. We will share what we learn with health professionals who provide care to families for making and maintaining healthy lifestyle changes for weight management.

Are there any possible risks of this study?

We do not believe there are any physical risks to volunteering with this study. It is unlikely, but some of the interview questions may bring up strong feelings and emotions. You may stop the interview at any time if you feel uncomfortable.

How is information kept confidential?

Each study participant (youth and parent) will be assigned a study-specific number. No one outside of the study team will have access to your research data. Some of the audio-recorded interviews will be transcribed (converted to text). The person doing this work will have no information or knowledge about the participants being interviewed. Research information we collect will be accessible by our research team members, but will not be shared with PCWH staff, other study volunteers or between you and your child.

Any information on a computer will be protected with a password. All paper copies of your family's information will be stored in a locked filing cabinet. Some of the study data will be stored on industry-standard, secure servers in Canada and the United States, including web-based questionnaires that measure diet and psychosocial health. Data stored on servers in the United States are subject to their

privacy laws. However, there is no risk of anyone being identified because only study-specific ID numbers will be used to identify participants (no names or personal identifiers will be used).

All of the information will be kept for a minimum of five years. The results of this study may be published in a scientific journal or presented at a conference. No names or identifying information will be published, and only group-level information will be presented. All of your family's information will be kept private.

NOTE: Some of the lifestyle information collected for this study may be useful to the PCWH dietitian and exercise specialist in their counseling and education. For example, the 24-hour web-based diet survey and 7-day accelerometer are not currently done by these health professionals. However, if you want, we can share this information with the dietitian and exercise specialist at the PCWH. On the consent form (question #3, below), there is a spot for you to indicate whether or not you want to share this research information with them. It is optional.

Can we withdraw from this study?

Your participation in this study is completely voluntary. If you decide that you do not want to be in this study, it is OK. You may stop the study at any time. If you decide to stop or not take part in this study, your decision will have no effect on the care you and your child receive at the PCWH.

Is there any reimbursement for taking part in this study?

As a token of our appreciation, you will receive a $75 gift card (for your family) and a $10 gift bag (for your child) when all of your data have been collected at baseline, 6-months after baseline, and 12-months after baseline. If you and your child complete data collection at all 3 points in time, you will be eligible to receive 3 gift cards and 1 gift bag (total value: ~$235). For completing the optional visit, you and your child will receive an additional $75 gift card (total value: ~$310).

Is there an independent office we can contact if we have concerns about this study?

If you have any concerns about this study, you may contact the Health Research Ethics Board at 780-492-0302. This office at the University of Alberta has no connection with the study researchers.

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PARENT CONSENT FORM

Title of Project: **The Readiness and Motivation Study for Families**

Principal Investigator: Dr. Geoff Ball (University of Alberta) Phone: 780-492-8727

Research Coordinator: Ms. Nadia Browne (University of Alberta) Phone: 780-729-0556

Please circle your answers:

1. Do you understand that you and your child have been asked to be in a research study?	Yes	No
2. Have you received and read a copy of the attached Information Sheet?	Yes	No
3. Do you agree to share your child's nutrition and physical activity data obtained from this research study with the PCWH clinicians? This information may assist them with providing care to your family.	Yes	No
4. Do you understand the benefits and risks involved in taking part in this research study?	Yes	No
5. Do you understand who will have access to your records, including personally identifiable health information?	Yes	No
6. Do you grant the research team permission to retrieve data from your child's PCWH medical chart as needed?	Yes	No
7. Have you had an opportunity to ask questions and discuss this study with the researchers?	Yes	No
8. Do you understand that you are free to refuse to participate or withdraw from the study at any time? You do not have to give a reason. Refusing to participate or withdrawing will not affect the medical care your family receives.	Yes	No
9. Has the issue of confidentiality been explained to you?	Yes	No
10. I agree to take part in this study.	Yes	No
11. I agree for my child to take part in this study.	Yes	No

Signature of Parent: _____ Date (dd/mm/yyyy): ____/____/_____

Printed Name: _____

Signature of Witness: _____ Date (dd/mm/yyyy): ____/____/_____

Printed Name: _____

Signature of Researcher: _____ Date (dd/mm/yyyy): ____/____/_____

Printed Name: _____

Demographic Form

Please complete the survey below.

