The Feasibility of Family-Based Interventions for Paedeatric Obesity Delivered Over the Internet

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THESIS SUBMITTED TO THE FACULTY OF GRADUATE AND POSTDOCTORAL STUDIES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE PH.D. DEGREE IN CLINICAL PSYCHOLOGY

ACKNOWLEDGMENTS

First and foremost, I would like to thank Dr. Elizabeth Kristjansson and Dr. Gary Goldfield, my thesis advisors, for their assistance, guidance, and encouragement. This thesis would not have been possible without them. I also appreciate, and am grateful, for the thoughtful feedback provided by my committee members, Dr. Tim Aubry, Dr. Cary Kogan and Dr. John Sylvestre. As well, the administrative School of Psychology staff has been immensely helpful in helping me navigate through graduate studies.

Patrick McGrath (IWK) was instrumental in contributing to the initial HEALTHY study, and providing a website and technology support.

I would like to thank those individuals who provided invaluable advice and assistance throughout this process: Danijela Maras, Jakub Racek, Mariya Maistrovskaya, Margaret Sampson, and Laura Peters.

I am incredibly grateful to the families who participated in my studies. This thesis also would not have been possible without their willingness to contribute to research.

I would also like to thank my family and friends for their support and encouragement. They have, and continue to, inspire me to achieve. I especially want to thank my daughter, Makenna, for giving me the motivation to persevere.

Finally, I would like to acknowledge the Heart and Stroke Foundation, for their funding of the initial HEALTHY study. Also, I have been supported by a number of funding agencies throughout my graduate studies, including the Social Sciences and Humanities Research Council, the Ontario Graduate Scholarship, and the Canadian Institutes of Health Research.

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Analysis of Variance	ANOVA
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Health-Related QOL	HRQL
Healthy Eating and Active Living Throughout Youth	HEALTHY
QOL	QOL
Randomized Controlled Trial	RCT
Self-Regulation Questionnaire for Exercise	SRQ-E
Self-Regulation Questionnaire for Healthy Eating	SRQ-HE
Socioeconomic Status	SES
World Health Organization	WHO

ABSTRACT

Obesity is a growing concern in North America and current research suggests that for addressing childhood obesity, family-based behavioural interventions targeting children are the treatment of choice. Due to the lack of clinics that offer face to face treatment, the Internet may serve as a viable method for the delivery of such interventions. Three studies are presented in order to explore the viability of the internet as a treatment modality for delivering family-based interventions for children who are overweight.

The first study attempted to deliver a family-based behavioural intervention via the internet - the Healthy Eating and Active Living Throughout Youth (HEALTHY) - for children aged 8 to 14 (M = 10.5). The initial goal was to evaluate the effectiveness of the internet as a treatment modality for childhood obesity. A total of 20 families consisting of 25 child-parent dyads consented to the intervention. However, adherence and attrition were significant issues throughout the 3-month intervention and only two child-parent dyads (8%) completed the 3-month intervention. Therefore the goals of this study changed to become primarily exploratory, with the aims of identifying factors related to treatment adherence and attrition.

For the second study, the parents of the 20 families who consented to the HEALTHY intervention were invited to participate in a telephone interview around their impressions of the study, barriers to participation, and their needs in seeking services for their children. Sixteen families (80%) provided consent and thematic analyses were conducted. Four categories of themes emerged from the data and included: ‘Knowledge and Education’, ‘Social Supports’, ‘Tools for Success’, and ‘Program Goals’. These categories, and the themes embedded within each category are presented and discussed.

For the third study a systematic review of exclusively web-based studies for paediatric obesity was conducted. Five health and social sciences databases were search between 1995 and March 2012 (including an initial and updated search). A total of 2432 bibliographic records were identified (following de-duplication) and were subjected to title and abstract screening, and a further 120 records were subject to full-text screening. Two reviewers independently assessed the eligibility of each bibliographic record at these multiple levels and conflicts were resolved by third party. Three records were included in the review, and a further three records were identified as noteworthy in that they reported on one larger web-based study with a minimal face-to-face component (i.e., 4 sessions over 2 years). Data regarding attrition, adherence, and body composition changes were extracted by two independent reviewers. Attrition rates from the included studies ranged from 43% to 85%. The noteworthy study reported 18% overall attrition at six months (following randomization: 18% from the intervention group) and 34% overall attrition at two years (following randomization: 36% from the intervention group). Adherence measures were varied, but suggested low adherence to study components. Body composition changes were marginal in the short-term, but then lost in the longer-term. Implications for research and practice will be discussed.

The contributions of this thesis include examining whether family-based interventions for pediatric obesity delivered over the internet are feasible. This question will be answered by exploring baseline characteristics that are related to treatment adherence and attrition, investigating barriers that interfere with adherence and contribute to attrition, and reviewing other research conducted in the field. Following from this thesis, and other relevant research, implications and recommendations for future research and clinical practice will be discussed.

General Introduction

Background

Overweight and obesity are becoming increasingly prevalent in Canada. In 2004, the height and weight of a nationally representative sample of Canadians was measured directly as part of the 2004 Canadian Community Health Survey (CCHS; Health Canada, 2006). Nearly 60% of adults (Tjepkema, 2005) and 26% of children and adolescents (Shields, 2005) were considered either overweight or obese. Directly measuring the height and weight of such a sample had not been undertaken in the 25 years since the Canada Health Survey was completed in 1978/1979 (Shields, 2008). Shields (2008) examined the growth in overweight and obesity since the time of the Canada Health Survey and the results were staggering, with significant growth in all age groups with the exception of 2 to 5 year olds. The economic cost of obesity in Canada is significant, with the most recent Economic Burden of Illness in Canada (EBIC) study indicated $4.3 billion dollars has been spent on obesity-related healthcare costs (Public Health Agency of Canada, 2011). This statistic is considered an underestimate, as it does not include healthcare costs related to overweight, paediatric obesity, and/or costs related to co-morbid chronic disease (Public Health Agency of Canada, 2011).

Although the etiology is complex and multi-factorial, ultimately overweight and obesity is a result of caloric imbalance (i.e., calories consumed are greater than calories expended). Measurement and classification of individuals as either overweight or obese is based on BMI (i.e., weight in kilograms divided by height in metres squared). For adults, overweight is determined by having a BMI of 25 or more and obesity is defined as having a BMI of 30 or more (Centers for Disease Control and Prevention, 2008b). However, in children and adolescents a determination that one is overweight or obese is based on age and sex specific percentile ranks (Centers for Disease Control and

Prevention, 2008a). Overweight is determined by having a BMI $\geq 85^{th}$ to $< 95^{th}$ percentile and obesity is determined by having a BMI $\geq 95^{th}$ percentile.

In terms of self-reported weight, results from CCHS since 2004 indicate continued growth of self-reported obesity among Canadian adults, though rates of overweight have remained relatively stable (Statistics Canada, 2011). However, self-report data should be interpreted cautiously since research has demonstrated that as body mass index (BMI) increases individuals are more likely to under-report their weight status (Shields, Gorber, & Tremblay, 2008).

The increasing prevalence of overweight and obesity in Canada is reflective of the growing epidemic worldwide. In fact, the prevalence of overweight and obesity has grown so much that the World Health Organization (WHO) coined the term "globesity" (Deitel, 2002) . In 2005 the global prevalence of overweight surpassed 1 billion people and obesity over 300 million, with the Americas having some of the highest BMI's (World Health Organization, 2009). Moreover, the prevalence of overweight and obesity is projected to continue increasing through the year 2015 (World Health Organization, 2005).

The public health implications of the obesity epidemic are great. In 2009, the World Health Organization (WHO, 2009) reported "65% of the world's population lives in a country where overweight and obesity kills more people than underweight". The WHO has examined the mortality associated with major health risk factors including overweight and obesity as well as other diet-related factors (i.e., low fruit and vegetable consumption, physical inactivity, high cholesterol, high blood glucose, and high blood pressure) (World Health Organization, 2009). They identified 10 risk factors that account for 33% of global deaths, with overweight and obesity ranking as the 5^{th} leading risk factor causing death worldwide, and the 3^{rd} leading risk factor causing death in high-

income countries such as Canada. Overall, 4.8% of deaths worldwide and 8.4% of deaths in high-income countries in 2004 were attributable to overweight and obesity. Furthermore, they found other risk factors related to overweight and obesity have been identified as significant causes of death worldwide (e.g. physical inactivity is 4th leading risk factor) and in high-income countries (i.e., physical inactivity is 4th leading risk factor, low fruit and vegetable consumption is 7th leading risk factor). Altogether, diet-related factors (including overweight and obesity) have together contributed to 19.1% percent of deaths worldwide and 25.2% of death in high-income countries (WHO, 2009).

The WHO has also examined the global burden of disease (i.e., lost years of healthy life) and found overweight and obesity is the 10th leading risk factor causing loss of healthy life globally, and in high-income countries it is the 3rd leading risk factor (World Health Organization, 2009). Overall, overweight and obesity attribute to 2.4% of loss of healthy life worldwide and 6.5% of loss of healthy life in high-income countries. Other risk factors related to overweight and obesity have been identified as significant causes of loss of healthy life in high-income countries, including physical inactivity (the 6th leading risk factor) and low fruit and vegetable consumption (the 10th leading risk factor). Diet-related factors (including overweight and obesity) have together contributed to 7% of loss of healthy life worldwide and 12.6% of loss of healthy life in high-income countries.

Much of the mortality and burden of health associated with overweight and obesity (and other diet-related factors) is related to the negative health consequences associated with overweight and obesity. These include, but are not limited to, increased risk of ischemic stroke, coronary heart disease, kidney failure, high cholesterol, type II diabetes, osteoarthritis, respiratory problems, asthma, and reproductive complication (Office of the Surgeon General, 2001; World Health Organization, 2009).

In children and adolescents, the health consequences of overweight and obesity include higher cardiovascular disease risk factors (i.e., hypertension, high cholesterol), increased risk for Type II diabetes, hyperlipidemia, liver disease, sleep apnea, and orthopaedic complications (Dietz, 1998b; Office of the Surgeon General, 2001; Chu, Rimm, Wang, Liou, & Shieh, 1998; Daniels, 2006). Unfortunately, many of these co-morbities begin during childhood (Lee, 2007) Obesity is also associated with a number of negative psychosocial consequences, such as reduced quality of life (QOL) (Schwimmer, Burwinkle, & Varni, 2003) social discrimination (Dietz, 1998a; Office of the Surgeon General, 2001; Daniels, 2006; Riazi, Shakoor, Dundas, Eiser, & McKenzie, 2010), increased risk of depression (Goldfield et al., 2010b) and body image disturbances (Goldfield et al., 2010b). Furthermore, weight-based teasing is higher among overweight and obese youth, especially girls, and this type of teasing has been associated with anxiety, emotional distress, and increased disordered eating (Goldfield et al., 2010a).

The health and psychosocial implications of obesity may be even greater for individuals of lower socio-economic status (SES), as they have fewer resources and access to care than those with higher SES. Furthermore, there is a strong relationship between obesity and SES, whereby adults of lower SES are more likely to be overweight and obese (Dietz, 1998a; Power, Manor, & Matthews, 2003). However, research suggests that there is a gender effect among adults and this relationship may not hold true for adult men in developed countries like Canada (McLaren, 2007). Results for children generally follow the same trend, although results are inconsistent (Wang & Beydoun, 2007; Shrewsbury & Wardle, 2008).

The 2004 Canadian Community Health Survey included the most recent Nutrition Cycle. Findings (Health Canada, 2006) and evaluated relationships between SES and overweight/obesity. Overweight and obesity were significantly associated with being in a

middle-income household and marginally associated with being in a low-income household, however children living in households where no one had achieved greater than a high school education were significantly more likely to be overweight or obese than children from households where at least one person had some post-secondary education (Shields, 2008).

Given that childhood obesity is likely to result in adult obesity (Office of the Surgeon General, 2001) and that weight-based interventions in adults are largely ineffective in the long term (Jeffery et al., 2000; Perri et al., 1988), effective childhood weight-based interventions are critical in order to help overweight and obese children to regulate their weight and reduce the likelihood of remaining obese in adulthood. Interventions delivered to children and adolescents appear to be more efficacious due to the fact that there is a large learning component in changing health habits and they are easier to change when the habits are not well established. Moreover, the growth in height during puberty also provides a distinct advantage when treating obesity in children compared to adults. However, although the need for these interventions is great, there is a dearth of such interventions that are comprehensive and evidence-based.

For example, an expert panel in Canada devised practice guidelines for the management of obesity in children and adults, including recommendations on treatment (Lau et al., 2007). They recommended that best practices in treating obesity should include a comprehensive approach, comprising team members from the medical profession (e.g. paediatrician, general practitioner), mental health profession (preferably a psychologist or psychiatrist), nutrition health profession, and exercise or fitness profession.

However, examination of a registry of both publicly-funded and private paediatric obesity treatment programs maintained by the Canadian Obesity Network (CON, 2011)

reveals that although 7 of the 13 provinces and territories in Canada offer weight management programs to children and adolescents, a number of these programs are not comprehensive or multidisciplinary, in that they have a limited range of health professionals on their treatment teams (Table 1).

Using the criteria set for forth by Lau and colleagues (2007a) there are only seven known treatment programs in Canada providing comprehensive treatments for paediatric obesity. These programs include the Centre for Healthy Weights in Vancouver (BC Children's Hospital, 2011), the Paediatric Centre for Weight and Health in Edmonton (Alberta Health Services, 2011), the Paediatric Weight Clinic in Calgary (Pediatric Weight Clinic, 2011), The Centre for Healthy Active Living (CHAL) in Ottawa (CHEO, 2011), the Sick Kids Team Obesity Management Program (STOMP) in Toronto (Sick Kids, 2011), the Clinique de Nutrition/Consultation Pediatrique in Montreal (CHU Sainte-Justine, 2011), and the Janeway Lifestyle Program in St. John's (Eastern Health, 2011). It should also be noted that a majority of the programs require parental participation. This is promising, given that parental involvement has also been demonstrated to be an important variable in paediatric obesity treatment (Epstein, Valoski, Wing, & McCurley, 1990). While these programs are engaging in critical work with children and adolescents who are overweight, it appears that in a given year, less than 1,000 Canadian youth are receiving the comprehensive services they need in order to achieve a healthier lifestyle. When this number is compared to the high prevalence of overweight and obesity in Canadian children, indicating the need for services is high, the current level of actual service provision is clearly inadequate.

Family-based Behavioural Interventions

Family-based behavioural interventions for childhood obesity, as developed by Epstein and colleagues, are the most rigorously evaluated interventions to date. These

Table 1

Canadian Paediatric Weight Management Treatment Programs in Canada (adapted from TROPIC)

Program	Location	Started	Ages Served	Patients/year	Parent Participation Mandatory?	Health Professionals on Treatment Team*
Centre for Healthy Weights	Vancouver, BC	2006	6-17	160	Yes	GP, RD, FP, PSY
Make it Happen	Calgary, AB	2005	6-17	100	Yes	GP, RN
Paediatric Centre for Weight and Health	Edmonton, AB	2006	8-17	100	Yes	PED, RD, FP, RN, PSY
Paediatric Weight Clinic	Calgary, AB	2004	6-18	NR**	Yes	PED, PSY, NUT, FP
Family Lifestyles Program	Winnipeg, MB	2005	8-15	30	Yes	RD, FP
Building Better Bodies for Teens	Scarborough, ON	2000	13-18	40	Yes	PED, RD, RN
Centre for Healthy Active Living	Ottawa, ON	2010	NR**	96	Yes	PED, RD, FP, RN, PSY, NP, CYC
Child & Teen Outpatient Nutrition Clinic	Toronto, ON	1990	1-18	3000	Yes	PED, RD
Children's Exercise & Nutrition Centre	Hamilton, ON	1990	1-18	360	Yes	PED, RD
Family Weight Management Clinic	Aurora, ON	2008	5-17	NR**	Yes	GP
Healthy Eating & Activity Program	London, ON	2009	8-18	120	Yes	PED, RD, FP, RN
Healthy Weight for Life Clinic	Winchester, ON	2008	3-18	NR**	Yes	PED, RD
OAR	Hamilton, ON	2006	3-17	NR**	Yes	PED, RD, FP, RN

Program	Location	Started	Ages Served	Patients/year	Parent Participation Mandatory?	Health Professionals on Treatment Team*
Sick Kids Team Obesity Management Program (STOMP)	Toronto, ON	Not available	12-17	NR**	Yes	PED, RD, FP, PSY, SW, NP
Y Kids Fit	Ottawa, ON	2006	6-15	NR**	No	RD, FP
Clinique de Nutrition/Consultation Pediatrique	Montreal, QC	1998	1-18	250	Yes	PED, RD, RN, PSY, SW,
Kin-Hin	Quyon, QC	2009	NR**	10	No	FP, PSY
McGill Cardiovascular Health Improvement Program (CHIP)	Montreal, QC	1996	11-17	35	Yes	PED, RD, FP, PSY
Weight Management Clinic (Hopital Maisonneuve Rosemont)	Montreal, QC	1994	5-18	25	Yes	PED, RD, PSY
Weight Management Clinic (Montreal Children's Hospital)	Montreal, QC	2000	10-18	100	Yes	PED, RD
Paediatric Lifestyle Management Program	Fredericton, NB	2004	5-12	15	Yes	RN, RD, FP
Janeway Lifestyle Program	St. Johns, NFL	2006	4-18	40	NR**	PED, RD, FP, PSY, SW
Dr. Bernstein Diet & Health Clinics	Nationwide	1990	8-15	NR**	Yes	GP, RN

*GP: General Practitioner; PED: Paediatrician; RN: Registered Nurse; RD: Registered Dietician; NUT: Nutrition Consultant; FP: Fitness Professional; PSY: Psychologist; SW: Social Worker; NP: Nurse Practitioner; CYC: Child & Youth Counsellor
**NR = Not Reported

Adapted from CON TROPIC (Canadian Obesity Network, 2011)

interventions involve most of the effective intervention components that have been identified in research. These components include: providing a combination of lifestyle (e.g., exercise)and diet interventions (Epstein, Wing, Koeske, & Valoski, 1984), including a parent as active participant (Epstein et al., 1990), providing mastery criteria for behaviour change (Epstein, McKenzie, Valoski, Klein, & Wing, 1994), goal-setting techniques (Foreyt & Goodrick, 1994a), problem solving techniques (Epstein, Paluch, Gordy, Saelens, & Ernst, 2000), the use of reinforcement to increase activity and reduce sedentary behaviour (Epstein, Saelens, & OÆBrien, 1995; Epstein, Paluch, Kilanowski, & Raynor, 2004), a focus on reducing screen time (Epstein et al., 2008), and social support (Foreyt & Goodrick, 1994a). A particularly important aspect of youth obesity interventions is the provision of training to parents (e.g., effective praise, problem solving) to improve their parenting skills (Epstein et al., 1985). A number of randomized controlled trials (RCTs) have demonstrated Epstein's approach is more effective than no-treatment control groups (Epstein et al., 1984), nutritional education (Epstein, Wing, Steranchak, Dickson, & Michelson, 1980), and attention placebo (Epstein et al., 1980; Epstein et al., 1985).

The effectiveness of Epstein's approach often generalizes to non-participating family members as well (Epstein, Paluch, & Raynor, 2001). This may help children maintain better habits if more family members make lifestyle changes. In fact, treatment effects in children have been observed through to a 10-year follow-up (Epstein et al., 1990; Epstein, Valoski, Wing, & McCurley, 1994). Psychosocial improvements have also been observed in children receiving Epstein's intervention approach, including reduced somatic complaints, reduced symptoms of internalizing disorders (i.e., anxiety and depression), increased competence, and increased social interaction and involvement in activities (Epstein, Paluch, Saelens, Ernst, & Wilfley, 2001; Myers, Raynor, & Epstein, 1998).

Cognitive-behavioural therapy (CBT).

It has also become common to include components of CBT (e.g., self-monitoring, problem solving, and contingency management/reinforcement) in the treatment of obesity (Foreyt & Goodrick, 1993; Foreyt & Goodrick, 1994b; Wadden & Stunkard, 2004). CBT is the main treatment orientation guiding the 'Healthy Eating and Active Living Throughout Youth (HEALTHY) study (Study #1). CBT has historical roots in early behaviour and cognitive therapies. Behaviour therapies, sometimes referred to as behavioural modification, were popularized in North America and Europe during the mid-1900's following research conducted by B.F. Skinner on operant conditioning (Skinner, 1953). However, behaviour therapy has its early roots in John Watson's radical behaviourism (Watson, 1930), and evidence of clinical applications of behaviourism existed in the early 1900's (Jones, 1924).

Behaviour therapy is a psychological treatment approach that aims to treat psychopathology, and/or unwanted behaviours, by modifying behaviours (Murdoch & Barker, 1991). This type of approach assumes that maladaptive behaviours are learned and therefore behaviour change is achieved by reinforcing, and thereby increasing, desirable behaviours while simultaneously decreasing undesirable behaviours. Psychoeducation regarding how behaviour modification can lead to changes in psychological states is another important component.

Cognitive therapy refers to a psychological treatment approach that aims to treat psychopathology and other difficulties by modifying distorted and dysfunctional thinking, thereby modifying underlying beliefs (Beck, 1970; Beck, Carlson, & American Psychological Association, 2006). Cognitive therapy was initially developed by Aaron Beck in his treatment of depression (Beck, 1964), and was later applied to other 'emotional

disorders' (Beck, 1970). Aaron Beck is also credited with merging behaviour and cognitive therapy into CBT, which draws on both the behavioural and cognitive perspectives.

CBT is currently an accepted approach to treating a wide variety of presenting problems (National Institute of Mental Health, 2010), likely because it is present-focused, short-term, problem-oriented, collaborative, and empirically-based (Cooper, Fairburn, & Hawker, 2003). CBT produces change in cognitions using the techniques of cognitive restructuring and behavioural experiments.