Thank you!

Youth	
Date Interviewed	_____ (mm-dd-yyyy)
Youth Initials	_____ (eg. ABC or A-C)
Personal Health Number (PHN)	_____

Youth (Demographics)	
First Name	_____
Middle Initial	_____
Last Name	_____
Birthdate	_____ (mm-dd-yyyy)
Gender	◯ Male ◯ Female
Ethnic Background: (check all that apply)	☐ Indigenous ☐ White ☐ Arab ☐ Chinese ☐ Black ☐ South Asian (East Indian, Pakistani, Sri Lankan, etc.) ☐ Latin American ☐ Southeast Asian (Cambodian, Indonesian, Vietnamese ☐ West Asian (Afghan, Iranian, etc.) ☐ Japanese ☐ Korean ☐ Other
Other, Please specify	_____
Indigenous: (check all that apply)	☐ North American Indian ☐ Metis ☐ Inuit ☐ Other
Other, Please specify	_____

Youth (Contact Information)	
Address	_____
Unit Number	_____
City	◯ Edmonton ◯ St. Albert ◯ Sherwood Park ◯ Spruce Grove ◯ Stony Plain ◯ Leduc ◯ Other
Other City	_____
Province	◯ Alberta ◯ British Columbia ◯ Saskatchewan ◯ Manitoba ◯ Ontario ◯ Quebec ◯ Nova Scotia ◯ New Brunswick ◯ Prince Edward Island ◯ Newfoundland and Labrador ◯ Nunavut ◯ Northwest Territories ◯ Yukon
Postal Code	_____
Phone Number	_____ (780-555-5555)
Phone Number	◯ Home ◯ Cell ◯ Work ◯ Other
Alternate Number	_____ (780-555-5555)
Alternate Number	◯ Home ◯ Cell ◯ Work ◯ Other ◯ NA
Email address	_____
Preferred method of contact:	☐ Phone Number ☐ Alternate Phone Number ☐ Email

Youth (Clinical)

Weight related co-morbidities: (check all that apply)

- ☐ Hypertension
- ☐ Dyslipidemia
- ☐ Polycystic Ovaries
- ☐ Pre-Diabetes
- ☐ Type 2 Diabetes
- ☐ Musculoskeletal
- ☐ Fatty Liver
- ☐ GERD
- ☐ Sleep Apnea
- ☐ Microalbuminuria
- ☐ ADHD
- ☐ Mental Health Disorder (Depression, Anxiety)
- ☐ Other Mental Health Disorders
- ☐ Other
- ☐ None

Other Mental Health Disorders (Please specify) _____

Mental Health Disorder: Did a physician diagnose you? ◯ Yes ◯ No

Other weight related co-morbidities (Please specify) _____

Family history of chronic diseases: (check all that apply)

- ☐ Hypertension
- ☐ Stroke
- ☐ Asthma
- ☐ Heart Disease
- ☐ Diabetes
- ☐ High Cholesterol
- ☐ Obstructive Sleep Apnea
- ☐ Eating Disorder (Bulimia, Anorexia)
- ☐ Other Eating Disorders
- ☐ Mental Health Disorder (Depression, Anxiety, OCD)
- ☐ Other Mental Health Disorders
- ☐ Other
- ☐ None

Other Eathing Disorders (Please specify) _____

Other Mental Health Disorders (Please specify) _____

Mental Health Disorder: Did a physician diagnose you? ◯ Yes ◯ No

Other Family history of chronic diseases (Please specify) _____

Primary Caregiver (Demographics)

Subject ID: [subject_id] Subject Initials: [init] Date interviewed: [doi]

First Name	_____
Middle Initial	_____
Last Name	_____
Parent Initials	_____ (eg. ABC or A-C)
Birthdate	_____ (mm-dd-yyyy)
Gender	◯ Male ◯ Female
Ethnic Background: (check all that apply)	☐ Indigenous ☐ White ☐ Arab ☐ Chinese ☐ Black ☐ South Asian (East Indian, Pakistani, Sri Lankan, etc.) ☐ Latin American ☐ Southeast Asian (Cambodian, Indonesian, Vietnamese ☐ West Asian (Afghan, Iranian, etc.) ☐ Japanese ☐ Korean ☐ Other
Other, Please specify	_____
Indigenous: (check all that apply)	☐ North American Indian ☐ Metis ☐ Inuit ☐ Other
Other, Please specify	_____

Total Household Income (check one):	◯ Less than $10 000 ◯ $10 001-$20 000 ◯ $20 001-$30 000 ◯ $30 001-$40 000 ◯ $40 001-$50 000 ◯ $50 001-$60 000 ◯ $60 001-$70 000 ◯ $70 001-$80 000 ◯ $80 001-$90 000 ◯ $90 001-$100 000 ◯ More than $100 000 ◯ Don't know ◯ Prefer not to say

Primary Caregiver Contact Information

Youth Address:
[address], [unit]
[city], [city_other], [province], [postcode]

☐ (Check if same as youth address)

Address

_____

Unit Number

_____

City

◯ Edmonton
◯ St. Albert
◯ Sherwood Park
◯ Spruce Grove
◯ Stony Plain
◯ Leduc
◯ Other

Other City

_____

Province

◯ Alberta
◯ British Columbia
◯ Saskatchewan
◯ Manitoba
◯ Ontario
◯ Quebec
◯ Nova Scotia
◯ New Brunswick
◯ Prince Edward Island
◯ Newfoundland and Labrador
◯ Nunavut
◯ Northwest Territories
◯ Yukon

Postal Code

_____

Phone Number

_____
(780-555-5555)

Phone Number

◯ Home ◯ Cell ◯ Work
◯ Other

Alternate Number

_____
(780-555-5555)

Alternate Number

◯ Home ◯ Cell ◯ Work
◯ Other ◯ NA

Email address

_____

Preferred method of contact:	☐ Phone Number ☐ Alternate Phone Number ☐ Email
Relationship to youth/child	◯ Biological Mother ◯ Biological Father ◯ Adoptive Mother ◯ Adoptive Father ◯ Biological Grandparent ◯ Adoptive Grandparent ◯ Guardian ◯ Social Worker
Does youth live with you?	◯ Yes ◯ No

Primary Caregiver (Clinical)

Weight related co-morbidities: (check all that apply)

- ☐ Hypertension
- ☐ Dyslipidemia
- ☐ Polycystic Ovaries
- ☐ Pre-Diabetes
- ☐ Type 2 Diabetes
- ☐ Musculoskeletal
- ☐ Fatty Liver
- ☐ GERD
- ☐ Sleep Apnea
- ☐ Microalbuminuria
- ☐ ADHD
- ☐ Mental Health Disorder (Depression, Anxiety)
- ☐ Other Mental Health Disorders
- ☐ Other
- ☐ None

Other Mental Health Disorders (Please specify) _____

Mental Health Disorder: Did a physician diagnose you? ◯ Yes ◯ No

Other weight related co-morbidities (Please specify) _____

Family history of chronic diseases: (check all that apply)

- ☐ Hypertension
- ☐ Stroke
- ☐ Asthma
- ☐ Heart Disease
- ☐ Diabetes
- ☐ High Cholesterol
- ☐ Obstructive Sleep Apnea
- ☐ Eating Disorder (Bulimia, Anorexia)
- ☐ Other Eating Disorders
- ☐ Mental Health Disorder (Depression, Anxiety, OCD)
- ☐ Other Mental Health Disorders
- ☐ Other
- ☐ None

Other Eating Disorders (Please specify) _____

Other Mental Health Disorders (Please specify) _____

Mental Health Disorder: Did a physician diagnose you? ◯ Yes ◯ No

Other Family history of chronic diseases (Please specify) _____

☐ Enter another family member (if applicable)?