As previously mentioned, the use of CBT techniques has become common in the treatment of obesity. Applied to obesity, CBT can be viewed as having three main characteristics (Cooper et al, 2003, p.2):

1) Cognitive-behavioural treatments are based on a cognitive conceptualization of the processes that maintain obesity.
2) Cognitive-behavioural treatments are designed to modify the postulated cognitive and behavioural mechanisms that maintain obesity in order to achieve lasting change.
3) Cognitive-behavioural treatments use a combination of cognitive and behavioural procedures to help the participant identify and change the targeted mechanisms.

Thus, from a CBT perspective, thought and cognition are central to obesity treatment and cognitive change is the primary goal of CBT (Fabricatore, 2007). In fact, it has been proposed that part of the reason that behavioural approaches alone have been insufficient in producing lasting maintenance of weight-loss is due to the absence of cognitive techniques which are thought to help sustain and maintain behavioural change (Cooper et al., 2003; Fabricatore, 2007)

CBT has been found to be an effective modality for the treatment of obesity (Ayyad & Andersen, 2000; Weinstein, 2006) that combines both behavioural (e.g., stimulus control, reinforcement) and cognitive (e.g., education, cognitive restructuring) treatment components. Furthermore, a number of these techniques are also incorporated in Epstein's family approach.

CBT is often used in conjunction with information on nutrition and physical activity in family-based interventions for childhood obesity (Johnson et al., 1997; Braet, Winckel, & Leeuwen, 1997). Research suggests that CBT is an effective treatment for obesity with a number of review articles demonstrating that CBT interventions improve the success of weight loss programs (Ayyad & Andersen, 2000; Weinstein, 2006).

Despite evidence favouring family-based interventions for the treatment of childhood obesity, there remains a shortage of these interventions, potentially due to barriers in implementing them. Some of these barriers may include shortages in qualified health care providers using family-based approaches (Tremblay & Willms, 2000), reluctance on the part of families to seek face-to-face treatment (Dunn, Lackey, Kolasa, & Mustian, 1998; Offord et al., 1987; Sherwood et al., 1998), and/or the inconvenience and expense (e.g. lost wages) of attending face-to-face treatment (Kazdin, 1996). In addition, these multi-faceted interventions are labour intensive and therefore service provision is very costly.

Family systems theory.

Family systems theory is important in understanding the HEALTHY study. This theory is grounded in General Systems Theory (Von Bertalanffy, 1950; Von Bertalanffy, 1968), whereby a system refers to "a set of objects together with relationships between the objects and between their attributes" (Hall & Fagen, 1956, p. 18). Bowen (1966) proposed the idea that the family should be viewed as a system because...

> ...a change in one part of the system is followed by compensatory change in other parts of the system..., (where) the functioning of any system is dependent on the functioning of the larger systems of which it is a part, and also on its subsystems (p.353).

That is, Bowen is highlighting the interconnectedness of family members, the environments in which the family system is embedded (e.g. social and cultural influences), and the importance of the individuals (i.e. subsystems) that are in the family. He further defined the family system as a primarily emotional unit, defined by intense connections between individual members. In fact, the apparent ease with which individual members are capable of influencing the thoughts and behaviours of others within the system make it appear as though a family system shares an 'emotional skin' (The Bowen Center, 2011). Family systems can be defined by a number of different features, including but not limited to, structural characteristics (e.g. size, composition) and psychobiological features of individual members (e.g. age, gender, personality) (Broderick, 1993).

Therefore, in considering the family as an interconnected system it makes sense that interventions targeting children would be increasingly effective if they incorporated a more holistic family approach, as appears to be the case in Epstein's family-based treatment of obesity (Epstein et al., 1990). Given that child behaviours will impact on parental behaviour (and vice versa), that children partly learn through social learning and modelling of parental behaviours (Bandura & Walters, 1963), and parents play a large role in the household food environment (Van Der Horst et al., 2007), food preferences (Benton, 2004), and family activities (Shaw & Dawson, 2001), the importance of the involvement of family members within the family system in initiating and maintaining lifestyle behaviours becomes quite apparent. It also makes intuitive sense that if an intervention is targeting behaviours that are

affected by both genetic and environmental factors (Hill, 2002), that a family-based approach would be expected to be especially helpful. Therefore, in recognition of the importance of the family system and recommendations for best practices from the CMAJ (Lau et al., 2007), based on previous successful research incorporating families and parental involvement is highly recommended.

The Use of the Internet in Implementing Interventions

Over 80% of Canadian families use the internet in the home and over 70% of individuals use the internet to access health information (Statistics Canada, 2009). Studies have shown that health information accessed over the internet is valued and it influences people's treatment decisions (Borzekowski & Rickert, 2001; Fox & Rainie, 2000). As well, a recent review suggests that online interventions are cost-effective, convenient for health consumers, allow for timely access to health information and support, and help to increase consumer control over interventions among other benefits (Griffiths, Lindenmeyer, Powell, Lowe, & Thorogood, 2006). Additionally, CBT interventions delivered over the internet may save time for therapists, thus reducing waiting lists and improving access to weight-based treatment (Cuijpers, Van Straten, & Andersson, 2008)

Given these factors, the internet may represent a viable, convenient, and cost-effective means for the delivery of behavioural interventions to large segments of the population, especially where face-to-face accessibility to care is an issue. Moreover, having increased control over the intervention, and hence one's progress, may help to increase adherence to the intervention. Finally, individuals using the internet are increasingly diverse in terms of socioeconomic status, ethnicity, age, and educational attainment (Rainie et al., 2001; Victory & Cooper, 2002). Thus, the internet has the potential to have greater reach in terms of potential participants, and their representativeness of the population at large.

The Internet is an effective means for the prevention and treatment of various health conditions (Cuijpers et al., 2008; Wantland, Portillo, Holzemer, Slaughter, & McGhee, 2004), including disordered eating (Celio et al., 2000; Zabinski, Celio, Wilfley, & Taylor, 2003). Some controlled studies have begun to evaluate the effectiveness of the Internet in treating obesity or maintaining weight loss. In fact, Weinstein (2006) found that interventions delivered via the internet were as effective as face-to-face interventions; however given the time and cost savings associated with internet interventions they could be argued to be more advantageous. A recent review of eight family-based randomized-controlled trials (RCTs) delivered over the internet for paediatric obesity did report mixed results, however the evidence suggested these interventions have some promise in a young population (An, Hayman, Park, Dusaj, & Ayres, 2009). It is important to note, however, that many of these interventions blended internet components with face-to-face support, and in one case the internet intervention following a summer camp intervention.

In Weinstein's (2006) review of controlled weight loss programs delivered via the internet, it was found that all but one of the reviewed programs produced positive results in either reducing or maintaining weight loss in adults. The one program that did not produce a positive result was a popular commercial diet site. The reviewed studies included studies by Tate and colleagues that included a cognitive-behaviour therapy component. In these studies, internet-based behavioural weight loss programs were effective at lowering the weight of obese healthy adults over six months (Tate, Wing, & Winett, 2001) and in adults at risk for type II diabetes (Tate, Jackvony, & Wing, 2003) in comparison to education-control groups. These studies produced double the percentage of initial and long-term weight loss than studies which did not include a cognitive therapy component (Weinstein, 2006).

While the review article exploring the effectiveness of internet-based RCTs (most with some face-to-face component) in children and adolescents suggested these types of interventions are promising (An et al., 2009), some limitations were identified. Most notably, seven of the eight RCTs only included children aged eleven and older (Celio, 2005; Doyle et al., 2008; Haerens et al., 2006; Marks et al., 2006; White et al., 2004a; Williamson et al., 2005a; Williamson et al., 2006b); therefore, of 3697 children, 3662 were comprised of older children. The remaining 35 children in the sample were part of a study examining weight loss in African-American eight year-old girls (Baranowski et al., 2003). Therefore, the results of the latter study are restricted in terms of generalizability Furthermore, the first month of this intervention involved attending a summer camp following which the girls and their parents participated in an 8-week internet-based intervention. Therefore, the results of the study by Baranowski and colleagues (2003) are further restricted in evaluating the effectiveness of internet-based interventions since it involved a mixed design, including an initial month of face-to-face interventions.

An additional four RCTs (Baranowski et al., 2003; Haerens et al., 2006; Williamson et al., 2005a; Williamson et al., 2006b) involved face-to-components; thus, further limiting the ability to tease apart the effects of the internet versus the face-to-face interventions. Further limitations of the review article include the fact that three of the RCTs did not adopt a family-based approach (i.e., there was no parental involvement) (Celio, 2005; Doyle et al., 2008; Marks et al., 2006), one of the studies was of a very short duration (i.e., 2 week duration vs. 12 weeks or more) (Baranowski et al., 2003), and three of the studies were drawn from the same sample but involved either different treatment groups or different time points (White et al., 2004a; Williamson et al., 2005a; Williamson et al., 2006b).

If one were to exclude from consideration the RCTs that incorporated face-to-face components, did not adopt a family-based approach, and/or were very brief in duration, then only one study remained. In this study White and colleagues (White et al., 2004a) found body composition improvements, including reduced fat mass and reduced weight, in adolescent African-American girls and an obese biological parent in comparison to an Internet-based education-control. However, more long-term follow-up was not able to demonstrate maintenance of this weight loss (Williamson et al., 2006b). As well, results from the review article examining these types of interventions in children and adolescents also highlight the problematic issue of long-term (lack of) maintenance of weight loss (An et al., 2009).

Finally, other research has found that when internet-based interventions involve some level of individually-tailored feedback to study participants, a greater impact on reduced weight is observed than when general information is provided alone (Oenema, Brug, & Lechner, 2001).

Insights from program implementation research.

Developing effective interventions is a complex process following four phases: program dissemination, adoption, implementation and sustainability. However, as this process unfolds, interventions typically experience diminishing returns, with many not having far enough reach, experiencing problems with implementation, and not attaining sustainability (Durlak & DuPre, 2008). Implementation can be understood in terms of eight primary features, including fidelity (i.e., does the intervention correspond to initial intentions?), dosage (i.e., how much of the intervention has been delivered), quality, participant responsiveness, program differentiation (i.e., uniqueness from other programs), monitoring of comparison conditions, program reach (i.e., participation rates, representativeness of

sample, and scope of intervention), and adaptation (i.e., modifications made during implementation) (Durlak & DuPre, 2008; Dane & Schneider, 1998). Some of these features are more commonly evaluated in research, whereas others receive less research attention. As well, most studies that evaluate implementation tend to focus on only one feature.

Durlak and DuPre (2008) reviewed 581 promotion and prevention programs for children and adolescents in order to determine whether program implementation has an effect on outcomes, and if so, which of the contextual factors impacted on implementation. The reviewed studies included a range of disciplines, including studies focusing on physical health. They also compared their results to several other reviews that had been recently conducted (Stith et al., 2006; Fixsen, Naoom, Blase, Friedman, & Wallace, 2005). Overall results suggested that implementation can greatly impact on outcomes; better implementation (reflected by monitoring and documentation of implementation process) was associated with effect sizes two to three times greater, and potentially 12 times greater in the most ideally implemented programs.

Durlak and DuPre (2008) further identified 23 contextual factors related to program outcome. These factors mapped onto a four-level ecological model, including factors related to communities, providers and innovations, and aspects of the delivery (i.e, organizational capacity) and support systems (i.e., training). Convergent validity for their ecological model and 23 factors was obtained by comparing their findings to other reviews (Greenhalgh, Robert, Bate, Macfarlane, & Kyriakidou, 2005; Fixsen et al., 2005; Stith et al., 2006). More thorough information on these factors can be obtained from their review.

Durlak and DuPre (2008) also highlighted organizational capacity, which includes capacity building, collaboration with multiple partners, and community involvement, as crucial to delivering effective interventions. They further cite other researchers who have

found associations between capacity and effective implementation (Gingiss, Roberts-Gray, & Boerm, 2006; Riley, Taylor, & Elliott, 2001).

Attrition from Web-based Studies

Attrition from web-based studies is a significant issue and poses a major methodological limitation to these types of studies. Eysenbach (2005) argues that a 'Science of Attrition' is needed in order to help researchers understand issues of impact and uptake in web-based research. He further argues that this new science is related to diffusion research (Rogers, 1995), which explains the rate and process by which innovations (such as web-based research) are adopted. According to the Rogers model, adoption of innovation, and relatedly decision reversals (which are consistent with drop-out), are related to the relative advantages offered, compatibility (e.g. consistent with values and experiences), complexity (e.g. difficulties with understanding and use), trialability (e.g. degree of experimentation), and observability (e.g. degree of visibility to others) (Eysenbach, 2005). Other important factors to consider include 'push factors' (e.g. reminders to participate) and participant factors that can be measured with baseline characteristics. Eysenbach (2005) contends that more systematic study of attrition is needed as high attrition contributes to threatened validity, selection bias in those who do not drop-out, and a publication bias in research literature.

Summary

After evaluating the existing literature when the HEALTHY study (described in Study #1 on page 29) was proposed, two main gaps were identified in the research. Importantly, no solely internet-based intervention to reduce weight has targeted children across the breadth of the proposed age range, from eight years-old through fourteen. However, some overlap exists at the extremes of this age range; with at least one study

including eight year-old African American girls (Baranowski et al., 2003) and some studies including children aged eleven years and older, although the average age of participants in those studies was closer to 14 years of age (An et al., 2009). The second gap in the literature is that only one family-based intervention similar in scope to the HEALTHY study was identified, again in children aged 11 and older (White et al., 2004a). Given that lifestyle interventions aimed at treating overweight and obesity in children are more effective than similar (Glenny, O'Meara, Melville, Sheldon, & Wilson, 1997), and based on the fact that the inclusion of parents is critical to any weight-based intervention delivered to children (Epstein et al., 1990), the identified gaps were in need of evaluation.

The HEALTHY study was initially designed to be an outcome study, using a RCT to compare an intervention group to an education-control group in terms of body composition changes. An evaluation component was also planned to evaluate the various components of the HEALTHY study. The initial purpose of the HEALTHY study was to evaluate the effectiveness of the internet in delivering a family-based behavioural weight loss intervention to overweight and obese youth, in terms of improving body composition, QOL, and self-esteem over the 3-month intervention. It was expected that positive improvements would be observed in both overweight/obese children and their parents. Analysis of variance (ANOVA), and/or analysis of covariance (ANCOVA) if baseline differences were found, were proposed to analyze outcomes. As well, exploratory regression analyses were planned in order to see if family SES was related to treatment outcome, with the hypothesis that higher family income would be associated with greater improvements (e.g., body composition, QOL) in comparison to lower income families.

This was intended to fill some of the gaps in the research at the time of the proposal, using a novel family-based approach delivered over the internet. Although evidence from

studies with adolescents and adults suggested the potential utility of delivering weight-based interventions via the internet, outcomes of such interventions remained unknown for boys and girls aged eight to fourteen. At the time of proposal, no truly similar study could be identified in the literature.

The purpose of the evaluation study was to examine the delivery of the intervention and associated process variables (e.g. satisfaction with various intervention and website components) in order to help identify the essential components of the intervention. The evaluation questionnaire was intended for families who completed the HEALTHY study. However, because adherence and attrition were significant issues in the HEALTHY these goals needed to be revised. The overall revised goal sought to answer the question of whether the internet is a viable option for treating overweight/obesity in children aged eight through fourteen.

Study #1 evaluated whether baseline characteristics (i.e., body composition, QOL, self-esteem, and motivation) of HEALTHY participants were related to measures of adherence (e.g. number of log-ins) and attrition (i.e., number of weeks in the study). Study #2 was a qualitative inquiry into the impressions and barriers that were experienced by HEALTHY participants, as well as their needs in seeking services for their overweight children. Finally, Study # 3 represents a systematic review of attrition and adherence in web-based lifestyle interventions aimed at treating childhood overweight and obesity.

Study #1: A pilot study of a family-based behavioural intervention for paediatric obesity delivered over the internet.

Stephanie Leclair, Gary Goldfield, Elizabeth Kristjansson, Pat McGrath

Pilot Study of a Family-based Behavioural Intervention for Paediatric Obesity delivered over the Internet

Background

Overweight and obesity, the result of caloric imbalance measured and classified based on BMI (i.e., weight in kilograms divided by height in metres), is becoming increasingly prevalent in Canada and worldwide. The determination of overweight and obesity varies across age groups, with adults considered overweight at a BMI of 25 or more and obese when BMI reaches 30 or more (Centers for Disease Control and Prevention, 2008b). In children and adolescents, age and gender specific ranks are employed, with a BMI $\geq 85^{th}$ to $< 95^{th}$ percentile considered overweight and above the 95^{th} percentile obese (Centers for Disease Control and Prevention, 2008a). Globally, overweight and obesity is the 5^{th} leading risk factor causing death, and the 3^{rd} leading risk factor causing death in high-income countries such as Canada (WHO, 2009).

Using data collected from the 2004 Canadian Community Health Survey (CCHS; Health Canada, 2006) researchers found nearly 60% of adults (Tjepkema, 2005) and 26% of children and adolescents (Shields, 2005) were considered either overweight or obese. Furthermore, in 2008 Shields examined the growth in overweight and obesity since the 2004 Canada Health Survey and found an additional increase of 6% in overweight and 5% in obesity across all age groups except 2 to 5 year olds (Shields, 2008). Worldwide over 1 billion people were overweight and 300 million were obese in 2005 according to the World Health Organization and this trend is expected to continue until at least 2015 (World Health Organization, 2005). These rates of overweight and obesity have a tremendous impact on healthcare in terms of elevated costs, both directly and indirectly.

For example, the most recent estimate of the economic cost of obesity in Canada is $4.3 billion dollars in obesity-related healthcare costs (Public Health Agency of Canada, 2011). Various health problems have been associated with overweight and obesity including increased risk of ischemic stroke, coronary heart disease, kidney failure, high cholesterol, type II diabetes, osteoarthritis, breathing problems, and reproductive complication (Office of the Surgeon General, 2001; World Health Organization, 2009).

Children and adolescents are not immune to the negative consequences of overweight and obesity and a variety of health effects are increasingly seen in these age groups including cardiovascular disease risk factors such as, hypertension and high cholesterol, increased risk for Type II diabetes, hyperlipidemia, liver disease, sleep apnea, and orthopaedic complications (Dietz, 1998b; Office of the Surgeon General, 2001; Chu et al., 1998; Daniels, 2006). In addition, negative psychosocial factors and also commonly reported such as reduced quality of life (QOL) (Schwimmer et al., 2003) and social discrimination (Dietz, 1998a; Office of the Surgeon General, 2001; Daniels, 2006; Riazi et al., 2010).

Childhood obesity typically results in adult obesity (Office of the Surgeon General, 2001) and unfortunately, interventions targeting weight-loss in adults have proven to be largely ineffective (Jeffery et al., 2000; Perri et al., 1988), making effective childhood interventions critical. In fact, interventions targeted to children and adolescents have shown greater effectiveness, likely due to the large learning component in changing health habits which are more amenable to change when less well established. Nonetheless, there are few comprehensive and evidence-based interventions available.

According to an expert panel in Canada, best practice guidelines for treating obesity in children and adults is a comprehensive approach that involves medical, mental health, nutrition and fitness professionals (Lau et al., 2007). Despite these recommendations, there

are only seven known treatment programs in Canada providing comprehensive, multi-disciplinary treatments for paediatric obesity Canadian Obesity Network (CON, 2011). As a result of the limited number of programs available, fewer than 1,000 Canadian youth are receiving the comprehensive interventions necessary to achieve a healthier lifestyle. This level of service provision is grossly inadequate given the high demand for treatment.

Family-based Behavioural Interventions

An important variable in successful paediatric obesity interventions is parental involvement (Epstein et al., 1990) such as in the family-based behavioural interventions developed by Epstein and colleagues (1984). These approaches include diet and lifestyle interventions (Epstein et al., 1984), mastery criteria for behaviour change (Epstein et al., 1994), goal-setting and problem-solving techniques (Epstein et al., 2000), reinforcement for increased activity (Epstein et al., 1995; Epstein et al., 2004), reduction of screen time (Epstein et al., 2008), social support (Foreyt & Goodrick, 1994a) and active parental participation along with parent training in problem-solving and effective reinforcement (Epstein et al., 1990). Many studies to date have demonstrated the effectiveness of Epstein's approach (Epstein et al., 1984); 1985; (Epstein et al., 1980) and changes in lifestyle have been shown to be maintained up to 10 years post-treatment (Epstein et al., 1990; Epstein et al., 1994).

Components of cognitive-behavioural therapy (CBT) such as self-monitoring, problem solving, and contingency management/reinforcement are also increasingly incorporated in obesity interventions (Foreyt & Goodrick, 1993; Foreyt & Goodrick, 1994b; Wadden & Stunkard, 2004). in addition to education on nutrition and physical activity (Johnson et al., 1997; Braet et al., 1997) and have been shown to increase the success of weight loss programs (Ayyad & Andersen, 2000; Weinstein, 2006).

Despite evidence on the effectiveness of these interventions for treating childhood obesity, as previously noted, there are few programs available. This may be due in part to a shortage of service providers or the time commitment and expenses associated with seeking treatment (Tremblay & Willms, 2000). A viable alternative may be the delivery of interventions using the internet.

For example, Weinstein (2006) found that interventions delivered via the internet were as effective as face-to-face interventions and a recent review of eight family-based randomized-controlled trials (RCTs) delivered over the internet reported some promise in children and adolescents. However, the authors of the review reported limitations among the various studies including restricted age ranges, gender, ethnicity and treatment delivery (An et al., 2009). Nonetheless, the internet has been shown to be convenient and cost effective for health consumers (Griffiths, Lindenmeyer, Powell, Lowe, & Thorogood, 2006) and Statistics Canada reports over 80% of Canadian families use the internet in the home and over 70% of individuals use the internet to access health information (Statistics Canada, 2009). Consumers also have a greater degree of control and more timely and immediate access to information and services, which may serve to improve adherence.

Although there are many advantages to delivering interventions using the internet, one significant limitation to web-based studies is attrition (Eysenbach, 2005). It is difficult to determine the reasons for the high drop-out rates and Eysenbach (2005) proposed that the delivery and consumption of interventions delivered via the internet is similar to diffusion research (Rogers, 1995), which attempts to explain the rate and process by which innovations, in this case web-based research, are adopted.

Based on this model, innovations are more likely to be adopted if there are advantages offered, and the rate of adoption increases if the innovations are consistent with

the consumer's values and experiences, simple to understand and use, there is some degree of experimentation available, and the innovation is observable to others (Eysenbach, 2005; Rogers, 1995). Decision reversals, which are consistent with drop-out in web-based research, occur when these conditions are not met to a satisfactory degree. Additional factors to consider in web-based research designs are reminders to participate, or 'push factors', along with various participant factors that can be measured with baseline characteristics.

In order to develop a better understanding of the dynamics involved in the consumption of information made available on the internet and participation in web-based research, Eysenbach (2005) suggests a 'Science of Attrition' is needed. This would allow researchers to clarify the issues of impact and uptake in web-based research. This is particularly salient in research since high rates of attrition threaten validity. Furthermore, it is critical to be able to explain why some participants complete the research protocols while others drop-out in order for results to be meaningful and generalizable to the population at large.

Relatedly, implementation is another important factor to consider. Durlak and DuPre (2008) report implementation is never perfect and positive results can be observed with levels around 60%. This is especially important in light of adaptation, which refers to modifications and adaptations that are made during the implementation of a program. They highlight adaptation as having some of the most interesting findings in terms of program implementation. They argue that adaptations are inevitable, as most providers make modifications during implementation; however what they highlight as interesting is that most providers view adaptations as a failure of implementation, especially as it impacts upon fidelity. In their review only three studies evaluated the impact of adaptation on study

outcomes. Of note, all of these studies found that adaptation had a positive impact on outcomes (Blakely et al., 1987; McGraw et al., 1996; Kerr, Kent, & Lam, 1985).

Program implementation research by Stevens and colleagues (2008) evaluated the implementation of a web-based program to support weight maintenance in adults. Their implementation included a three-month period of pilot testing, where participants and staff provided feedback that would help the researchers understand the user experience and improve utilization. One key finding suggested having an individualized website orientation including account set-up, as well as practice and training in using the website. Another key finding was the importance of an automated reminder system.

Summary

Overweight and obesity in children is a significant health issue that if left untreated, can have long-lasting, negative impacts on healthcare costs, cardi-metabolic health, quality of life and psychosocial development. Furthermore, research suggests that treatment for adult overweight and obesity is largely unsuccessful and changes in lifestyle must be established in childhood or adolescence in order to be maintained. Despite the high rate of overweight and obesity in children and adolescents, and evidence that these rates will continue to increase in the foreseeable future, there are few intervention programs available and participation is low, possibly due to the costs involved, the time commitment, and the inconvenience of attending face-to-face interventions. Therefore, the HEALTHY study was developed to pilot a web-based intervention program for childhood obesity. The program incorporated CBT techniques aimed at targeting problematic cognitions and behaviours, along with Epstein's family-based approach, with the goal of achieving lasting weight-loss. Specifically, the goal of the first study was to institute a solely internet-based family intervention to reduce weight

by enhancing nutrition and physical activity, targeted at children ages eight through fourteen years.

The HEALTHY Study

The HEALTHY study was based on Epstein's standard family treatment approach, which has the greatest empirical validity and has demonstrated efficacy when delivered in person (Epstein et al., 1994). The study was grounded in cognitive-behavioural and family systems theories. It gave attention to both lifestyle and diet interventions, included one parent as an active participant, provided mastery criteria in order to help overweight/obese children change their behaviour, attempted to help participants problem solve lifestyle and weight issues that arose in everyday life, and reinforced positive change throughout the program. Participants were provided with an online coach[1] who monitored their progress (i.e., checked and encouraged self-monitoring, directed them to weekly readings and quizzes), helped them develop goals and rewards, helped them problem solve difficulties, and answered questions about the HEALTHY study.

Purpose and Hypotheses

Given significant barriers in recruiting families to take part in the study (over a two year time period) it was decided to use a pre-post design to evaluate the effectiveness of the intervention. However over the course of the intervention, adherence, which refers to the act of complying with HEALTHY study protocol components, such as self-monitoring, logging into the website, reading weekly psychoeducational modules and completing weekly quizzes and attrition were significant issues. As a result, the purpose of the HEALTHY study became primarily exploratory, with the aims of identifying factors related to treatment adherence and attrition. It was hypothesized that variables measured at baseline in overweight/obese

[1] All families were coached by the author of this thesis.

children and parents, such as demographic variables, self-esteem, motivation to exercise and eat healthy (as measured by self-regulation), and HRQL, would be related to adherence and attrition.

Contribution of the Study

The HEALTHY study makes several contributions to the literature in this area. Firstly, internet-based research that delivers weight loss interventions to overweight/obese children and their families is in its infancy, having only emerged in the past 10 years. Given this short history, there is much still to learn about these types of interventions. Moreover, in the research that does exist the results are mixed, despite suggesting the promise of such interventions (An et al., 2009). Therefore, the current study helps to identify factors that are related to treatment adherence and attrition and possibly the long-term maintenance of weight loss so that future research can be informed about these factors and address them in their designs. Another contribution of the HEALTHY study relates to the age of the child participants. As discussed, the bulk of the research to date has focused on older children (who overlap the ages of youth in the HEALTHY study) and little has been done with younger children. The HEALTHY study was intended to fill this gap in the research as it has been demonstrated that the age of children who participate in these types of interventions is important for several reasons.

For example, data from the Canadian Community Health Survey (Shields, 2008) indicates increasing rates of overweight and obesity in Canadian children, with the exception of children aged 4 years-old and younger. However, the rate of obesity in children aged two to five years is still an issue as the incidence of obesity in this age group is 21% (Shields, 2006 (Shields, 2005)). Furthermore, research shows that overweight and obesity does not typically diminish or remit in young people (Rugholm et al., 2005). In fact, when young

children are overweight or obese the typical course predicts that they will likely continue to be overweight or obese as an adult (Serdula et al., 1993). Research by Whittaker and colleagues (Whitaker, Wright, Pepe, Seidel, & Dietz, 1997) examined the odds of becoming an obese young adult based on obesity status in childhood and parental obesity (another risk factor for later obesity). The odds of becoming an obese adult ranged from 8% (at one to two years of age) to 79% (at ages 10 to 14 years of age) for obese children with at least one obese parent. After controlling for parental obesity, odds ratios associated with later obesity ranged from 1.3 (at one to two years of age) to 17.5 (at 10 to 14 years of age).

As previously discussed, there are a number of health implications associated with overweight and obesity. Given the increased prevalence of overweight and obesity in young children, the lifelong trajectory of overweight and obesity, and the associated health implications there is a strong rationale to start intervening and teaching children healthy lifestyle behaviours from as young an age as possible. Given that internet-based interventions do require some level of reading ability, children in middle childhood could potentially start to benefit from these types of interventions.

Method

Sample Size Calculations

A priori sample size was calculated using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) based on the initially proposed methodology of conducting a randomized-controlled trial and ANOVA analysis. Observed effect size was expected to be in the medium range based on research at the time that evaluated internet-based behavioural interventions in: African-American families (effect size 0.50; White et al., 2004a), healthy obese adults (effect size 0.76; Tate et al., 2001), and obese adults at risk for Type II diabetes

(effect size 0.42; Tate et al., 2003). Given these findings, an estimated effect size of 0.56 was expected and using a two-tailed test ($\alpha = 0.05$), a total sample size of 28 was required.

Participants

Data were obtained from 25 child-parent dyads, drawn from 20 families (several dyads came from the same family where one parent participated along with two youth who met inclusion criteria). Parents ranged in age from 34 to 44 years (M = 39.5, SD = 3.1) and overweight/obese children ranged in age from 8 to 14 years (M = 10.5, SD = 2). The parents were primarily female (95%) and educated (55% completed post-secondary education; 35% completed graduate studies). The overweight/obese children were more evenly distributed in terms of gender, with 56% male and 44% female. Children were enrolled in schools in a range of different grades (see Table 2). Families varied in terms of annual family income, place of residence, and the number of computers in the household (see Table 2).

At baseline children ranged in BMI from 18.7 to 46.3 (M = 28, SD = 64), which represents BMI percentiles from the 85th to >97th percentile (M = 95.5, SD = 3.4). Measured weight ranged from 36.6 kilograms to 109.3 kilograms (M = 62.3 kg, SD = 18.5 kg); and their percent body fat ranged from 17.6% to 57.4% (M = 36.6, SD = 10.2). At baseline measured BMI in parents ranged from 23.5 to 40.5 (M = 32.2, SD = 5.9). Measured weight in parents ranged from 61.9 kilograms to 107.4 kilograms (M = 85.9 kg, SD = 15.9 kg); and percent body fat ranged from 31.6% to 50.8% (M = 39.7, SD = 6.9).

Sample Selection

Families were considered eligible for inclusion in the HEALTHY study if the participating child/youth was between 8 and 14, had a BMI at or above the 85th percentile for age

Table 2

Demographic Information

Variable	Frequency	Percentage
Parent Gender (*n* =20)		
Female	19	95
Male	1	5
Child Gender (*n* =25)		
Female	11	44
Male	14	56
Highest level of parent education (*n* =20)		
Completed secondary	1	5
Some post-secondary	1	5
Completed post-secondary	11	55
Completed graduate studies	7	35
Current grade of child (*n* =25)		
2nd grade	1	3.8
3rd grade	5	19.2
4th grade	5	19.2
5th grade	3	11.5
6th grade	6	23.1
7th grade	2	7.7
8th grade	3	11.5
Annual Family Income (*n* =20)		
Less than $20,000	2	10
$20,000 to $34,999	2	10
$35,000 to $49,999	0	0
$50,000 to $64,999	6	30
$65,000 to $79,999	5	25
$80,000 to $99,999	2	10
$100,000 and over	3	15
Place of Residence (*n* =20)		
Urban	6	30
Suburban	4	20
Rural	9	45
Number of Computers in Household (*n* =20)		
One	6	30
Two	10	50
Three or more	4	20

and gender based on CDC growth chart data, had one parent/guardian willing to follow the protocol, and had access to a working computer and the internet at home.

Families were ineligible to participate if: (a) the child/youth had an existing medical condition which altered nutritional status, intestinal absorption, or any other condition which may have influenced response to nutritional/activity intervention (e.g. diabetes mellitus, severe asthma) or make participation inadvisable; (b) the child/youth used any medications and/or supplements that may enhance performance and/or affect body composition, lipids, or glucose

metabolism (e.g. steroids); (c) the child/youth and/or participating parent had experienced a significant change in weight (i.e., $\geq$ 10% increase or $\geq$ 5% decrease) during the two-month period prior to enrolment; (d) the child/youth and/or parent had a current eating disorder (see screening measures); (e) the child/youth and/or participating parent suffered from current substance abuse and/or severe depression (see screening measures); (f) the participating parent was either planning to become pregnant and/or was pregnant and/or lactating; and (g) the child/youth and/or participating parent was unwilling to sign the informed consent.

Procedure

All procedures for the HEALHTY study were approved by the Research Ethics Board at the Children's Hospital of Eastern Ontario and the University of Ottawa. Participants for the HEALTHY study were obtained from a convenience sample via a number or recruitment sources. A list of all paediatricians and physicians in the Ottawa area was taken from the College of Physicians and Surgeons of Ontario (CPSO) website. Most physicians had contact information, including a fax number, on the CPSO website; those who did not list a fax number were contacted by telephone to inform them of the study and to offer faxed information. All other physicians whose fax numbers were on the College of

Physicians and Surgeons of Ontario (CPSO) website were faxed a recruitment package, including a personalized letter to the physician, a fact sheet on the HEALTHY study, and a recruitment poster (including contact information for the study) which physicians were invited to post in their waiting rooms.

All physicians were followed up with telephone calls to inquire as to whether the packages were received and whether they had questions about the HEALTHY study. In most cases, messages were left with reception staff and/or on answering machines. All physicians who sent referrals to the HEALTHY study were also faxed letters of thanks, while encouraging them to refer any other families who they felt would be eligible for participation. Recruitment packages were also sent to the Community Health and Resource Centres in the Ottawa area with similar follow-up procedures implemented.

In addition, recruitment advertisements for the HEALTHY study were placed on a popular social networking website, Facebook. The ads contained the same language as found in the recruitment poster, but was shortened in order to meet Facebook requirements. The advertisements were targeted towards parents (i.e., were only able to be viewed by people over age 18). Over an 8-month period the ad made 2, 252, 916 impressions (i.e., was visible on the website in a small advertisement) and was selected to view 590 times, which connected individuals to the homepage of the HEALTHY website where information identical the recruitment poster could be found.

Recruitment ads for the HEALTHY study were also placed in two newspapers in the recruitment area including a popular daily newspaper which ran advertisements for the HEALTHY study in several Saturday editions and a free monthly parenting newspaper, which featured the ad in their popular back-to-school September issue, available to

consumers for 6 weeks on newspaper stands. All recruitment advertisements included contact information for the HEALTHY study.

A recruitment flowchart can be found in Figure 1. A total of 33 families contacted the HEALTHY study, either over telephone or email, after having viewed advertisements. After families initiated contact, attempts were made to reach them to provide additional information about the study. Families who emailed the study were asked if they wanted to be contacted by telephone or receive additional information over email; all other families were contacted over telephone. A telephone script was used as a guideline for the conversation, and information provided over email was taken from the telephone script.

Contact was established with 28 families; the other five families could not be reached after a minimum of three attempts over a two-month period. These 28 families were informed about the study requirements and advised of the study components, namely that the HEALTHY study took place over a 3- month period with one parent required to participate along with their child/ren, both would be asked to visit CHEO for baseline and post-treatment assessments (parking would be reimbursed), and both would be asked to monitor their dietary intake, physical activity, and "screen time" over the study duration. All 28 families participated in a screening telephone call (those that received initial information via email scheduled a time for the telephone call) in order to ensure that they met eligibility criteria for the study.

During the telephone screening, three families were deemed ineligible for participation in the HEALTHY study as one child was outside the required age rage, one child was on stimulant medication (which is expected to alter metabolism), and one child was underweight. A further two families expressed no further interest in the study following

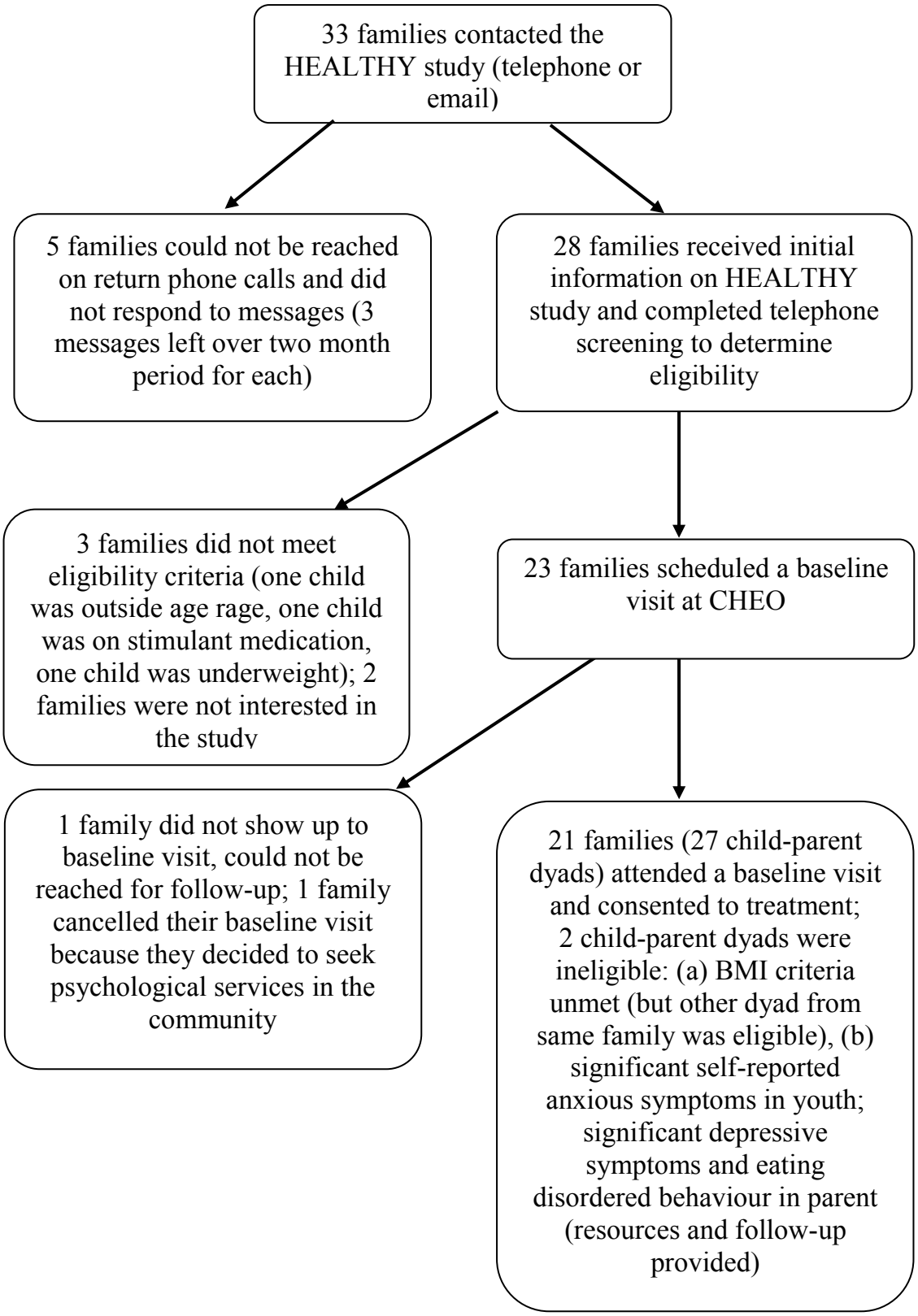

Figure 1. *Recruitment Flowchart*

the screening telephone call. Twenty-three families scheduled an individual baseline visit at a time that was convenient for them; one family did not show up and did not reschedule and one family cancelled because they decided to pursue individual psychological services in the community. Of the twenty-one families who attended the baseline visit, one family was ineligible to participate as the youth self-reported a significant number of symptoms of anxiety at the baseline visit and the youth's mother reported a significant number of depressive symptoms and eating-disordered behaviours. The family was offered community resources and follow-up was provided. Another family (with two parent-youth dyads who attended the baseline visit) had one child who was ineligible because the child's BMI was below the 85th percentile.

Families who attended a baseline visit met one of two research personnel in the lobby of CHEO and were escorted to the research laboratory. An informed consent for parents (Appendix A) and child assent (Appendix B) were reviewed and discussed with each family. Families were assured of the confidentiality of the study and were offered the opportunity to ask questions prior to giving informed consent. Following consent, families were weighed and measured by trained research personnel to obtain body composition measurements then children and their participating parents completed questionnaire packages. In cases where the children/youth were not adept at reading and understanding questions, research staff administered questionnaires in an interview format. Researchers periodically checked-in and/or answered questions for the children/youth filling out their own questionnaires.

Upon completion of body composition measurements and questionnaires, a researcher provided families with individual log-ins and passwords (they were asked to change their password on their first log-in), introduced families to the HEALTHY website, provided families a tutorial on how to navigate the website and complete self-monitoring

entries, discussed the importance of rewards and reinforcements, and provided paper copies of the Traffic Light Diet manuals to the families.

All families were sent a welcome message to thank them for their participation, welcome them to the study, and encourage them to familiarize themselves with the website, complete set-up of their user account and personal goals and begin their self-monitoring. For the first week they were asked to maintain their usual eating and activity habits in order to establish a true baseline for gradual change. .

Participants then took part in the intervention for up to three months (the maximum intervention period). The exact procedures involved are described in the "Structure of the Internet-based Behavioural Treatment" section. Afterwards, the families who completed the 3-month intervention participated in a post-treatment visit at CHEO where they again completed baseline measures, body compositions measurements, and an evaluation survey. Participants were not compensated financially for their participation, however parking passes and/or bus tickets were provided for all visits made to CHEO.

Structure of the intervention website.

The HEALTHY website had five main sections for navigation, with an additional section for parents, as follows: (a) 'Home Page', (b) 'Food & Activity Guide' (which also contained links to Canada's Food Guide and Canada's Physical Activity Guide, (c) 'My Self-Monitoring' (d) 'My program', (e) 'Downloaded forms', and (f) 'Parent section' (if applicable).

Home page.

The 'Home Page' section was a basic page where participants could edit their profile information, enter the chat room, post/read messages on the message board, post goals (and their associated steps) to attain during the program, and access their mailbox in order to

communicate with their coach (the author of this dissertation and a PhD candidate in clinical psychology under the supervision of a registered clinical psychologist on the project) (Appendix C).

Food and activity guide.

The 'Food and Activity' section allowed participants to access information on food and nutrition including the Food Reference Guide (which classified common foods into red, yellow, and green foods), a link to fitday.com (where additional nutritional information could be obtained on foods not in the Food Reference Guide or that did not have nutritional information provided), and links to Canada's Food Guide (Health Canada, 2007) and Canada's Physical Activity Guide for children and adults (Health Canada, 2002).

My self-monitoring.

'My Self-Monitoring' section contained basic information on self-monitoring, common goals (e.g. eat 5 less red foods per week than in the previous week), access to all the online self-monitoring forms and summary tables of their self-monitoring to date (Appendix D). Participants were requested to self-monitor calorie intake, physical activity, and sedentary behaviour on a daily basis. As well, participants were required to weigh themselves twice weekly and enter this information into the online self-monitoring. Summaries and weight graphs were available to participants following the entry of weekly data.

My program.