Other Family Member (Demographics)

Subject ID: [subject_id] Subject Initials: [init] Date interviewed: [doi]

First Name	_____
Middle Initial	_____
Last Name	_____
Birthdate	_____ (mm-dd-yyyy)
Gender	◯ Male ◯ Female
Ethnic Background: (check all that apply)	☐ Aboriginal ☐ White ☐ Arab ☐ Chinese ☐ Black ☐ South Asian (East Indian, Pakistani, Sri Lankan, etc.) ☐ Latin American ☐ Southeast Asian (Cambodian, Indonesian, Vietnamese ☐ West Asian (Afghan, Iranian, etc.) ☐ Japanese ☐ Korean ☐ Other
Other, Please specify	_____
Aboriginal: (check all that apply)	☐ North American Indian ☐ Metis ☐ Inuit ☐ Other
Other, Please specify	_____
Household Income (check one):	◯ Less than $10 000 ◯ $10 001-$20 000 ◯ $20 001-$30 000 ◯ $30 001-$40 000 ◯ $40 001-$50 000 ◯ $50 001-$60 000 ◯ $60 001-$70 000 ◯ $70 001-$80 000 ◯ $80 001-$90 000 ◯ $90 001-$100 000 ◯ More than $100 000 ◯ Don't know ◯ Prefer not to say

Other Family Member (Contact Information)

Youth Address:
[address], [unit]
[city], [city_other], [province], [postcode]

☐ (Check if same as youth address)

Address

_____

Unit Number

_____

City

◯ Edmonton
◯ St. Albert
◯ Sherwood Park
◯ Spruce Grove
◯ Stony Plain
◯ Leduc
◯ Other

Other City

_____

Province

◯ Alberta
◯ British Columbia
◯ Saskatchewan
◯ Manitoba
◯ Ontario
◯ Quebec
◯ Nova Scotia
◯ New Brunswick
◯ Prince Edward Island
◯ Newfoundland and Labrador
◯ Nunavut
◯ Northwest Territories
◯ Yukon

Postal Code

_____

Phone Number

_____
(780-555-5555)

Phone Number

◯ Home ◯ Cell ◯ Work
◯ Other

Alternate Number

_____
(780-555-5555)

Alternate Number

◯ Home ◯ Cell ◯ Work
◯ Other ◯ NA

Email address

_____

Preferred method of contact:	☐ Phone Number ☐ Alternate Phone Number ☐ Email
Relationship to youth/child	◯ Biological Mother ◯ Biological Father ◯ Adoptive Mother ◯ Adoptive Father ◯ Biological Grandparent ◯ Adoptive Grandparent ◯ Guardian ◯ Social Worker
Does youth live with you?	◯ Yes ◯ No

Other Family Member (Clinical)

Weight related co-morbidities: (check all that apply)

- ☐ Hypertension
- ☐ Dyslipidemia
- ☐ Polycystic Ovaries
- ☐ Pre-Diabetes
- ☐ Type 2 Diabetes
- ☐ Musculoskeletal
- ☐ Fatty Liver
- ☐ GERD
- ☐ Sleep Apnea
- ☐ Microalbuminuria
- ☐ ADHD
- ☐ Mental Health Disorder (Depression, Anxiety)
- ☐ Other Mental Health Disorders
- ☐ Other
- ☐ None

Other Mental Health Disorders (Please specify) _____

Mental Health Disorder: Did a physician diagnose you? ◯ Yes ◯ No

Other weight related co-morbidities (Please specify) _____

Family history of chronic diseases: (check all that apply)

- ☐ Hypertension
- ☐ Stroke
- ☐ Asthma
- ☐ Heart Disease
- ☐ Diabetes
- ☐ High Cholesterol
- ☐ Obstructive Sleep Apnea
- ☐ Eating Disorder (Bulimia, Anorexia)
- ☐ Other Eating Disorders
- ☐ Mental Health Disorder (Depression, Anxiety, OCD)
- ☐ Other Mental Health Disorders
- ☐ Other
- ☐ None

Other Eating Disorders (Please specify) _____

Other Mental Health Disorders (Please specify) _____

Mental Health Disorder: Did a physician diagnose you? ◯ Yes ◯ No

Other Family history of chronic diseases (Please specify) _____