The 'My Program' section contained the educational component of the program including a 'Healthy Program Overview', twelve weekly reading modules and their respective quizzes (see Table 3), and a 'Journal/Diary' section (Appendix E). The journal section contained standard questions that were to be answered at least three times per week.

Table 3

'My Program' and 'Parent Section' Weekly Educational Topics

Week	My Program	Additional Parent Topics
1	Self-monitoring	Becoming aware, Calorie and fat intake goals
2	Eating Healthy	Making healthy choices, Why are red foods bad for your child?, Cutting down on red foods, Keeping red foods out of the house, Planning, Beverages, Eat right for the right reasons
3	Eating Healthy	Eating healthy, Three meals each day, Breakfast is important, Lunch, Dinner
4	Active Habits	Making physical activity a habit, Lead the way by example, Not just any activity will do
5	Screen Time	TV, Video games, and Computer
6	Family and Friends	How will we Relax?, Keeping red foods away
7	Special Events	Increasing your own activity level, Providing praise, Special events, Don't use food as a gift, Restaurants
8	Rules	Healthy alternatives, Teaching your child
9	Problem Solving	Lead by example, Problem solving
10	Teasing	Talking about teasing with your child, Helping your child handle teasing
11	Feeling Good about Yourself	Body image, Media messages
12	Taking Care of Your Body Depends on your Mind	Positive attitude, Success, Tips & tricks

These questions were designed to encourage self-reflection on eating and exercise habits and situations that triggered difficulties with adherence in the HEALTHY study. The journal section also included special topics that could be self-chosen or assigned by a coach if they felt it was needed to help with problematic behaviours (e.g. self-reflection questions related to cutting down on red foods, eating at restaurants and/or parties, problem solving difficult situations).

Download forms.

This section allowed participants to download self-monitoring forms, the daily food diary, information on rewards and reinforcements, the food reference guide, and a weight chart.

Parent section.

The parent section was only available on parent accounts (Appendix F). In this section, parents were given addition information to supplement their introduction to the program and to supplement the educational information in the 'My Program' section (see Table 3). This section also included information that was specifically intended for parents only, such as information on philosophy of the program and the various behavioural modification techniques (e.g. reinforcements and rewards, praise, stimulus control, and healthy recipes).

Structure of the Internet-based Behavioural Treatment

The HEALTHY study was designed to take place over a three-month period. Both the participating parent and their child were encouraged to fully take part in all aspects of the program. During this time, behavioural counselling and individualized feedback was provided to children/youth and their participating parent/ guardian via weekly emails from

their coach, with at least one weekly individualized behavioural email delivered independently to both children/youth and their participating parent/guardian.

For the families who adhered to the intervention, back-and-forth contact was typically made several times a week. Additional emails were sent to support participants with issues or difficulties arising with the program, to answer any of their questions about study components, and to provide cognitive-behavioural techniques in areas where some participants requested additional support (e.g. emotional eating).

A chronological diary detailing all participant contacts was maintained and at the start of the study and were reviewed by the clinical supervisor. As the study progressed only a random selection of contacts continued to be reviewed. Feedback aimed to counsel participants towards behaviour change, focusing specifically on program components (e.g. self-monitoring, quiz completion, understanding of materials, weight change, and goal-setting). Participants were informed that "live" interactions with the family could be arranged for any pressing issues with the option to lock the chat room (and available to the coach) in order to create a confidential place to engage in real-time interactions. No families requested this additional service.

The intervention was delivered on a closed, fully secure website. Each participant had a unique individual login (which also tracked login frequency). Using their log-in, participants could access all website content, view personal self-monitoring records, message the coach, access a discussion board, and enter the study chat room. The latter two were included in order to increase positive peer interactions, facilitate social support, and provide opportunities for group problem solving among participants.

Moreover, attempts were made to include a weekly group chat, facilitated by the HEALTHY coach, in order to help participants problem solve any difficulties they were

having with the program. Unfortunately, participants declined this additional support, and a number of families reported that they were too busy to commit to a regular weekly time to participate.

During each week, participants completed self-monitoring exercises including recording red foods, physical activity, screen time, and weekly weight. These self-monitoring diaries were reviewed once a week by the coach and appropriate feedback provided to the participants. All feedback messages included a summary of the weekly self-monitoring entries (e.g. reviewing the number of red foods eaten), goals for the following week (e.g. to increase physical activity by an average of 15 minutes a day) and praise for the attainment of previous goals. If weight changes were observed in the weekly self-monitoring forms these were also mentioned (with praise included for weight decreases) and attempts were made to link behavioural changes with the self-reported weight changes (i.e., asking them what behaviours lead to their weight changes).

Every week a behavioural technique was reviewed with each family, however, the techniques were chosen based on individual family circumstances and needs, and they did not necessarily follow a common protocol. For example, some families identified increasing physical activity as a primary goal so techniques related to physical activity would be discussed earlier in the intervention process. A tracking sheet of the various behavioural techniques was maintained for each family in order to ensure that the breadth of techniques was provided to each family.

At times, weekly messages also included corrective feedback (e.g. if recording errors in red foods were discovered), addressing parental issues (e.g. encouraging praise and reinforcement for healthy choices, exploring barriers to lifestyle changes), evaluating the attainment of short- and long-term behavioural goals, and teaching problem-solving to deal

with difficulties in attaining a healthier lifestyle. It was hoped that regular feedback would also contribute to enhanced motivation for change, program adherence, a sense of support for participants, and improved parenting skills (e.g. attending to child behaviour, reinforcing positive behavioural changes). Once the intervention was complete, participants continued to be provided with access to the HEALTHY website to allow for longer-term support, however, this did not include the ability to message and obtain individualized help from the coach.

The educational component (e.g. healthy eating, active living) of the behavioural intervention was provided to participants in modular format. The weekly topics were previously discussed and are listed in Table 3. These modules promoted a cognitive-behavioural approach to healthy lifestyle change and were available at anytime on the website. Thus, each week participants had an assigned module containing information that they were asked to read. Afterwards, participants were directed to a brief quiz that tested them on the important content of the weeks reading.

The purpose of these quizzes was to help reinforce content and direct participants to areas that they had difficulty understanding. The HEALTHY coach was able to view results of these quizzes and incorporate poorly understood concepts into weekly feedback. When the goals of the study were changed and became more exploratory, the number of completed quizzes was used as a measure of adherence.

Components of the Internet-based Behavioural Treatment

Food plan.

The Traffic Light Diet (e.g. Epstein, Valoski, Wing, & McCurly, 1990) was the basis for information and education on healthy eating (e.g., serving sizes, reading nutritional labels, food selection, hidden calories, macronutrient composition) provided to participants.

Although the diet is based on the American Food Pyramid (USDA, 2007), it corresponds closely to Canada's Food Guide (Health Canada, 2007) in terms of its macronutrient composition. This diet was chosen because it has been empirically validated in RCTs with overweight/obese children over a 20-year period (Epstein et al, 1990; Epstein & Saelens, 2000; Goldfield, Raynor, & Epstein, 2002) and has been found to promote healthier eating patterns in children in previous research (Duffy & Spence, 1993).

The Traffic Light Diet divides foods into five categories: (a) fruits and vegetables; (b) grains; (c) milk and dairy; (d) protein; and (e) other. Each category is subdivided into red, yellow and green designations according to nutritional composition such as fat and sugar. In general, foods that have less than two grams of fat per serving are 'green' (i.e., 'go') foods, those with two to five grams of fat per serving are 'yellow' (i.e., 'caution'), those with 5 or more grams of fat per serving are 'red' (i.e., 'stop') foods. Moreover, foods with 10 or more grams of sugar in a serving are 'red' (i.e., 'stop') foods. One exception is that all families were asked to consider yogurt with sugar content greater than 10 grams as an exception from being a red food. The research personnel felt it was important to not discourage children from eating yogurt because of the health benefits of consuming calcium during childhood (Greer & Krebs, 2006), and the relationship between low dairy intake and the accumulation of excess body fat in children (Moore, Bradlee, Gao, & Singer, 2006). The focus of this diet is to increase 'green' food intake while reducing 'yellow' and 'red' food intake (e.g. reducing red foods by an average of 5 red foods per week until 15 servings per week is reached). The less restrictive nature of this diet makes short- and long-term adherence more likely.

While the program is called a 'diet', in the HEALTHY study it was emphasized to participants that the goal was not to diet, but rather to promote the adoption of healthier

eating choices and practices for long-term health and weight management. This is consistent with expert guidelines to focus on healthy choices as opposed to weight loss (Barlow & Dietz, 1998) For this reason, the caloric restriction in the original Traffic Light Diet was removed. In order to facilitate following the Traffic Light Diet, a food reference guide that classified most common foods was uploaded onto the HEALTHY website and paper copies were provided to families for quick reference at home.

In the case where a particular food was not included in the food reference guide participants were advised to use nutritional information on food packages or encouraged to visit a comprehensive online resource (fitday.com) where macronutrient composition could be determined, thus allowing participants to determine if a food fell into the green, yellow, or red category. Because recent research has shown a relationship between the high consumption of juice and other sugar-containing drinks with increased weight (Dennison, Rockwell, & Baker, 1997; Ludwig, 2001), limiting intake of these beverages was encouraged at baseline visit and throughout the intervention via weekly modules and individualized feedback.

Participants were asked to monitor all food intake, including whether a food was considered red, yellow, or green. At the end of first week, participant food intake journals were reviewed and attempts were made to identify areas where families could make healthier substitutions.

As previously stated, parents were encouraged to participate in all aspects of the current program, whether or not they were overweight and/or obese. This included following the dietary component. However, only one participating parent had a normal weight at baseline.

Lifestyle activities.

Physical activity.

The web intervention promoted a lifestyle activity program that was based on Epstein's model (Epstein, Valoski, Wing, & McCurley, 1994; Epstein, Wing, Koeske, Ossip, & Beck, 1982; Epstein, Wing, Koeske, & Valoski, 1985), which has also been replicated with adults (Andersen et al., 1999; Dunn et al., 1999) and has demonstrated superior adherence for obese children in comparison with a more structured exercise program (Epstein et al., 1982; Epstein et al, 1985).

As outlined in this program, participants were provided a list of various activities and their associated caloric expenditures as well as weekly guidelines on the number of minutes of exercise they are to strive to reach. These guidelines gradually increased exercise time each week by an average of 15 minutes per day, until reaching the goal of 60 minutes of moderate to vigorous physical activity for children and 60 minutes for adults was achieved most days of the week (goals based on Canada's Physical Activity Guidelines; Health Canada, 2002a; 2002b).

An emphasis was placed on incorporating lifestyle activities such as riding a bicycle to school/work, using stairs instead of an elevator/escalator, parking at the far end of parking lots, etc, into daily routines. Furthermore, families were encouraged to participate in physical activity together as much as possible to improve the parent-child relationship (e.g. taking a walk after dinner, going on family hikes. Participants were asked to record the number of minutes they spent engaged in various forms of activity, and to include whether the activity was considered 'easy' (e.g. you do not feel out of breath), 'moderate' (e.g. your heart is beating faster and you feel like you are working), or 'vigorous' (e.g. you are working hard). Participants were provided with the aforementioned descriptors and examples of activities.

Screen time.

Although two-hours is the daily recommended limit for screen time encouraged by Active Healthy Kids Canada (2011), their most recent report card indicates that the average Canadian child is spending six or more hours a day engaged in screen time. Thus, participants were encouraged to decrease their screen time by an average of 15 minutes per day, each week, until their average daily screen time reached a maximum of two hours. Screen time included sedentary time that participants spent watching television, playing video games, and/or recreational computer time. The exceptions discussed with families were that the maximum recommended amount of daily screen time did not include computer time spent completing homework for children/youth, time spent completing work-related activities for parents, and/or time spent on the HEALTHY intervention for either child or parent. In addition, the use of active video games where participants are standing *and* actively moving their limbs was not counted towards daily screen time. However, participants were informed *not* to count the use of active video games in the monitoring of physical activity.

Parent training component.

The parent training component included information aimed at modelling and teaching healthy parenting attitudes and behaviours. This information was designed to help educate parents on the key components of behavioural change such as self-monitoring of diet and physical activity, modelling, problem solving, structure of the family environment to promote positive change, and positive reinforcement. It also aimed to teach parents ways to deal with difficult situations including low motivation, poor compliance, weight gain, relapse prevention and weight-based teasing.

Behaviour modification techniques.

Several behaviour modification techniques following a mastery approach to behaviour change (Epstein, McKenzie et al., 1994) were employed in order to modify diet and physical activity. In this approach skills are mastered sequentially based on their complexity such that basic skills are learned and mastered before progressively more complex ones. Implementation of these strategies was based on information from educational modules and individual needs and circumstances obtained through regular communication with the HEALTHY coach.

***Self-monitoring*.**

Self-monitoring has been demonstrated to be an effective strategy in promoting behaviour change in obese children (e.g., Epstein, McCurley, Wing, & Valoski, 1990). Thus, participants were asked to self-monitor daily red food intake as well as the number of minutes engaged in physical activity and sedentary behaviour (e.g. watching television, playing sedentary video games, computer time) using an online self-monitoring system. Participants were able to access summaries of this information by day and by week. This allowed them to engage in self-reflection in regards to their daily self-monitoring, which they could also compare to the recommendations made to them by their coach.

As well, participants were asked to take a measurement of their weight at least once a week using a home scale and enter the information into the same online self-monitoring system. This was converted into a graph so that participants could visually assess their weight change over time. It was expected that this novel format may have been an interesting way of self-monitoring that could potentially enhance adherence.

Finally, self-monitoring was also a helpful way for parents to determine when reinforcement should be provided or for the HEALTHY coach to inquire about and/or recommend the implementation of rewards.

Reinforcement.

Families were encouraged to use two positive reinforcement techniques to assist in learning and maintaining healthy behaviour changes. The first technique was the use of praise, which is a demonstrated method for increasing new behaviours, even when the effects of other reinforcing contingencies are withdrawn (Eisenberger & Cameron, 1996). Parents were encouraged to use praise regularly as a reinforcement method and frequent reminders were included in individual feedback messages.

Families were also asked to meet each evening to review daily eating and physical activity, with the intention of increasing the opportunity for parents to praise their child's lifestyle choices and behavioural changes. Research has demonstrated that feedback is an important source of motivation for task contingent or choice situations (Eisenberger & Cameron, 1996) and these meetings provided the opportunity for regular feedback on progress, in addition to the feedback delivered weekly by therapists. The length of these nightly meetings varied according to individual families; however, some families reported that nightly meetings were not possible. These parents continued to check in with their child on an ongoing basis and met with them several times a week to review changes and enter self-monitoring into the online diary.

The second positive reinforcement technique that was utilized in the HEALTHY study comprised a reward system. A point-based reward system was encouraged, which would allow children and youth to earn desired privileges and activities through accumulating points. However, all families who participated in the program used a more informal reward system. Each of the families agreed to rewards that they would use, with most families giving smaller, frequent rewards during the initial phase of the intervention, and larger, less frequent rewards during the latter stages. Families were strongly discouraged

from using money or food as rewards. Instead, they were asked to choose rewards that consisted of social and physical activities and/or parent-child activities aimed at improving both social support and the parent-youth relationship.

Rewards were to be earned for behaviours that have an empirically demonstrated relationship with weight control in children, such as decreased intake of red foods (Epstein et al., 1990; 1994; 2001) and reduced sedentary behaviour (Epstein, Paluch, Gordy, & Dorn, 2000; Epstein et al., 1995). Ongoing monitoring of the provision of rewards took place at least twice a month by the coach via the weekly parent feedback and communications.

Problem solving.

Families were taught how to plan for and problem solve high risk situations where relapse to eating unhealthy food are likely to occur (e.g., parties, vacations) using a variety of strategies such as identifying alternative solutions and/or overcoming barriers. This was accomplished via the weekly reading modules, the diary section, and weekly communication with the coach. For example, one commonly recommended strategy was to plan to have a healthy snack before attending a family party so the participants would feel less hungry and less likely to overeat later. Opportunities for problem solving were also encouraged during the regular parent-youth meetings.

Modelling.

Parents were educated about the importance of modelling healthy behaviours as a strategy to promote positive behaviour changes in their child. The importance of modelling these behaviours was reinforced in the weekly reading modules and through regular communication from the HEALTHY coach. Parents were encouraged to model healthy eating behaviours and/or behaviours they wanted their children to imitate (such as physical

activity), while refraining from modelling behaviours they did not want their children to imitate.

Stimulus control.

The goal of stimulus control is to change environmental factors in a way that will contribute to positive behaviour change and maintenance of these new behaviours (Foreyt & Goodrick, 1993). One way of accomplishing this was to promote modifying the home food environment to make it compatible with the desired behavioural changes in the HEALTHY program. This could include reducing and/or removing high calorie, nutritionally-void foods and red foods from the home while increasing the availability of healthy foods and green foods that are nutritionally dense. The principles of stimulus control were also applied to help families increase physical activity and decrease sedentary behaviour.

Social skills.

Weekly reading modules and individualized feedback sought to teach families how to engage other family members, as well as friends, in a healthy lifestyle. Moreover, education on how to deal with pressure, teasing, and bullying was available on the website.

Behavioural hygiene.

Behavioural hygiene refers to behaviours that participants could adopt to assist them in achieving healthier lifestyles. Adherence to the HEALTHY intervention was anticipated to be difficult, especially for children, because food is naturally rewarding (Hoebel, 1988; Salamone, 1994). Also, behaviours on the part of the parent can and in the case of overweight and obese children often have in the past, unintentionally increased the reward value of food by using food as a reward for compliance or by using food as a means of providing comfort. Coaching feedback also aimed to encourage parents to identify instances

when they used food as rewards for their child's behaviour and, in these instances, they were encouraged to use non-food rewards and other coping strategies instead.

Treatment Integrity.

The integrity and fidelity of the intervention was insured by several methods. First, all educational materials were standardized for all participants. Second, a standardized format was used by the coach for providing feedback to families in addition to the more individually-tailored aspects of feedback. Furthermore, the coach was supervised by a registered clinical psychologist following a cognitive-behavioural orientation in order to maintain the quality of service provision. As previously mentioned, this included monitoring all initial email communication (i.e., for the first month), and a random selection of 20% of later email communications.

Adaptations to the HEALTHY Study

The initial cohort of HEALTHY participants (n = 4 dyads) were asked to self-monitor all consumed foods in their weekly journals and all activities, including the level of intensity. However at the conclusion of the first week, all families that had started the program reported that the self-monitoring was much too cumbersome, particularly in terms of dietary self-monitoring. As a result, this initial cohort all quickly dropped-out of the HEALTHY study.

Given the overwhelming agreement among these families in regards to the self-monitoring component, important adaptations were made. In terms of dietary self-monitoring, the HEALTHY study was modified such that only red foods required recording (although families were encouraged to independently monitor yellow food consumption). As well, physical activity monitoring was modified so that families only had to record the total number of minutes engaged in physical activity per day.

The initial cohort was informed of these modifications and invited to return to the study; unfortunately, all families declined. Throughout the remainder of the study, the red food diaries continued to be reviewed and recommendations for healthier substitutions were made when available (e.g. cereals with lower sugar content, white milk instead of chocolate milk). As well, the coach inquired about types of physical activity in weekly messages and continued to encourage an increase of moderate and vigorous physical activity.

Measures

Children and parents were assessed at CHEO at baseline and three-months post-treatment. The author of this thesis and another PhD student in clinical psychology were trained in the use of the measures and were responsible for taking measures throughout the study period. Due to the fact that children varied in their reading comprehension, one of the research personnel informally assessed the ability of the children to complete self-report measures on their own (e.g., asking them/their parent about reading ability, having child read part of a questionnaire aloud and explain the meaning of items). If children required assistance with their questionnaires or requested help then a person on the research team verbally administered the measures.

Screening measures.

A number of screening measures were used to confirm eligibility for participation. These measures were administered to participants following informed consent but prior to administering the primary measures for the study. These measures were checked immediately upon completion in order to confirm eligibility for the study.

The Center for Epidemiologic Studies Depression Scale (CES-D).

The CES-D (Radloff, 1977) was used to screen for the presence of depressive symptoms over the previous week in parents. This self-report measure, available in the

public domain, has 20-items that cover symptoms in six main areas, including depressed mood (e.g., "I felt sad"), guilt/worthlessness (e.g., "I thought my life had been a failure"), helplessness/hopelessness (e.g. "I felt hopeful about the future" [reverse scored]), psychomotor retardation (e.g., "I could not get going"), appetite (e.g., "I did not feel like eating; my appetite was poor"), and sleep (e.g., "My sleep was restless"). All items are rated on a four-point scale ranging from '0' (i.e., indicating no presence of the symptom) to '3' (i.e., indicating presence of a symptom 'most or all of the time'); four items are reverse scored. Scores can range from 0 to 60, and a cut-off score of 16 was used to indicate clinically significant symptoms of depression, and therefore ineligibility for the HEALTHY study.

The CES-D is a psychometrically sound instrument with demonstrated validity and reliability, including high internal consistency in healthy (α = .85) and patient (α = .90) samples, and moderate test-retest reliability (0.45 – 0.70). As well, more recent research has confirmed adequate psychometric properties of the CES-D with diverse populations (Naughton & Wiklund, 1993). Moreover, the CESD-D has comparable psychometric qualities to the Beck Depression Inventory, a measure of depressive symptomatology that is widely used in clinical practice and primary care (Sharp & Lipsky, 2002).

The Center for Epidemiologic Studies Depression Scale for Children (CES-DC).

The CES-DC (Weissman, Orvaschel, & Padian, 1980) was used to screen for the presence of depressive symptoms (e.g. appetite, hopelessness, fatigue) over the previous week in children. This self-report measure, also available in the public domain, has 20-items that cover the same six symptom areas as the CES-D. Rating, scoring procedures and the clinical cut-off indicating ineligibility for the HEALTHY study are the same as those of the CES-D.

The CES-DC is also a psychometrically sound instrument with demonstrated validity and reliability, although the psychometric properties become more limited in younger children (Fendrich, Weissman, & Warner, 1990). The CES-DC has high internal consistency (α = .89), good concurrent validity with various diagnostic and demographic groups, and convergent validity with self-devaluation and low-self-esteem. Furthermore, the CES-DC has been demonstrated to be a good screening instrument for detecting Major Depressive Disorders in Children (Fendrich et al., 1990).

The Screen* for *Child Anxiety Related Emotional Disorders (SCARED).

The SCARED (Birmaher et al., 1997) was used to assess for symptoms of anxiety in children occurring over the previous three months. It is available in the public domain. The SCARED has 41 items that assess anxiety symptoms in five areas including panic/somatic symptoms, (e.g., "When I feel frightened it is hard to breathe", generalized anxiety, (e.g., "I am a worrier"), separation anxiety, (e.g. "I don't like to be away from my family"), social anxiety, (e.g., "It is hard for me to talk with people I don't know well"), and school avoidance. (e.g., "I am scared to go to school"). Items are rated on a 3-point Likert scale ranging from '0' (i.e., 'not true or hardly ever true') to '2' (i.e., 'very true or often true'). Scores can range from 0 to 82, and a total cut-off score greater than or equal to 25, which indicates the likelihood of an Anxiety Disorder, was used to determine ineligibility for the HEALTHY study.

The SCARED has demonstrated internal consistency (α .74 through .93), test-retest reliability (r =70 to .90), and convergent validity between and within various anxiety disorders. As well, the SCARED was shown to be a promising instrument for screening for anxiety disorders in children (Birmaher et al., 1997). These psychometric properties were

replicated with a new sample several years after the screening measure was developed (Birmaher et al., 1999)

The Eating Disorders Diagnostic Scale (EDSS).

The EDDS (Stice, Telch, & Rizvi, 2000) was used to screen for the existence of eating disordered behaviours in parents and children (Birmaher et al., 1997). This measure is a 38-item self-report questionnaire, similar to the Eating Disorders Examination (Cooper & Fairburn, 1987). This questionnaire has 22 questions rated on various Likert scales (e.g. '0'/not at all to '6'/extremely), categorical responses (e.g., number of days in a week that symptoms were present) and dichotomous responses (e.g., yes/no). Eligibility for the HEALTHY study was based on having responses that were not indicative of the presence of a current eating disorder based on diagnostic decision criteria set forth by Stice and colleagues (2000).

It is important to note that for ethical reasons all children, irrespective of their reading level, were administered the EDDS in an interview format. Extreme caution was used in asking children about items #15 through #18, and these items were modified to be more open ended. Specifically, instead of asking children if they had ever made themselves vomit (item #15), use laxatives/diuretics (item #16), fasted or skipped meals (item #17), and/or engaged in excessive exercise (item #18) in order to prevent weight gain or counteract the effects of over-eating, children were asked one open-ended question regarding whether they have ever done anything to prevent weight gain or counteract the effects of over-eating. If a positive response was given, then children were asked to report what behaviours they had engaged in. The rationale for substituting these questions came out of concern of suggesting these strategies to children.

The EDDS has demonstrated solid psychometric properties (Stice et al., 2000; Stice, Fisher, & Martinez, 2004), including temporal reliability (κ = .80), criterion validity with interview diagnoses (κ = .83), strong internal consistency (α = .89), good test-retest reliability (*r* = .87), and convergent validity with other measures of eating pathology. Moreover, at its most discriminatory cut-off point both specificity (0.91) and sensitivity (0.90) are high. The EDDS has also been validated in youth (Lee et al., 2007) with demonstrated internal consistency, construct validity, and test-retest reliability.

Primary measures.

Demographics.

A number of demographic variables (Appendix G) were collected, including: parent/child age, parent/child gender, parent/child ethnicity, parent/child highest level of education, household income, place of residence (i.e., urban, suburban, or rural), and the number of computers in the family home.

Body composition.

A number of body composition measurements were obtained during the baseline visit. Initially, these measures were intended to be primary outcome measures in the intervention study. It is important to keep in mind that all of these measures are highly correlated with one another since they provide related measures of body composition in a given individual.

Percent body fat. Body fat percentage in HEALTHY participants was measured using foot-to-foot bioelectrical impedance analysis scale that participants were to stand on during their reading. The percent of body fat is derived by the level of resistance through the body to electrical impulses. In a recent study, it correlated very highly with the gold standard dual x-ray absorptiometry (*r* =/> 0.95) (Goldfield et al., 2006).

Body mass index. Body composition was also assessed in children and adults using BMI. BMI is a height-to-weight ratio (i.e., body weight in kilograms divided by height in meters squared) commonly used to determine weight status in individuals. Therefore, the height and weight of all participants was recorded for the purposes of calculating BMI. BMI is intended to be a simple measure of overall body composition (World Health Organization, 1995), and it is associated (r = 0.7 to r = 0.8) with more exact measures of body fat (Keys, Fidanza, Karvonen, Kimura, & Taylor, 1972; Daniels, Khoury, & Morrison, 1997). Measurement of BMI is considered a Grade A recommendation (i.e., gold standard) for screening and monitoring overweight status according to the 2006 Canadian Clinical practice guidelines on the management and prevention of obesity in adults and children (Lau et al., 2007)

Waist circumference. Waist circumference is an important measure of overweight and overall health. This was measured in centimetres and was landmarked at the widest part of the participant's waist. Measurement of waist circumference is also considered a Grade A recommendation for screening and monitoring overweight status according to the 2006 Canadian Clinical practice guidelines on the management and prevention of obesity in adults and children (Lau et al., 2007). Waist circumference was measured according to Canadian guidelines (Douketis, Paradis, Keller, & Martineau, 2005), just above hip-level, while participants stood with their feet hip-width apart following a normal expiration.

. ***Psychosocial measures.***

Various psychosocial measures were administered at baseline in order to evaluate whether the factors assessed were related to adherence and attrition in the HEALTHY study.

Motivation. Motivation was evaluated using the Self-Regulation Questionnaire (SRQ), which assesses domain specific differences in types of motivation within individuals.

The original format of this questionnaire was designed for children and related to motivation and locus of control in school (Ryan & Connell, 1989). The original format has been adapted to measure motivation and self-regulation for a number of different behaviours across the lifespan, including the Self-Regulation Questionnaire for Exercise (SRQ-E) (University of Rochester, 2008) (Appendix H). The SRQ-E authors were contacted and it was suggested by them that the SRQ-E be adapted to create a version for healthy eating (SRQ-HE; Appendix I), by simply replacing all instances of 'exercise' with 'eat healthy' (e.g. 'I want to *exercise* because I would feel bad about myself if I did not *exercise"* was changed to "I want to *eat healthy* because I would feel bad about myself if I did not *eat healthy"*).

The SRQ-E and SRQ-HE produce a number of scores, reflecting various levels of self-regulation. The higher level categories refer to controlled motivation (i.e., motivation that has a more external locus of control) and autonomous motivation (i.e., motivation that has a more internal locus of control) (University of Rochester, 2008). Two subscales are embedded within each of these categories. The controlled motivation category includes external motivation (4 items; e.g., "I want to exercise/eat healthy because others would be angry at me if I did not") and Introjected motivation (4 items; e.g. ""I want to exercise/eat healthy because I feel guilt if I do not exercise/eat healthy"). The autonomous motivation category includes identified motivation (4 items; e.g., ""I want to exercise/eat healthy because I believe exercising/eating healthy helps me feel better") and intrinsic motivation (4 items; e.g., "I want to exercise/eat healthy because I enjoy exercising/eating healthy"). Scores within each category and subscale were averaged, thus scores ranged from 0 to 7 with higher scores reflecting a higher level of motivation and self-regulation.

Health-related quality of life (HRQL). HRQL was assessed in children using the Paediatric QOL Inventory Version 4.0 (PedsQL 4.0) (Varni, Seid, & Rode, 1999; Varni,

Seid, & Kurtin, 2001) at baseline and three-month post-treatment. The PedsQL 4.0 has 23 items that are rated using a 5-point Likert-type scale ranging from '0' (i.e., '*never a problem')* to *'4' (i.e., 'almost always a problem'*). The PedsQL 4.0 yields four generic core scales based on mean responses to items: (a) physical functioning (8 items; e.g., "I find it hard to walk more than one block"); (b) emotional functioning (5 items; e.g., "I feel sad or blue"); (c) social functioning (5 items; e.g., "I have trouble getting along with peers"); and (d) school functioning (5 items; e.g., "I find it hard to concentrate"). As well, it yields a psychosocial health summary score which is a composite of emotional, social, and school functioning, a physical health summary score which is the same as the physical functioning score, and a total score. Responses to items are linearly transformed to a scale ranging from 0 to 100, where higher scores indicate better HRQL.

Varni and colleagues (2001) explored the reliability and validity of the PedsQL 4.0 in a sample of 963 children. Internal consistency reliability were primarily adequate to good, with the exception of the school functioning scale which approached adequacy: total scale score ($\alpha = 0.88$), psychosocial health ($\alpha = 0.83$), physical functioning ($\alpha = 0.80$), emotional functioning ($\alpha = 0.73$), social functioning ($\alpha = 0.71$), and school functioning ($\alpha = 0.68$). The PedsQL 4.0 also demonstrated good construct validity and was able to distinguish healthy children from those with acute and chronic health conditions. Furthermore, the PedsQL has been validated in obese children (Schwimmer et al., 2003).

Health-related quality of life (HRQL) was assessed in parents using the SF-36 Health Survey ***(SF-36)*** (Ware & Sherbourne, 1992). The SF-36 has 36 items that are rated with a combination of Likert-scales, categorical responses, and dichotomous responses. The SF-36 assesses eight domains of HRQL, including physical functioning (10 items; e.g. ability to lift/carry groceries), role limitations due to physical health difficulties (4 items; e.g. cutting

down time doing activities/accomplishing less because of physical health), bodily pain (2 items related to magnitude of pain and interference with life), general health (5 items; e.g. to provide an overall health rating as excellent, very good, good, fair, or poor), vitality/energy (4 items; e.g. having pep/feeling full of life), social functioning (2 items related to extent and time), role limitations due to emotional difficulties (3 items; e.g., cutting down time doing activities/accomplishing less because of emotional difficulties) and mental health. The items were transformed into the various scales using the Medical Outcomes scoring method (Ware, Kosinski, & Gandek, 2001; Ware & Sherbourne, 1992) ; scores range from 0 to 100 whereby higher scores reflected better HRQL (or less pain) in the assessed domains.

A number of studies have evaluated the psychometric properties of the SF-36; these studies have found consistent psychometric properties and are summarized in depth elsewhere (The SF-36, 2011). For example, internal consistency was demonstrated to be greater than $\alpha = .80$ for most studies (in examining more than 25 early studies using the SF-36) and test-retest reliability in these early studies were consistent. As well, factor analytic studies have demonstrated good construct validity for the scale and the scale has been compared to other health survey questionnaires in order to establish good content validity.

Self-esteem. Self-esteem was assessed in parents and children using the Rosenberg Self-Esteem Scale (Rosenberg, 1965). The Rosenberg Self-Esteem scale has 10 items that are rated on a 4-point scale where respondents indicate the degree to which they agree (e.g., strongly or slightly) or disagree (e.g., strongly or slightly) with statements related to self-esteem (e.g. “I am able to do things as well as most other people”). Items are counter-balanced; therefore five of the items are reverse scored. Scoring for the Rosenberg was based on the summation of responses to ten questions (range 0 to 3), with reverse coding used for negatively phrased questions. The scale ranges from 0 – 30, with scores below 15 suggesting

low self-esteem, scores between 15 and 25 in the normal range, and scores greater than 25 suggesting high self-esteem. The RSES was initially developed with adolescents, however is used with people of all ages. It is one of the most widely used measures of self-esteem (Byrne, 1996). In paediatrics the RSES has demonstrated internal consistency ($\alpha = 0.75 - 0.92$), test-retest reliability ($\alpha = 0.85 – 0.88$), and concurrent validity of 0.6 to 0.72 (Myers & Winters, 2002).

Self-monitoring diaries. Data was also collected from self-monitoring diaries where participants recorded red food intake, physical activity measured in minutes and intensity, screen time, time spent on the intervention, and weekly weight. Unfortunately this data was grossly incomplete because of adherence and attrition issues and could not be used for analysis.

Adherence and attrition. Program adherence was assessed using login frequency and the number of completed weekly quizzes, a measure suggesting participant's had read the weekly educational module. Attrition was measured using the total number of weeks, if any, that were spent in the intervention.

Evaluation questionnaire.

Parents and children completed an evaluation questionnaire to complete at the post-treatment visit (Appendix J). The purpose of this questionnaire was to understand which components of the HEALTHY study were most important. The first question asked if families liked the website. Subsequent questions asked families to evaluate the main components of the HEALTHY intervention, including the psychoeducation, weekly quiz, self-monitoring, journal section goals, coach contact, and the discussion board. Participants responded to questions regarding how much they liked the various components, ease of use, learning, and ability to understand. Additional questions were asked in regards to coach

support. Items were rated on a 4-point scale where respondents indicated the degree to which they agree (e.g., 'yes, definitely' or 'yes, generally') or disagree (e.g., 'no, not really' or 'no, definitely not') with statements. Participants were also asked to rank the various components from most to least helpful. Finally, participants were given the opportunity to provide additional comments in an open-ended space.

Data Analysis Plan

The initial primary question sought to evaluate whether the HEALTHY study would result in differences in body fat percentage, BMI, waist circumference, and weight loss at 3-month post-treatment in children and their parents. Secondary questions concerned whether or not the intervention would result in increased physical activity and HRQL and decreased screen time. Analysis of variance (ANOVA), and/or analysis of covariance (ANCOVA) if baseline differences were found, were proposed to analyze outcomes. As well, exploratory regression analyses were planned in order to see if family SES was related to treatment outcome, with the hypothesis that higher family income would be associated with greater improvements (e.g., body composition, QOL) in comparison to lower income families.

Due to limitations of the data as a result of poor adherence and attrition in the HEALTHY study, these hypotheses were adjusted to become more exploratory in nature. The primary revised hypotheses were that baseline levels of motivation to exercise and eat healthy, self-esteem, and HRQL would be related to adherence and attrition for children and their parents, whereby higher levels of motivation and lower levels of self-esteem and HROL would be related to better adherence and a greater number of weeks in the HEALTHY study. The secondary hypothesis was that body composition at baseline would be predictive of adherence and attrition, whereby greater levels of overweight/obesity would be related to better adherence and a greater number of weeks in the HEALTHY study. Finally, it was

hypothesized that family income would be related to better adherence and a greater number of weeks in the HEALTHY study. In order to keep the analyses consistent, correlation analyses were conducted in order to investigate all hypotheses.

Results

Preliminary Analyses

Prior to the analyses, all variables of interest were examined using SPSS for accuracy of data entry, missing values, out of range values, and fit between their distributions and the assumptions for correlation analyses. Some out of range values were found and corrected by obtaining the proper values from the measures. One missing variable was found on the SF-36 (HRQL for parents) and a mean substitution was performed using the mean of the other 4 responses on that scale, as recommended by Ware and colleagues (2002). Variables were examined for significant skew (defined as skew > 1.97) and transformed in order to reduce skew and improve pairwise linearity. All scales that were significantly skewed were first transformed using square root transformations.

If skewness remained significant following square root transformations then logarithmic (i.e., LG10) transformations were performed followed by inverse transformations for those that remained significant. Throughout the transformations, all scales that were negatively skewed were reflected into their mirror image for linear transformations. Following data transformations, variables were examined for outliers. No extreme outliers remained following transformations with the exception of one variable, which will be discussed later in this section.

In five cases, skew remained significant following logarithmic transformations and inverse transformations were performed. Of these five variables three remained significantly skewed; however, for two of these variables the skew was slight (e.g. inverse of HRQL for

parents, physical role skew = 2.26) and there were no extreme outliers within these inverse-transformed variables. Therefore, these three variables were not further transformed or dichotomized for the analysis. That is, the inverse transformations of these variables were used for the analysis. One variable maintained significant skew (i.e., the inverse transformation of HRQL for parents, emotional role, skew = -5.41) and had three extreme outliers that were not eliminated using inverse transformations; therefore, this scale was dichotomized into a "high" category (i.e., scores of 100, representing the upper limit and 88% of the sample) and a "low category" (i.e., remaining scores ranging from 16 to 67, representing 12% of the sample). A list of all the variables used for the analysis, and the type of transformation performed (if any), are listed in Table 4.

Baseline characteristics.

Rosenberg Self-Esteem Scale.

Overall, the majority of the sample presented with self-esteem in the normal range. Children obtained an average score of 21.4 (*SD* = 5.3) and parents obtained an average score of 22.9 (*SD* = 3.9). Overall, one child (score = 11) and one parent (score = 13) from the same child-parent dyad responded in a way suggestive of low self-esteem. Conversely, eight children and five parents responded in a way suggesting high self-esteem. Neither child or parent self-esteem was skewed; therefore no transformations were performed on these variables.

Health-Related Quality of Life (HRQL).

Results of HRQL for children in the HEALTHY study can be found in Table 5, while the transformed variables are listed in Table 4. Recall that scores on this measure range from 0 to 100 and higher scores are indicative of better HRQL. In general, children presented with HRQL scores on the various scales as follows: physical functioning/physical health summary

Table 4

Variables Transformed for Analysis

Variable	Type of Transformation
Adherence	
# of log-ins (child)	Logarithmic
# of log-ins (parent)	Logarithmic
# of log-ins (family)	Logarithmic
Log of weeks	Logarithmic
Inverse of # quizzes	Inverse
HRQL	
PEDS-QL Physical Functioning	Square root (mirror)
PEDS-QL Psychosocial Functioning	Square root (mirror)
PEDS-QL total score	Square root (mirror)
SF-36 Physical Functioning	Square root (mirror)
SF-36 Physical Role	Inverse (mirror)*
SF-36 Social Functioning	Logarithmic (mirror)
SF-36 Emotional Role	Dichotomized
Motivation	
External Motivation to Exercise – Child	Log transformed
External Motivation to Exercise – Parent	Inverse transformed*
Introjected Motivation to Exercise – Parent	Square root (mirror)
Identified Motivation to Exercise – Parent	Logarithmic (mirror)
Intrinsic Motivation to Exercise – Parent	Square root (mirror)
External Motivation to Eat – Child	Square root
External Motivation to Eat – Parent	Inverse
Identified Motivation to Eat – Parent	Logarithmic (mirror)
Intrinsic Motivation to Eat – Parent	Square root (mirror)
Relative Autonomy Index/Exercise – Parent	Square root (mirror)
Controlled Motivation to Exercise – Child	Square root
Controlled Motivation to Exercise – Parent	Square root
Controlled Motivation to Eat – Child	Square root
Autonomous Motivation to Exercise – Parent	Logarithmic (mirror)
Autonomous Motivation to Eat – Parent	Logarithmic (mirror)
Body Composition	
Baseline Child BMI	Square root

*This variable was still significantly skewed (skew = 2.2) following an inverse transformation.

**This variable was still significantly skewed (skew = 2.2) following an inverse transformation.

Table 5

HRQL in HEALTHY Participants

	M	*SD*	Range	Skew*
PEDS-QL (children)				
Physical Functioning/Physical Health Summary	76.6	16.3	34.4 - 96.9	-2.2
Emotional Functioning	68.6	19	20 - 100	-1.25
Social Functioning	68.8	21.1	10 - 100	-1.69
School Functioning	68	18.3	25 - 95	-0.91
Psychosocial Health Summary	68.4	16.8	20 - 96.7	-2.27
Total Score	71.3	16.3	25 - 96.7	-2.41
SF-36 (parents)				
Physical Functioning	85	17.2	25 – 100	-4.3
Role limitations/physical health difficulties	80	35.6	0 - 100	-3.1
Bodily pain	63.9	24.5	10 - 100	-1.5
General health	67.1	18.3	35 – 97	0.07
Vitality/energy	48.2	18.1	20 – 80	0.5
Social functioning	86	22	12.5 - 100	-4.2
Role limitations/emotional difficulties	94	18.6	16.7 – 100	-7.6
Mental health	72.2	13.6	48 – 96	0.2

n =25

*Skewness prior to transformations

(*M* = 76.6, *SD* = 16.3), emotional functioning (*M* = 68.6, *SD* = 19), social functioning (*M* = 68.8, *SD* = 21.1), school functioning (*M* = 76.6, *SD* = 16.3), psychosocial health summary (*M* = 68.5, *SD* = 16.8), and total score (*M* = 71.3, *SD* = 16.3). These results suggest adequate HRQL in these domains.

Results of HRQL for parents in the HEALTHY study can be found in Table 5, while the transformed variables are listed in Table 4. Interpretation of these scores is the same as for HRQL in children. In general, parents presented with HRQL scores on the various scales as

follows: physical functioning (*M* = 85, *SD* = 17.2), role limitations due to physical health difficulties (*M* = 80, *SD* = 35.6), bodily pain (*M* = 63.9, *SD* = 24.5), general health (*M* = 67.1, *SD* = 18.3), vitality and energy (*M* = 48.2, *SD* = 18.1), social functioning (*M* = 86, *SD* = 22),

role limitations due to emotional difficulties (*M* = 94, *SD* = 18.6), and mental health (*M* = 72.2, *SD* = 13.6).

Motivation.

Descriptive statistics of scores on the various self-regulation scales for children and their parents can be found in Table 6. Overall, autonomous motivation to exercise was higher for both children (*M* = 4.5, *SD* = 1.1) and parents (*M* = 5.3, *SD* = 1) in comparison to controlled motivation to exercise in children (*M* = 2.4, *SD* = 1.3) and parents (*M* = 2.3, *SD* = 0.9). Likewise, autonomous motivation to eat healthy was higher for both children (*M* = 4.3, *SD* = 1.3) and parents (*M* = 5.3, *SD* = 1.1) than controlled motivation to eat healthy in children (*M* = 2.4, *SD* = 1.3) and parents (*M* = 2.6, *SD* = 1). Within autonomous motivation, identified motivation to exercise (Child *M* = 4.8, *SD* = 1.3; Parent *M* = 5.9, *SD* = 1.1) and eat healthy (Child *M* = 4.7, *SD* = 1.4; Parent *M* = 5.9, *SD* = 1) was highest. This means that

Table 6

Motivation to Exercise and Eat Healthy in the HEALTHY study

	Children			Parents		
	M	*SD*	Range	*M*	*SD*	Range
Exercise						
Controlled	2.4	1.3	1 – 6.25	2.3	0.9	1 – 4.5
External	2.1	1.4	1 – 6.8	1.4	0.7	1 – 3.5
Introjected	2.7	1.3	1 – 5.8	3.1	1.4	1 – 5.5
Autonomous	4.5	1.1	1.8 – 6.1	5.3	1	1.8 – 6.8
Identified	4.8	1.3	2 – 7	5.9	1.1	2 – 7
Intrinsic	4.1	1.2	1.5 – 6	4.7	1.1	1.5 – 6.5
RAI	4.9	3.3	-4 – 9.8	7.7	2.9	0 – 11.5
Eat Healthy						
Controlled	2.4	1.3	1 – 5.5	2.6	1	1.3 – 4.9
External	2.2	1.4	1 - 5.5	1.9	1.1	1 – 4.5
Introjected	2.5	1.4	1 – 5.5	3.5	1.3	1.3 – 5.5
Autonomous	4.3	1.3	1.9 – 6.9	5.3	1.1	2.1 – 6.8
Identified	4.7	1.4	2 – 7	5.9	1	2.8 - 7
Intrinsic	3.9	1.4	1.5 – 6.8	4.7	1.2	1.5 – 6.5
RAI	5.5	4	-1.5 – 14.5	8.5	4.3	-1.5 – 14.8

n =25
RAI = Relative Autonomy Index

both children and parents have accepted that exercise and eating healthy are personally important to them; however they are not fully self-determined and autonomous in regulating these behaviours. Within controlled motivation, external and introjected self-regulation was similar for parents and children across both exercising and eating healthy. A number of motivation variables were skewed .

Body composition.

Body composition at baseline was previously described. None of these variables had significant skew, with the exception of child BMI, which was square root transformed. One non-extreme outlier remained following transformation; therefore this outlier was left in the dataset.

Demographic variables.

Demographic variables were previously described. None of the variables of interest to analyses had significant skew or outliers.

Adherence and Attrition

Adherence was measured using the number of log-ins to the treatment website including youth log-ins, parent log-ins, and family log-ins, as well as the number of weekly quizzes completed. Attrition was measured using the number of weeks in the intervention; descriptive statistics can be found in Table 7. In six child-parent dyads (24%) neither the child, nor their participating parent ever logged into the HEALTHY website. Including these six dyads, more than half the sample (52%) failed to complete the first week of the HEALTHY study. Therefore, the HEALTHY study had a high attrition rate of 92%.

Behavioural Change and Body Composition

The quality and consistency of self-monitoring was poor, and the available data was insufficient for intention-to-treat analyses. However, a qualitative description of outcomes is

Table 7

Adherence and Attrition in the HEALTHY study

	Mean	Std. Deviation	Range
Adherence			
Log-ins			
Child	12.9	21	0 - 84
Parent	13.4	24.3	0 - 113
Family	26.3	44.7	0 - 197
Number of Completed Quizzes	2.8	6.1	0 - 24
Attrition			
Number of Weeks	2.5	4.1	0 - 12

possible. Six families (24%) completed at least 3 weeks in the intervention and reported at least some promising results in terms of behavioural changes and body composition (Table 8). For example, five of the six families who completed 3 weeks reported decreased intake of red foods from their first to last week of tracking; the sixth family did not have complete data to evaluate. Four of the six families reported increased minutes engaged in physical activity (daily average in minutes) from their first to last week of tracking; the other two families did not have complete data to evaluate. Three families reported decreased screen time (daily average in minutes) over their time in the intervention while two families reported increased screen time; the remaining family did not have complete data to evaluate. All four families who completed between three and ten weeks in the intervention reported at least some weight loss for both family members (i.e. parent and child).

Of the two families who completed the program, both reported minimal weight loss during the study according to weekly self-report data (when reported); however, by the end of the study their weights resembled baseline levels (with small gains or losses observed). The only body composition change that appeared meaningful was the loss of nearly 7% body fat in one of the children enrolled in the study. Despite little change in body composition, both families reported at baseline a high level of satisfaction with their achieved behavioural changes. One family really emphasized at their post-treatment visit the positive changes they had subjectively experienced in their quality of life, which they attributed to the study.

Evaluation Questionnaire

Two families completed the evaluation questionnaire at the post-treatment visit. Given the small number of participants who completed the questionnaire, no statistics will be presented; rather responses will be reported qualitatively. In response to whether or not they liked the website, all completers ($n = 4$) responded very positively (i.e., ‘yes, definitely). In

Table 8

Summary of behavioural and body composition changes in families who completed at least 3 weeks of more of the HEALTHY study

		Changes from Baseline Week to Last Reported Week (Self-report)				
Family	Number of Weeks	Red Foods	Exercise	Screen Time	Weight Change	Body Composition at Post-treatment*
A	3	↓	↑	↓	Parent: - 5 lb. Child: - 2 lb.	n/a
B	6	↓	↑	↓	Parent: - 10 lb. Child: - 8 lb.	n/a
C	10	↓	n/c	↑	Parent: - 8.4 lb. Child: - 2.6 lb.	n/a
D	10	i/c	i/c	i/c	Parent: - 8 lb. Child: - 4 lb.	n/a
E	12	↓	↑	↑	Parent: - 1 lb. Child: n/c	Parent Weight: - 0.3lb BMI: – 0.1 Fat percent: + 0.3% Child Weight: + 5 lb BMI: + 0.8 Fat percent: + 1%
F	12	↓	↑	↓	Parent: + 2 lb. Child: n/c	Parent Weight: + 0.5 BMI: – 0.2 Fat percent: - 0.8% Child Weight: n/c BMI: - 1.3 Fat percent: - 6.9%

n/c = no change
i/c = incomplete self-monitoring

response to the questions regarding the various components in terms of likeability, ease of use, learning, and ability to understand, three out of four participants replied positively (i.e., 'yes, definitely' or 'yes, generally') to all questions. The fourth participant (a child) responded similarly for most components, with the following exceptions: (a) in terms of likability negative responses were provided for the journal and goals section, (b) the journal section was rated as *not* easy to use, (c) it was reported that the child did not learn from the journal or goals section, and (d) the journal and goals section were rated as *not* easy to understand.

In terms of the rankings, there was overwhelming agreement regarding which components of the website were most helpful, with coach support, education, and self-monitoring always listed as the top three components, albeit in various orders, for all participants. As well, all participants ranked the discussion board as least helpful. Other than these similarities at the extremes of the rankings, the other components varied in terms of rank. In terms of coach support, all participants (n = 4) responded positively (i.e., 'yes, definitely' or 'yes, generally') to additional questions, including whether the coach showed personal interest in them, helped them, answered their questions, and motivated them.

Only one participant left an additional comment in the open-ended section to thank the coach for their support throughout the program.

Main Analyses

Pearson's product-moment correlation analyses were performed to investigate whether self-esteem, HRQL, motivation, body composition, and age were related to adherence to the HEALTHY study. Kendall's tau-b correlation analyses were performed to investigate whether categorically-defined demographic variables (e.g., number of computers in the home, family income) were related to adherence to the HEALTHY study. All

correlation analyses were two-tailed, and because these analyses were primarily exploratory, a liberal level of significance was maintained ($\alpha = 0.05$).

Self-esteem.

Self-esteem in overweight/obese children was related with the number of times parents logged into the HEALTHY website ($r = 0.42$, $r^2 = 0.18$ $p = 0.04$). This means that with higher levels of self-esteem in children, parents were more likely to log-in to the website. The proportion of variance in parent log-ins accounted for by youth self-esteem was 18%. Child self-esteem was not significantly related with the other adherence measures. Parent self-esteem was not significantly related with any of the adherence or attrition measures.

HRQL.

Two variables measuring HRQL in overweight/obese children were significantly related with various adherence and attrition measures. The strongest and most robust relationships were found for the physical functioning/physical health summary scale. This domain of HRQL in youth was related with all measures of adherence, including the number of youth log-ins ($r = -0.41$, $r^2 = 0.17$, $p = 0.04$), parent ($r = -0.56$, $r^2 = 0.31$, $p = 0.004$), and family ($r = -0.5$, $r^2 = 0.25$ $p = 0.01$) log-ins, as well as the number of completed quizzes ($r = 0.41$, 0.17, $p = 0.04$). The physical functioning/physical health summary scale was also related with attrition, as measured by the number of weeks in the intervention ($r = -0.41$, $r^2 = 0.17$, $p = 0.04$). It is important to keep in mind that physical functioning was mirror transformed prior to analyses, therefore as physical functioning increased: (a) the number of log-ins and weeks in the intervention increased, and (b) the number of completed quizzes decreased. The proportion of variance in the various adherence/attrition measures accounted for by the youth's physical functioning was 17% for the number of youth log-ins, number of

weeks in the intervention, and number of completed quizzes, 31% for the number of parent log-ins, and 25% for the number of family log-ins.

The total paediatric QOL score for overweight/obese children was significantly related to the number of parent log-ins (r = -0.43, r^2 = 0.19, p = 0.03) with the proportion of variance in parent log-ins accounted for by overall paediatric QOL at 19%. The total score for paediatric QOL was also mirror transformed, therefore as HRQL decreased the number of log-ins also decreased.

General health in parents was significantly related with adherence and attrition measures. In terms of adherence, general health was significantly related with child (r = -0.51, r^2 = 0.26, p = 0.004) and family (r = -.42, r^2 = 0.18, p = 0.038) log-ins. This means that as perceived general health in parents decreased, child and family log-ins increased. The proportion of variance in log-ins accounted for by general health in parents was 26% and 18% respectively. In regards to attrition, general health was significantly related to the number of weeks in the intervention (r = -.57, r^2 = 0.33, p = 0.003). That is, as general health decreased in parents the families were more likely to stay in the intervention longer, with 33% of the proportion of variance in the number of weeks in the intervention accounted for by general health in parents.

Motivation.

Two motivation variables measuring aspects of healthy eating were significantly related to various adherence measures. Interestingly, significant relationships were only found in terms of motivation in parents. Introjected motivation to eat healthy in parents (considered a 'controlled' form of motivation) was significantly related with the number of parent log-ins (r = -0.51, r^2 = 0.26, p = 0.009), number of family log-ins (r = -0.41, r^2 = 0.17. p = 0.04), and number of weeks in the intervention (r = -0.45, r^2 = 0.20, p = 0.03). The

proportion of variance in these adherence measures accounted for by introjected motivation to eat healthy in parents was 26% for the number of parent log-ins, 17% for the number of family log-ins, and 20% for the number of weeks in the intervention. Introjected motivation to eat healthy was mirror transformed, therefore as this form of motivation increased the number of log-ins (all forms) and the number of weeks in the intervention increased.

Identified motivation to eat healthy in parents (considered an 'autonomous' form of motivation) was significantly related with the number of family log-ins ($r = 0.42$, $r^2 = 0.18$, $p = 0.04$) and the number of weeks in the intervention ($r = 0.41$, $r^2 = 0.17$, $p = 0.04$). The proportion of variance in these adherence measures accounted for by identified motivation to eat healthy in parents was 18% for the number of family log-ins and 17% for the number of weeks in the intervention. Identified motivation to eat healthy in parents was mirror transformed, therefore as this form of motivation increased the number of log-ins and weeks in the intervention decreased. None of the motivation variables related to exercising was significantly related to the various adherence measures.

Body composition.

A number of significant relationships were found between measures of body composition in parents at baseline and the various adherence and attrition measures, namely child and family log-ins and the number of weeks in the intervention. Given the number of significant relationships (likely because of the degree of relationship between the various body composition measures) these are summarized in Table 9. Interestingly, body composition in parents was highly related to the number of youth log-ins, family log-ins, and the number of weeks in the intervention. In all cases, as measures of body composition indicated higher levels of overweight/obesity, log-ins and the number of weeks in the intervention increased.

Table 9

Relationships between Parent Body Composition (at baseline) and Adherence

	Adherence				
	Child Log-ins	Parent Log-ins	Family Log-ins	Number of Weeks in the Intervention	Number of completed quizzes
Parent Body Composition					
Weight	$r = 0.54$ $p = 0.01$	*ns*	$r = 0.42$ $p = 0.04$	$r = 0.41$ $p = 0.05$	*ns*
BMI	$r = 0.54$ $p = 0.01$	*ns*	$r = 0.42$ $p = 0.05$	*ns*	*ns*
Waist Circumference	$r = 0.55$ $p = 0.01$	*ns*	$r = 0.43$ $p = 0.04$	*ns*	*ns*
Fat Mass	$r = 0.50$ $p = 0.02$	*ns*	*ns*	*ns*	*ns*
Lean Mass	$r = 0.49$ $p = 0.02$	*ns*	*ns*	$r = 0.46$ $p = 0.03$	*ns*
Percent Body Fat	$r = 0.45$ $p = 0.03$	*ns*	*ns*	*ns*	*ns*
Water Mass	$r = 0.49$ $p = 0.02$	*ns*	*ns*	$r = 0.46$ $p = 0.03$	*ns*

Only one significant relationship was found in terms of child body composition and attrition; child BMI was significantly related with the number of weeks in the intervention (r = -0.46, r^2= 0.21, p = 0.02) in that as BMI increased (suggesting higher levels of overweight/obesity) the number of weeks in the intervention decreased. The proportion of variance in the number of weeks in the intervention accounted for by child BMI was 21%.

Demographics.

Pearson's product-moment correlation analyses were conducted to investigate whether youth or parent age was related to adherence in the HEALTHY study; no significant relationships were found. Kendall's tau-b non-parametric correlation analyses were performed to investigate whether categorically-defined demographic variables, such as gender, income (in categories), place of residence (i.e., urban, suburban, rural), and number of computers in the household were related to adherence in the HEALTHY study. Correlation analyses were not performed between parent gender and the adherence/attrition measures because only one parent was male.

As well, because household income was a variable of interest, it was transformed into a new variable using a median split, to create a 'low' category (annual income under $20,000 through to $64,999), representing 48% of the sample, and a 'high' category (annual income of $65,000 and over), representing 52% of the sample. A Kendall's tau-b non-parametric correlation analysis was repeated in order to further investigate if household income was related with adherence or attrition. Again, no significant relationship was found.

Discussion

A three-month family-based intervention for paediatric obesity was piloted with 25 parent-child dyads. The lifestyle intervention was delivered over the internet to overweight children and a participating parent. Unfortunately, only two dyads completed the intervention

therefore a statistical analysis of outcome data was not possible. However, a qualitative analysis of outcomes suggested some positive behavioural changes, but little change in body composition was noted.

The failure to find changes in body composition at post-treatment is consistent with some previous research. For example, research by Moore (2007) did not find significant body composition changes following the delivery of an internet-based intervention to overweight and obese children aged six to twelve. Other researchers have noted initial body composition changes at six months in a sample of overweight adolescents and a participating parent (White et al., 2004a; Williamson et al., 2005a); however, these changes were not maintained over the long-term (Williamson et al., 2006b). Unfortunately, so little research has been carried out in this area resulting in few studies to compare results to.

Due to the high level of attrition (92%), the hypotheses of this study were revised to examine whether baseline characteristics in children and their parents were related to treatment adherence and attrition. Primary hypotheses were related to self-esteem, HRQL, body composition and motivation to eat healthy and exercise. Descriptive statistics were also examined. Only one other study similar in nature was identified that also examined associations between baseline characteristics and attrition.

A number of significant relationships emerged; interestingly, a larger proportion of these relationships were found to be based on the parents' baseline characteristics. For example, various factors were found to be related to an increase in adherence to the study protocols in the form of log-ins to the website, as well as a greater of number of completed weeks in the study. These included increased parental motivation and beliefs that healthy eating and exercise are important, higher levels of parental overweight and obesity and lower levels of general health.

These results are consistent with the revised hypotheses, but an unexpected finding was that these characteristics of the parent led not only to increases in their participation, but also in that of their overweight child. For parents, it is possible that having lower perceived general health and increased levels of overweight or obesity was a motivating factor in adhering and staying in the intervention for a longer duration. It is also possible that these parents had greater fears of their children becoming increasingly overweight/obese. However, surprisingly, as child BMI increased families were more likely to drop-out earlier. It is possible that these children experienced reduced self-efficacy in following the intervention, which may have influenced the family to leave treatment earlier. This latter finding is consistent with previous research with children where higher BMI has been shown to be associated with attrition (Barlow & Ohlemeyer, 2006; Skelton, DeMattia, & Flores, 2008).

With regards to parental characteristics potentially increasing child participation, this group of parents may have exerted more pressure or influence by emphasizing the negative impacts of excessive weight on their own health. Alternatively, children who were exposed to parents in a worsened physical condition may have been more motivated to adhere in order to potentially avoid a similar state in their future.

In terms of parental motivation and beliefs about exercise and healthy eating, it was only high levels of controlled motivations that led to an increase in log-ins and time spent in the study across family members, while higher degrees of autonomous control actually decreased them. These relationships are quite interesting given the research on forms of motivation. For example, research from the University of Rochester (2008) demonstrated that controlled motivation is typically high when individuals have more of an external locus of control regulating their behaviour; that is individuals feel that external factors - for

instance other people - have a greater influence on their behaviour than factors from within themselves.

Therefore, if external factors played a greater role in regulating and motivating their behaviours, parents with higher forms of controlled motivation may have been more likely to adhere and spend more weeks in the intervention because they were being monitored by their coach, an external person. The opposite could be true for those with more autonomous forms of motivation in that these parents may have felt more able to change their behaviours and less likely to feel the need for a coach to continue on in the intervention. These parents may have also decided to continue making lifestyle changes on their own, without the assistance of the intervention.

Finally, another interesting finding was that motivation to exercise and eat healthy was nearly identical within groups (parent or child) for exercising and eating healthy. That is, when the various forms motivation to eat healthy was high, so too was the same form of motivation to exercise and vice versa in terms of types of motivation that were lower. This suggests that there may be an underlying construct, such as a motivation to live a healthy life.

In addition to the parent characteristics that impacted adherence and attrition, there were also some child characteristics that were found to be related to both parental and child degree of participation. These included the child's level of self-esteem, physical functioning and overall paediatric QOL.

In terms of self-esteem, parents were more likely to adhere if their children had higher self-esteem. While no other research could be identified in this area, some studies looking at self-efficacy, a similar construct, found it played a role in treatment adherence for adolescents with insulin-dependent diabetes (e.g., Ott, Greening, Palardy, Holderby, &

DeBell, 2000). In the current context, it may be that parents were more motivated to adhere longer if their children communicated beliefs and attitudes, or demonstrated behaviours, congruent with higher self-esteem, which may have led parents to believe in a greater potential for better outcomes.

Among the health-related QOL variables related with attrition and adherence, physical functioning in children was the most robust of these relationships. Moreover, the strongest relationship between physical functioning and adherence/attrition was in terms of parent log-ins, such that increased physical functioning in children led to more log-ins (of both children and parents) and number of weeks in the intervention. The reasons for this finding are unknown and future research may seek to further understand this. However, it is possible that children with stronger physical abilities felt greater self-efficacy in terms of complying with physical activity recommendations, which could also assist them in adhering to screen time recommendations. Therefore, increased self-efficacy in terms of following recommendations may have increased adherence and attrition for children. It is possible that parents with children who were highly self-efficacious in terms of complying with the study, may have experienced a higher level of motivation in terms of adherence and attrition. Again, future research would need to investigate these hypotheses and/or explore alternative hypotheses.

What is less intuitive is that the completion of weekly quizzes decreased with higher levels of physical functioning in children when the other measures of adherence and attrition increased. If self-efficacy is involved, perhaps these children (and their parents) felt such high competence in completing the two of the three main study requirements (i.e., increased physical activity and decreased screen time) that they felt the additional readings and related quiz were less necessary in achieving lifestyle change. An alternative, but related

explanation, is that those children with higher physical functioning may have been less overweight/obese than the children with reduced and/or impaired physical functioning. If this is the case, it is possible that the smaller children (with higher physical functioning), and their parents, may have felt the additional readings and related quiz were less necessary in achieving lifestyle change.

In addition, higher total paediatric QOL in children (a composite of psychosocial and physical QOL) was associated with increased parent-logins. This may be a function of increased motivation to adhere to the intervention when QOL was not as compromised as it could have been. This finding is consistent with research done in adult women, where lower levels of QOL were related to early attrition from a group-based weight management program (Teixeira et al., 2004).

Secondary revised hypotheses sought to evaluate whether demographic variables, including household income, would be related to adherence and/or attrition, however no significant relationships emerged. A review article of attrition from paediatric obesity interventions conducted by Skelton and Beech (2010) suggests that face-to-face research is mixed in terms of whether demographic variables (e.g. race, income, education) are related to attrition. Only one comparable internet-based study was identified that also examined whether demographic variables were related to attrition, this study found that earlier attrition was associated with being white, having a depressed mood, and having shape concerns (Jones et al., 2008).

As noted in the introduction, Eysenbach (2005) suggests a 'Science of Attrition' is needed. This would allow researchers to clarify the issues of impact and uptake in web-based research. This is particularly salient in research since high rates of attrition threaten validity. Furthermore, it is critical to be able to explain why some participants complete the research

protocols while others drop-out, so that results to be meaningful and generalizable to the population at large.

Relatedly, implementation is another important factor to consider. Durlak and DuPre (2008) report implementation is never perfect and positive results can be observed with levels around 60%. This is especially important in light of adaptation, which refers to modifications and adaptations that are made during the implementation of a program. They highlight adaptation as having some of the most interesting findings in terms of program implementation. They argue that adaptations are inevitable, as most providers make modifications during implementation; however what they highlight as interesting is that most providers view adaptations as a failure of implementation, especially as it impacts upon fidelity. In their review only three studies evaluated the impact of adaptation on study outcomes. Of note, all of these studies found that adaptation had a positive impact on outcomes (Blakely et al, Kerr et al, McGraw et al).

The HEALTHY study did make a number of adaptations that were detailed in the procedure section, especially pertaining to the self-monitoring reported by the initial cohort of the health study. Specifically, self-monitoring requirements were significantly reduced (e.g. monitoring only red foods, as opposed to all foods; monitoring total minutes of exercise as opposed to duration, type and intensity) based on participant feedback, in order to reduce the burden of self-monitoring reported by this cohort.

Program implementation research by Stevens and colleagues (2008) evaluated the implementation of a web-based program to support weight maintenance in adults. Their implementation included a three-month period of pilot testing, where participants and staff provided feedback that would help the researchers understand the user experience and improve utilization. One key finding suggested having an individualized website orientation

including account set-up, as well as practice and training in using the website. The HEALTHY study similarly provided individual orientations to the website with participants at their baseline meeting and provided opportunities for practicing the navigation of the website. Participants were also shown specifically how to make self-monitoring entries. Another key finding from Stevens and colleagues (2008) was the importance of an automated reminder system. While the HEALTHY website did not have the capability of having automated reminders, all participants were sent at least three reminders to participate when they were not logging-in to the study website.

Other potentially important aspects for compliance and attrition as reported on the evaluation questionnaires completed by participants who completed the entire intervention in the current study include coach support, education and self-monitoring. While feedback indicated the majority of impressions regarding the website, and the various components, were positive, these particular components were ranked by all participants as being the most important. Durlak and DuPre (2008) comment that a number of researchers have argued that it is essential to identify the core features of interventions (e.g., Dusenbury, Brannigan, Falco, & Hansen, 2003; Mowbray, Holter, Teague, & Bybee, 2003) however "researchers have been slow to respond, so the active ingredients of most programs are currently unknown (Durlak & DuPre, 2008, p. 342)". Thus, this is a strength of the current study.

Limitations and Directions for Future Research

Firstly, due to using a non-probability sampling approach, the external validity of the current study is limited. As well, the sample was restricted on a number of variables in that parents were primarily female (95%) and well-educated (90% either having completed post-secondary education or graduate school). Therefore the results of the study may not be generalizable to males or those with less education. However, participants were relatively

diverse in terms of child age, family income, place of residence and the number of computers in the household and so the findings may be generalizable in this regard.

As well, given the exploratory nature of the study a liberal level of significance was maintained, using two-tailed tests and an alpha of .05. While this helps in identifying factors that may potentially be related to attrition and adherence it also leads to the increased risk of making type one errors, also known as a false positive error, given the number of comparisons made in the current study. In this case, some of the factors identified as potentially related to attrition and adherence may not actually be related.

Another limitation of the present study is the fact that several baseline characteristics were evaluated based on self-report measures. These measures may be subject to social desirability and depend on the capability and willingness of participants to complete them both honestly and accurately. Despite measures taken to assure participants of the confidentiality and anonymity of the study, a testing environment that requires participants to meet in-person with the researcher may motivate the desire to respond in socially desirable ways.

A final limitation of this study was its correlational nature which does not allow inference of cause and effect. Future research could use comparison groups and/or more longitudinal methods to further examine any potential causal relationships between the variables of interest.

Finally, future research may seek to further understand some of the relationships that emerged from this study. Foremost, future research may seek to answer the question of why parent HRQL, motivation, and body composition is more related with adherence and attrition in a web-based lifestyle intervention, when the intervention was primarily designed to target childhood overweight/obesity. As well, future research may seek to better understand the

relationships between adherence/attrition and child self-esteem, HRQL and motivation to eat healthy and exercise. It is possible that self-efficacy plays a role in these relationships and future research may wish to explore this hypothesis more. Finally, it could be interesting to investigate whether there is an underlying construct that links motivation to eat healthy and exercise.

As the field of paediatric obesity treatment continues to expand a better understanding of individual factors that relate to adherence and attrition should emerge. As knowledge in this area increases, interventions will hopefully evolve and become more efficacious.

Study #2: The needs and barriers of families who participated in a web-based paediatric lifestyle intervention: A qualitative inquiry.

Stephanie Leclair, Danijela Maras, Elizabeth Kristjansson, Gary Goldfield

The Needs and Barriers of Families who Participated in a Web-based Paediatric Lifestyle Intervention

Background

Attrition has been a major issue in face-to-face paediatric obesity treatment, with a recent review of weight loss interventions for adolescents reporting attrition rates up to 45% (Stuart, Broome, Smith, & Weaver, 2005). Similarly, a Cochrane review (Oude Luttikhuis et al., 2009) of randomized-controlled trials also reported attrition rates of up to 42% for all paediatric obesity interventions. Among individual studies there is wide variation in the reported rates, with roughly half of participants dropping out early. Epstein and colleagues (2007) published a follow-up of face-to-face family-based interventions over the past 25 years and reported attrition rates ranging from 5% to 25% (M = 13.5) at the low end of attrition rates. Conversely, others have reported much higher rates; for example, Skelton and colleagues (2008) reported an attrition rate of 73% and a multi-center study in Europe reported rates over 90% (Pinelli et al., 1999).

A recent review of attrition from paediatric weight management programs found that very few studies have examined the problem of attrition in this population (Skelton & Beech, 2011). Over a ten-year period they identified six articles that specifically evaluated attrition and an additional four studies that reported factors associated with attrition. In their review they reported that more than half of families entering treatment dropped out early; furthermore, dropout occurred for 25-50% of participants was following the initial visit. Their findings showed that being African-American, having a higher BMI, and being subjected to psychosocial and behavioral stressors were significantly related to attrition. As well, three of the reviewed studies asked families the reasons they dropped out; common reasons included the time commitment, missed work/school, cost, appointment times and

scheduling, and the content of educational materials. Skelton and colleagues (2011) concluded that much remains unclear around factors that contribute to attrition and what changes could improve retention in paediatric obesity interventions.

As Skelton and Beech (2011) state in their article: "Although 'attrition' and 'adherence' are distinct, attrition can be viewed as an exaggerated form of non-adherence (p. 277)". Based on this inter-relationship they argue that models of adherence may help to clarify knowledge about attrition. However, these models have largely drawn on different areas of research, such as chronic illness in children. In terms of childhood obesity, some research has been done in the area and has found that low and moderate levels of initial adherence are related with attrition (Israel, Silverman, & Solotar, 1987).

Attrition and adherence are also significant issues for internet research (Eysenbach, 2005). For children enrolled in weight-based internet interventions it appears these may be even more significant issues, perhaps partly because attrition and adherence are already significant in face-to-face paediatric weight interventions. Moore (2007) attempted to deliver a lifestyle intervention to children aged six to twelve years old. Low adherence and high attrition was a significant issue in Moore's (2007) study; out of 730 potential participants who created a log-in on the studies open-access website, 69 met criteria and consented to the research, 30 accessed treatment, and only 10 completed the treatment and post-treatment measures (Moore, 2007a). From time of consent, this represents an attrition rate of 85%. Of note, several modifications were made to Moore's (2007) study with the aims of improving adherence, such as simplifying self-monitoring and streamlining educational materials. Similar to these findings, the HEALTHY study (Study #1 in this dissertation) had an attrition rate of 92%, with 24% of families never logging in to the intervention website.

A recent systematic review of randomized web-based weight management programs in children and adolescents reported attrition rates ranging from 4.9% to 30% (An, Hayman, Park, Dusaj, & Ayres, 2009). Only two of the interventions that met their selection criteria were exclusively composed of the age groups targeted by the HEALTHY study and had attrition rates of roughly 12%; one of these studies was a 4 week obesity-prevention summer camp for 8 year-olds followed by an 8-week internet intervention (Baranowski, Baranowski, Cullen, et al, 2003), the other study involved a two-week program for 11 to 13 year-old girls (Marks, Campbell, Ward et al, 2006). Their lower attrition could be due to the brief duration of treatment and/or inclusion of face-to-face components in one study.

Adherence to weight management programs may be age related; being older is predictive of adherence in and attrition from web-based interventions, in that older participants tend to have better adherence and later attrition (Verheijden, Jans, Hildebrandt, & Hopman-Rock, 2007; Wangberg, Bergmo, & Johnsen, 2008). Relatedly, interventions of similar intensity and structure as Moore (2007) and the HEALTHY study have been successfully implemented in adult populations (Tate et al., 2003; Tate et al., 2001). For example, a recent review by Neve and colleagues (2010) found that attrition from web-based obesity interventions for adult obesity, in the majority of their reviewed articles, just surpassed 20%. This is consistent with face-to-face treatment of adult obesity done in RCTs, where attrition rates hover around 21% (Wadden, Crerand, & Brock, 2005)

Although adherence and attrition are major problems in both face to face and web-based paediatric obesity interventions, few investigators have reported the reasons behind these high rates and research is only beginning to evaluate factors associated with attrition. The purpose of the present paper is to report on a qualitative study regarding barriers to

completion of an intensive, web- and family- based lifestyle intervention program for paediatric overweight/obesity.

Purpose

Qualitative research allows for access to rich and nuanced information that may be missed using traditional data-collection techniques. This may be particularly important in this novel area of research. The purpose of this study was to understand factors that interfered with adherence and attrition in the HEALTHY study (Study #1). Therefore, parents were asked about their impressions of the study, in the event that negative impressions of the study (i.e., structure, coach) decreased adherence, as well as the barriers they experienced in adhering with the intervention. As well, parents were asked about their needs in seeking services for their overweight/obese children.

A number of investigators have argued that it is important to adopt an ecological perspective and consider multiple levels/systems that impact on obesity (Lau et al., 2007; Breslow, 1996; Egger & Swinburn, 1997; Lau et al., 2007). Therefore, the current study adopted a social-ecological approach in evaluating barriers at the individual (i.e., factors within the parent or child), family (i.e., factors within the family or household), social (i.e., factors within the social environment), and environment (i.e., factors that are typically geographic) levels.

Method

Sampling and Data Collection

All 20 families who initially participated in the HEALTHY study were contacted by telephone, and parents were invited to participate in a brief semi-structured interview regarding their impressions of the study, the barriers they experienced in either starting and/or adhering to the study, and their general needs in seeking services for their

overweight/obese children. We included parents rather than children as they would have a better understanding of barriers and needs and would be better able to respond to questions in rich and descriptive ways. As well, it was thought that by minimizing participant burden, more families would be likely to agree.

Of these 20 parents who were contacted, 16 agreed to participate (80% response rate); 2 parents (10%) stated that they were not interested in participating (one was too busy, the other did not provide a reason), one parent did not respond to voicemail messages, and one parent could no longer be reached.

Interviews were conducted over a 9-week period, from June 18, 2010 through September 1, 2010. To reduce demand characteristics associated with having the HEALTHY coach contact families for invitation and conduct the interview a Research Assistant in the Research Institute at CHEO, who had experience conducting interviews, took on this portion of the data collection. This Research Assistant signed a confidentiality agreement and was trained by the lead investigator using a semi-structured interview guide (Appendix K). Parents were then contacted by phone and were invited to participate in a telephone interview at a convenient time for them. Parents were informed that the interviews would be tape-recorded and transcribed verbatim to ensure accuracy.

Parents who indicated that they were interested in participating were scheduled for an interview time and were emailed a password-protected consent form (Appendix L) for their review prior to the interview. At their interview time the consent form was reviewed and participants were given an opportunity to ask any questions prior to providing verbal consent. All 16 participants provided their consent, following which the interview proceeded.

Initial questions about barriers and needs were open-ended; following participants' responses they were asked to rate the various barriers and needs in terms of severity on a 7-

point Likert scale. Barriers were rated from '0' (i.e., "not at all a barrier") to '6' (i.e., "very much a barrier) and needs were rated from '0' (i.e., "not at all important") to '6' (i.e., "very important"). Follow-up questions regarding barriers asked specifically about individual-level, family-level, social-level, and neighbourhood-level barriers. Interviews were between 16 and 144 minutes in duration, with the majority of interviews lasting less than 30 minutes.

Data Coding and Analysis

Once the interviews were completed, all interview data was transcribed verbatim. Coding and analysis of the data was conducted using QDA Miner, a qualitative organization and analysis software package (Provalis Research, 2011). An initial code list was derived by having both coders independently analyze the longest interview and another interview chosen at random to compare themes and build a codebook. Based on this preliminary list of initial codes from the data was conducted using guidelines developed by Braun and Clarke (2006). Agreement between the two coders was quite high (94%). However, one coder tended to use more macro-level themes (e.g. study specific barriers, family-level barriers, education) whereas the other coded tended to use more micro-level themes (e.g. lack of time, lack of motivation) in coding. The coders agreed to use the more macro-level themes because of the low frequency of micro-level themes. A common codebook was developed and remaining interviews were coded using this code book. Review and refinement of themes was conducted collaboratively as they became identified. Saturation appeared to be reached, as no new themes emerged from the data during the final interviews.

Results

Demographics

The sample comprised 1 male and 15 females. Four had never logged-in to the HEALTHY website, three logged-in a few times (*range* = 1 - 3) but never self-monitored,

two participated in the intervention (i.e., logged-in and self-monitored) for one week or less, two completed the intervention, and one parent each participated in the intervention for : ten days, four weeks, nine weeks, ten weeks, and eleven weeks.

Their initial referral sources to the HEALTHY study were varied: seven were referred by family physicians, four heard about the study through friends and family, three found out about the study from the CHEO website, one saw an advertisement on Facebook, and one saw an advertisement in a local newspaper.

Impressions of the HEALTHY Study

The majority of participants (n =12) reported positive impressions of the study, the website, and the research personnel.

> *"I actually thought it was quite well done overall in terms of what was there. There was the three components and that was great. I really think in that regard it was quite well thought out and simplistic enough for kids in terms of reduce this, add this, the stop light program. .. I found that the program itself was really well laid out."*

Some families were so impressed with the study they felt strongly that the study should continue to be offered to others. *"(My) overall impression...It's a great program and I think it should continue...It is very important and I think that a lot of people would find it useful."* These parents also reported positive experiences at their baseline visit.

> *"The whole experience was phenomenally positive. Just when you said think back, I just started to smile. It was a really great day... I thought that (it) was extremely excellent... The whole experience of coming into the lab, coming in through the...corridors of CHEO, the whole trek to the lab from the front door, the whole thing was really fun... She made it fun and engaging for my*

son... I understood everything that we were doing... The whole thing was really good, plus while the process was being explained to us, it was actually in and of itself a learning experience about behavioural change... The ideas were communicated really clearly to my son."

Three parents found the study to be too cumbersome and overwhelming. These families stated that the breadth and depth of the study felt beyond their abilities and/or the abilities of their children.

"It was a little intimidating . . . we got weighed and did our little questionnaire thing that was fine . . . the diet and the things were just too cumbersome. I don't know if they could have given me any more information. I think we just got busy, you know what I mean? All the stuff that the kids are involved in..."

Finally, one family reported neutral impressions. This parent was happy with the research personnel and the first visit for herself, but thought the program might be too difficult for her daughter. This parent was also excited by some of the equipment in the lab, but then disappointed that is was not being used for the HEALTHY study.

"The research personnel was great... really informative. I found that there was a bit too much paperwork. For me it was OK, but for my daughter, because she is 11, it seemed like there was too much for her. She wasn't taking it in. My impression of the lab was, 'Oh they've got a treadmill in here. We're going to be on this treadmill, wonderful', but that wasn't the case. Otherwise, everything was OK."

Participants were also asked specifically about their impressions of the various program components, including: web-based coach support, daily self-monitoring, the Traffic

Light Plan, increasing physical activity to meet Canada's Physical Activity Guidelines, decreasing screen time, the weekly readings and quiz, and the reward system.

Coach support.

The majority of parents (n =13) reported positive impressions of the web-based coach support. Many of these parents appreciated receiving regular feedback, and liked the fact that they could ask the coach questions and receive prompt replies. They also felt the coach took a personal interest in them. One mother stated

> "*It was good because myself I had... an emotional eating problem and I told many times to ... (the coach) and she replied to my e-mails and my concerns. She gave me some links for other websites that were helpful to read and get information from."*

Many parents also stated that their children looked forward to hearing from the coach. *"I liked how my daughter looked forward to the e-mails, and knowing that her weighing in was being monitored by someone else, she enjoyed that.*" Finally, some families admitted that they did not use the coach support as much as they could have but appreciated that is was available. "*It was good. I don't think we used it like we should have, but it was available to us."*

Other parents (n =2) reported more neutral impressions of the coach support. These parents received some coach support but felt that it could have been intensified with personal emails (outside of the study website) and/or telephone contact, to remind participants to stay engaged with the website. One parent reported that she did not feel pressure from her coach, but she was unsure whether to interpret this as the coach respecting her privacy or the coach feeling disinterested.

Finally, one family was dissatisfied with the coach support she received. This parent felt that she did not receive any coach support, however admitted to receiving an email from her coach, but felt confused with the information. *"(The coach) sent one e-mail explaining what we are supposed to do, but it wasn't quite clear. They said you have to measure this, you have to do this, but they never go through how."* Unfortunately, this mother did not report her continued concerns about this following the baseline visit to the coach; therefore the situation could not be rectified.

Daily self-monitoring.

All but one of the families struggled with self-monitoring. Several parents (n =3) stated that it was difficult to do the self-monitoring, but they recognized and appreciated its importance. As one mother stated, *"It's a good thing ... at the end of the day you have to think about what you did and what you ate and it helped to be aware exactly how much effort you put (in)."*

The majority of parents talked about how their busy lives and lack of time interfered with their self-monitoring. For some parents it was very difficult to track information on paper, whereas others struggled more with the additional step of inputting information into the study website.

Some parents talked about the difficulties and increased burden associated with trying to self-monitor for both themselves and their child. It was difficult to keep track of what their children ate while their children were at school and/or with caregivers. "*It's just a lot to monitor when you have kids and you've got stuff going on, and you can't have eyes and ears everywhere."* One parent felt so overwhelmed with the self-monitoring that it prevented her from starting the program:

> *"Yes, that was probably why I haven't started it yet because I know it's going to take awhile to sit there and put my input and the kids input. Exactly everything that they eat... however I know it's necessary, I just haven't done that."*

Finally, a number of parents stated that they did not attempt any self-monitoring and could not comment on it.

Traffic light plan.

The majority of parents (*n* =12) said that they liked the Traffic Light Plan and thought it was a good addition to the study. Parents felt that it made the eating component of the study simple to follow. For many, it helped to increase their awareness of nutrition. "*It helped me a lot to be aware what's good and what's bad and what's in the middle. From that time until now I always read the nutritional facts to know if it is red, green or yellow."* These parents also reported that their children liked the plan. "*It was kind of fun for her. Easy ... to know that there are certain categories that you can give is great. It's a cool name. She kind of enjoyed that part and we did it for awhile."*

The remaining parents (*n* =4) had mixed impressions about the Traffic Light Plan. Some parents felt the program could have been further simplified and/or they felt they needed more support in mastering the initial learning curve.

> *"At first it was a bit confusing because you think it could be a yellow food when in fact it is a red food, but once you read the booklet and the guide reference, it helps you to categorize the food groups."*

Some parents felt frustrated that some foods were red foods, when they expected they would be yellow or green foods. Finally, some parents reported some confusion

about the exceptions. For example, all families were asked to consider yogurt with sugar content greater than 10 grams as an exception from being a red food.

Increasing physical activity.

All parents agreed that increasing physical activity was an important study component. Several parents found that increasing activity was fairly easy for both them and their child, and in some cases these behaviour changes were maintained beyond participation in the study.

> *"Increasing physical activity... was wonderful. That was our biggest motivation, certainly for my daughter. She started on the treadmill 45 minutes a day from the time that she started the program. She loves it and it is kind of her…. If anything, that is her biggest change as a result of the program."*

Some parents also found having specific goals (in terms of minutes per day) encouraging and motivating. However, though all agreed on the importance of increasing activity, some parents struggled with the practicalities of it. For these parents, some of the difficulties they discussed included the challenges in finding the time, difficulty motivating children who are inactive or dislike exercise, and difficulties being active in poor weather.

Decreasing screen time.

Most parents (n =15) agreed that decreasing screen time was an important component of the study and had positive impressions of it. Many parents stated that they were already trying to limit screen time prior to the study and, in fact, some parents said that their families are so busy they rarely have opportunities for extended screen time. Some parents did encounter some resistance from their children but were able to get their children to cooperate. For many, the hardest part of decreasing screen time for the study was the actual process of self-monitoring screen time.

One parent stated that it was really hard to decrease screen time, however it was difficult to disentangle this from the other changes asked from the study. When asked specifically about her impressions of decreasing screen time she responded *"That was hard. It was like drop everything... It was a lot. I have other children in the household so it wasn't just (us)"*.

Weekly Reading and Quiz. The majority of parents (*n* =14) had positive impressions of the weekly reading and quiz. This included parents who did not do the weekly readings but agreed it was an important component of the study. Of those who did the readings and quizzes many said they were easy to do, were at an appropriate reading level, and found them informative.

> *"The weekly reading also gave us a lot of information and it's was good because it increased our knowledge. It wasn't hard. If you spent even 10 minutes or 15 minutes at least reading. If you want to read it one time you feel that there are a lot of things to read about it. But weekly you chunk it."*

Moreover, many of them said their children enjoyed doing the readings and quiz. "*She would do it every Sunday morning; she would sit and read... she did not think it was too hard."* As well, one parent talked about using the quiz to help reinforce her son's learning:

> *"I think that they are necessary, and also help kids remember. For instance, if you're driving somewhere in the car and trying to find a healthy snack to eat, you can use the question from the quiz that you had previously completed, to ask your child what an appropriate snack would be. So if you phrase your question the same as it was phrased on the quiz, it will not only serve as simple recall for the child, but will help them see the usefulness of what they have learned and read."*

Some parents with positive impressions did find it difficult to keep up with the weekly readings because of competing demands, and eventually stopped doing them.

Finally, one parent did not have a positive impression of the readings because she felt they were silly and offered little new information. "*I thought (they were) kind of dorky…A lot of it though is just basic common sense that you already know... No magic bullet in there or anything."*

Reward system.

Half of the parents (*n* =8) did not use the reward system, although most agreed that it was an important component.

Six parents stated that they used the reward system and that it was very useful in encouraging behaviour change. Parents also felt they learned parenting skills from using the reward system.

> *"I learned a lot from it. You shouldn't reward your son by using food, that was the first thing. When my son was doing something good I would give him chocolate or whatever... that was before I learned that it was a bad thing. I'm doing the same thing now with my youngest. So the reward system was explained good and they gave me many ideas like movies, friends, phone calls and other choices that were there."*

For many of the parents who used the reward system they said it was the most encouraging part of the program for their child. "*That is probably the most encouraging thing for my son because he is the type that needs a lot of encouragement and I think that that part of it is very important. He just found it very positive."*

Two parents did not use the reward system in the way that it was set up, but rather used a modified reward system. One of these parents said...

> *"I personally did not do it... We did a couple of times in the sense that I happened to change her bedtime and told her it was because she was doing such a good job and working out and stuff....We went to a movie one time to celebrate all the good work that we had been doing...We just kind of incorporated it into growing older, being more mature, growing up. We did it that way. We didn't really tie it into the Healthy Study."*

Another parent said that her son was so internally motivated he did not need external rewards to reinforce his new behaviours.

> *"He is so excited that he is losing weight, that is a reward in itself and he really was ... You know, he lost 8 pounds and so that was huge. So I said, I don't think that I need to come up with a reward. And I don't know what would be rewarding to him. The things he loves are sweets, and screen (time), and so to have the reward being internal to me is worth gold."*

Barriers to Participation

A number of barriers to participation were reported. Naturally, there was quite a bit of overlap between the barriers within families. As well, some barriers were identified in more than one level, depending on the context in which it was discussed by the parent. For example, lack of time was included as an individual-level barrier for some parents, if it was discussed by the parent in that context (e.g. their child or themselves lacking time), but also as a family-level barrier, when it was discussed in the context of the family lacking time and/or being too busy with other commitments.

Study specific barriers.

A number of study specific barriers were reported. Four parents stated that the number of study requirements were a barrier. This referred to the combination of reducing

red food intake and sedentary activity, increasing screen time, doing the weekly readings, and the self-monitoring. This category frequently overlapped with 'lack of time' and the competing demands of school, work, and leisure. "T*hey wanted you to write down your greens, your reds, how much you walk ... That's a lot of time."* The overall study requirements received an average rating of 5 in terms of severity.

The complexity of the self-monitoring and the process of inputting self-monitoring entries into the HEALTHY website was a barrier for three parents. Some parents did not feel the self-monitoring was appropriate for that age group. "*I found that it was at a kid's level other than the recording and submitting of the information."* Parents also felt that self-monitoring was too time-intensive because it took multiple phases to complete, including initially recording information on paper and then having to log-in to the website and re-enter the information. Dietary self-monitoring also required determining what food category (i.e., green, yellow, red) the various foods fit into. One mother also said that on a number of occasions, she entered into her food diary and the computer did not save the information. This barrier received an average severity rating of 5.75.

Two parents reported that navigating the study website was problematic. These parents reported some difficulties finding some of the additional information on the website (e.g. recipes) and having to contact their coach to find this information. Navigating the website received an average severity rating of 4.5.

Other study specific barriers included the fact that the website/program did not provide specific meal plans (n =1, severity = 6), there was too much content in the weekly readings (n =1, severity = 3.5), the website would come up as "unavailable" in web browsers (n =1, severity = 3), having frequent computer 'crashes' (n =1, severity = 6), and a child having difficulty using the computer (n =1, severity = 6).

Individual-level barriers.

A number of individual-level barriers were reported

Lack of motivation.

The greatest individual level barrier, reported by 8 parents, was a 'lack of motivation'. For many, motivation referred to feeling capable of engaging in all the study components with the information provided on the website and support from the coach. Motivation often overlapped with the 'lack of time/competing demands' barrier

> *"(It was) too overwhelming. Keep in minds these are kids going to school and they are on the computer. They don't have time. ... It was more like they wanted me to get involved in there. It was too much. It really wasn't motivating at all.*

As well, another factor that was often mentioned in connection with 'lack of motivation' was that more face-to-face contact might have increased motivation. Lack of motivation received an average severity rating of 4.25.

Lack of time/competing demands.

Lack of time and/or having competing demands was reported by 3 families when asked about barriers. However, the theme of lacking time came up in other interviews in different contexts.

> *"I had the link. I had the manual. I never managed to have the time. Everything got really busy in the evening, homework, I had some travel for work, somehow I didn't manage to anchor myself and get me and my child sitting at the computer...Somehow we just seemed to be struggling... I didn't manage to create the time."*

For another mother, her lack of time was further complicated by the fact that her son lived with his father on weekends...

> *"I have to say that at the end of the day, during the week, for me it's all (a) huge rush to get home, get dinner, get all of those things done, get him to bed on time, and then in the morning getting up and then he disappears on the weekend. He is at his Dad's... I don't have the weekends...Somehow we had to integrate activity into our life and I didn't know how to do it and there are sometimes when I am so tired that it's hard to have enough energy as a parent to get the activity in there."*

Lack of time and/or having a hectic life received an average severity rating of 4.25.

Other individual-level barriers.

A number of additional individual-level barriers were reported. For children, these barriers included too much reading for a child with high functioning autism (n =1, severity = 6), one child's fitness level at the time (n =1, severity = 6), a child's self-consciousness about their body (n =1, severity = 6), the fact that one child needed orthotics to be active (n =1, severity = 6), and the fact that one child was not invested in the study from the start (n =1, severity = 6). For parents, these barriers included food sensitivities (n =1, severity = 5), recovery from an injury (n =1, severity = 6), and looking for a new job (n =1, severity = 2). As well, one family mentioned a lack of accountability related to the delivery of the intervention over the internet (n =1, severity = 4).

Family-level barriers.

A number of family-level barriers were reported.

Lack of time due to family commitments.

The greatest barrier in this category, reported by 8 parents, was a lack of time due to family commitments and or other things going on in the lives of the family members.

> *"To be honest we didn't even really get that far* (regarding weekly quizzes). *I can't blame it all on the study. What was happening in our world at that stage, it was just too big a commitment, the time and sitting down each night and doing the readings, and testing. It was a little bit too much. I think that scared us away at first and then we didn't really give it (as) much commitment as we should have."*

Lack of time due to family commitments received an average severity rating of 4.75.

Home computer space.

This was reported by two families. For one mother, the location of her computer in the basement was a barrier:

> *"It was overwhelming for me. I think some of the reasons that was overwhelming personally for me was the position where my computer was. My computer is placed in the basement... (and) I have children who are not well, so it was very difficult for me to sit even for 10 minutes a day in the basement... I have to be always on the main floor with the babies, so it wasn't right for me."*

For another mother, the barrier was more related to the organization of the workspace. "*My computer environment is like a chaotic mess, so it's not like a child friendly area of the house... so for starters I didn't really have a good space."* This barrier received an average severity rating of 5.

Lack of support.

Lack of support from others in making behavioural changes was reported by two families. This often referred to the types of available foods kept in the house, whether it was decreasing the availability of unhealthy foods or incorporating a wider variety or different types of healthy foods (e.g. milk with 1% fat instead of 2%). *"There was a lack of really valid support from his Dad... ... it's not that Dad actively opposed it; it was just that his support was absent."* The lack of support from other family members received an average severity rating of 4.5.

Single-parent household.

Finally, one parent reported that being a single-parent was a significant barrier to participating (severity rating =6). This parent discussed how the financial burden and childcare burden interfered.

> "*Being a single Mom makes it harder for me to create opportunities for my kid to be active. There's just not two of me. If there was a second me, that other me could be spending 100% of the time being active with my child."*

Multiple households.

Another family stated that the study did not adequately accommodate children living in two households (n =1, severity = 5),

Social-level barriers.

Two social-level barriers were reported to interfere with participation in the HEALTHY study.

Lack of friends.

Two parents stated that their child's lack of friends for support was a significant barrier (severity rating = 6).

Difficulty adhering when with friends.

Two parents stated that their children had difficulty adhering to the program when out with friends (severity rating =3.75). *"The hard thing (is) to make a child understand is that when you go out, just because your friends are eating chips, your friends are having Coke or whatever, that you can't."*

Environmental-level Barriers.

Rural residence.

Two families reported that living in a rural area impacted on their participation due to the lack of recreational opportunities where they lived. These parents said that the range of recreational opportunities is not as diverse and most of they are usually too tired at the end of a long day to travel to the city for recreational opportunities. Lack of recreational activities in rural areas received an average severity rating of 4.5.

Other environmental-barriers.

Additional barriers reported at the environmental-level included finding appropriate exercise clothes to fit an overweight child (n =1, rating = 6), finding it difficult to be active outdoors during a cold winter (n =1, rating = 5), and the distance from the closest grocery store with healthy food offerings (n =1, rating = 3).

Parents' Needs in Seeking Services for their Overweight/Obese Children

A number of needs in seeking services for their overweight children were reported by parents. A total of 13 themes were elicited (Table 10). Four over-arching categories emerged from these themes. One of the themes was collapsed into another theme as a sub-theme. The four main categories included: (a) Knowledge and Education, (b) Social Supports, (c) Tools for Success, and (d) Program Goals. Again, there was some overlap in themes with barriers, and also among the various needs of these families.

Table 10

Parents Needs in Seeking Services for their Overweight/Obese Children; Themes

Categories	Themes
Knowledge and Education	Healthy Eating Knowledge
	Education on Active Living
Social Supports	Coaching
	- Involvement of a Person Outside the Family
	- Intensified Coaching
	- Sub-theme: Increased Accountability
	Peer Social Support
Tools for Success	Tips and Tricks
	Physical Activity Component
	Meal plans and Recipes
	Make it a Family Effort
	Adapting for Special Circumstances
Program Goals	Weight Loss
	Empowerment

Knowledge and education.

Knowledge and education emerged as an important need. This category included the two themes: 'Healthy Eating Knowledge' and 'Education in Active Living'.

Healthy eating knowledge.

'Healthy eating knowledge' was mentioned by 9 parents and referred specifically to receiving knowledge and education on healthy eating practices (e.g. portion control) and healthy food choices. Many parents felt they already had much of this knowledge, but that it could be difficult to convey to their children and/or difficult to put into practice. "*I have quite a bit of knowledge about healthy eating ...but I think because I don't necessarily put it into practice myself, it is hard to convey that to the kids."* Also, parents wanted to ensure that their children received this type of information because they felt unsure how much children learned about healthy eating in school. 'Healthy Eating Knowledge' received an average importance rating of 5.25.

Education on active living.

'Education on active living' was mentioned by 4 parents and referred to general information on living a healthy and active lifestyle from a trusted source. As well, parents highlighted the importance of teaching active living as a priority. "*Physical activity will change anyone. Making that a priority and teaching them now that it's a priority. I think that was certainly a benefit of the program."* One mother talked about her struggles in reducing screen time, and said that for her son reading the materials helped in getting him to cooperate with being less sedentary. "*I did control the screen time and ... explained (it) to him and (when) he read about it he was more concerned about it."* 'Education on Active Living' received an average importance rating of 6.

Social supports.

'Social supports' also emerged as important to parents. This category included two themes related to 'Coaching' and 'Peer Social Support'.

Coaching.

The coaching theme included 'Involvement of a Person outside the Family' and 'Intensified Coaching'. 'Intensified Coaching' also included a sub-theme of 'Increased Accountability'.

Involvement of a person outside the family.

Involvement of a person outside the family was mentioned by six parents who felt that it was important to have a credible and reliable source, outside of the family, to deliver information and provide support to their children. As well, many parents felt that having such a person helped to motivate and encourage their children...

> *"As a parent you can always encourage your child, but he's 13 now. He has a mind of his own, but having that program where someone outside the family is encouraging your child. I find that it is very positive, and like I said, in our case when my son realized someone else was also monitoring his progress he found that encouraging as well. That was very positive."*

'Involvement of a Person outside the Family' received an average importance rating of 6.

Intensified coaching.

'Intensified coaching' was mentioned by eight parents and referred to a person outside the family to support all the lifestyle changes being made. "*We needed the support in lifestyle choices like diet, exercise, that stuff … We needed the breakdown of the information, of how to achieve that in terms of the red, green, yellow categorization of food choices."* This theme also included seeking more intense coaching support and wanting more frequent

reminders to participate and adhere. While all families received at least three reminder emails to their personal email account, it appears that at least one parent either did not recall receiving an email, or something may have happened to her email reminder (e.g. sent to 'spam', deleted by a family member).

> *"I think what would have been helpful personally, and I thought a lot about this, I think if an actual e-mail had come out once a week. An actual e-mail, not on the website... to my actual e-mail saying, "We've noticed you haven't been on the website." But to send me an e-mail on the website, saying you haven't been on the website, well I'm not there to get it. So ... to follow-up saying, "You've been doing so well, but you haven't been on the site for the last 12 days. How are you doing? Check in on the site." This would have been so huge."*

Finally, some parents discussed wanting to have more "real-time" contact with their coach, whether that contact was in-person, over the telephone, or over web-based video conferencing such as Skype (i.e., free software program that allows users to make video calls over the internet).

> *"Somehow this kind of learning and this kind of behavioural change I needed interpersonal contact. A voice. A person. I suppose if we had ourselves appropriately set up with a camera and a microphone, then Skype would have been a good idea. We would have been able to see the other person. I don't think we need the person all the time in the traditional go in for an appointment once per week kind of thing, not in that sense. But I still think we need the person."*

'Intensified Coaching' received an average importance rating of 6.

Increased accountability. The sub-theme of 'increased accountability' was mentioned by two parents. In both cases, the issue of accountability emerged in the context of receiving intensified coaching with at least some face-to-face contact. These mothers stated that, "*You need face-to-face. Then you can't run away. You are accountable again"* and "*Face-to-face contact makes you comply a little bit more."* One mother felt the frequency of the contact should be ongoing once every couple weeks, whereas the other mother felt weekly contact was important initially, with a gradual phasing-out of that support. The latter mother felt that the intensified support during the initial stages was important "*in order to get going at the beginning"*. 'Increased Accountability' received an average importance rating of 6.

Peer social supports.

'Peer social supports' was mentioned by three parents. This referred to increasing the social supports between children in the program because of their shared difficulties.

> *"Interaction with other kids that are going through what she is going through. When she saw that there is a chat she asked if there was anybody she could talk to that is going through the same thing that she is going through... If she was to meet them, like say if you did have little group meetings or something it would kind of help her out... Her weight really bothers her a lot. If someone else was going through it, she would have their support."*

Parents suggested different ways this support could be achieved, including meeting as a group for social activities or meeting to engage in physical activity together. One parent felt that this sort of meeting would, in addition to providing support, give children the opportunity to engage in group problem solving...

> *"So if she were connected with other kids who felt the same way as she did about this and (they) were going down this journey and trying to lose the weight. And you're sitting in a group and they're talking to you, and you are not necessarily made to speak, certainly you're going 'OK, what are things that are hard?' And bringing these things up like birthday parties, going to McDonalds or whatever. Because you don't necessarily want to take them right out of their social life that way, but you are going to a birthday party, you are doing something, how can you still help yourself to eat healthily and then they come up with a suggestion."*

'Peer Social Support' received and average importance rating of 6.

Tools for success.

Many parents talked about tools that they felt would support them and their children in seeking services. This category included five themes: 'Tips and Tricks', 'Physical Activity Component', 'Meal Plans and Recipes', 'Make it a Family Effort', and 'Adapting for Special Needs'.

Tips and tricks.

'Tips and tricks' was mentioned by four parents and referred to practical and implementable suggestions that they could use in achieving and maintaining behavioural change. These included tips on determining portion sizes, ideas on getting in more physical activity, goal-setting, and parenting strategies to reinforce changes (e.g. modelling rewards). One mother talking about even making a small, summary guide of everything the program involved for a quick reference, as she said *"more tips and tricks... (a) Little Coles Notes version.'* 'Tips and Tricks received an average importance rating of 5.25.

Physical activity component.

The desire for a more structured physical activity component was mentioned by eight parents. Many parent talked about having a much more specific physical activity program with directives on types of activity, durations, and frequencies of involvement. "*The exercise could be improved by telling us what we have to do exactly, like having a program. Doing what for how long. More detailed, more specific."* Parents also talked about having their children go into a lab to perform physical activity or receive more personalized training. Some parents that this would be important at least at the beginning of a program.

> *"I wish that there was a fitness training lab where I could bring him...(with a) kind of hands on fitness trainer ...who likes kids, who could help him actively move and push him in a way that he is not actually going to hurt himself or strain himself ever, because he is actually in bad shape. To actually get to that point where he is starting to get a good endorphin feedback from exercise and then at that point it is easier for the parent to sustain it."*

Some parents also felt that the 'Physical Activity Component' could be done in a group setting. 'Physical Activity Component' received an average importance rating of 5.8.

Meal plans and recipes.

Three parents reported wanting meal plans and recipes. These parents wished that more specific and child-friendly meal plans could have been provided, in order to take the guess-work out of the healthy eating component. "*Rather than just having random recipes having more of a weekly menu and recipes to go along with it...and things that appeal to children and their tastes".* 'Meal Plans and Recipes' received an average importance rating of 5.

Make it a family effort.

Making the intervention a family effort was mentioned by four parents and referred to the importance of the entire family working together to live a healthier lifestyle. It included doing a range of tasks together that could lead to a healthier life.

> *"You are doing it with your child together, and it's supportive of a healthy lifestyle. It should be to cooking together, playing basketball in the driveway together... It should lead to parents and children being active and doing these lifestyle things together."*

One mother even talked about how the different study components could be framed as family time, in order to reduce competing demands that involve family time.

> *"I speak to parents who have very good intentions but that zone between leaving work and doing homework and getting dinner ready, and going to ball hockey and somehow getting a bath and to bed on time, and actually having family time, that's a really, really hard time to compete with. ... If within the structure of the study that time was identified as family time, like we agreed that that's an activity that constitutes family time, so that rather than seeing it as taking away from, it's seen as valid ."*

'Make it a Family Effort' received an average importance rating of 5.

Adapting for special circumstances.

The need to adapt the intervention for special circumstances was mentioned by four parents. In all four instances, it was discussed in different contexts but the message was the same: that there needed to be a way to adapt for special circumstances. The circumstances that parents needed help adapting to in the HEALTHY study included adapting the study materials for a children with special needs, adapting support for people with food

sensitivities or recovering from injuries, and a better awareness of the nutritional value of cultural foods. The adaptation did not necessarily have to be built-in to the study, but could have also involved connecting parents with other resources. For example, a mother with food sensitivities said that "*if there was the opportunity to connect to an existing resource at the hospital...(to) get that counselling to how to put foods together that are actually going to get us into better food choices but not make me (sick).*" 'Adapting to Special Circumstances' received an average importance rating of 5.

Program goals.

Program goals emerged when discussing their needs; reflecting things parents hoped a program would result in, including 'Weight Loss' and 'Empowerment'.

Weight loss.

The desire for a family-based intervention to results in weight loss was mentioned by four parents as a goal of seeking services for their overweight children, and received and average importance rating of 6.

Empowerment.

Two parents said that they hoped an intervention would result in child empowerment so that they could become independent and self-sufficient in maintaining changes. As one mother put it: "*I need a person to take my hand and help me ...With being really confident that once I was helped onto the path, I would be able to walk that path on my own.*" Parents also wanted their children to take on more responsibility for taking care of themselves. "*What I wanted was for my son to realize that he has to take care of himself.*" Empowerment received an average importance rating of 6.

Discussion

The purpose of the present study was to understand parent's barriers to completion in an internet weight-loss program for their children; we also sought to understand their overall needs in seeking services. The delivery of pediatric obesity interventions via the Internet is emerging. .Unfortunately, high rates of attrition without evaluation of the factors that impact on attrition and adherence limit the future of the field in that knowledge of these factors could help researchers develop improved interventions.

Impressions

Most parents reported positive impressions regarding many aspects of the study. Those with less than positive impressions reported feeling overwhelmed by the multitude of study components in that the study was overly cumbersome, especially given the busy lives of so many families. The program components with the greatest positive feedback from parents included coach support, the Traffic Light Plan, increasing physical activity and decreasing screen time, and the reward system.

Most families valued the coach support. They felt that the coach support provided motivation, support, and advanced knowledge in the field. Other studies have included various forms of support from a lifestyle coach as well (e.g.Kalarchian et al., 2009). Expert recommendations highlight the importance of continued therapist contact to effectively deliver lifestyle interventions for weight loss (Barlow & Dietz, 1998) and maintain weight loss post-treatment (Perri & Corsica, 2002). Parents also reported that coach support was helpful in terms of solving difficult situations and skill building. It is also possible that it was effective in terms of offering general support from an empathic adult.

Parents also had mostly positive impressions of the Traffic Light Plan. Given this plan is used in Epstein's approach, which is the most empirically validated approach to

paediatric obesity treatment, its continued use in similar interventions is strongly recommended. Some parents did report some difficulties in the initial learning of this nutritional plan and felt aspects of the program were sometimes confusing and counterintuitive. Thus, continued refinement of the program may be useful. As well, for interventions that are delivered over the internet, or that have a computer-based component, it might be helpful to develop software where families can input nutritional information and then be informed whether the food falls in the green, yellow, or red category.

Despite positive impressions of the physical activity component, many parents struggled with the practicalities of increasing physical activity, especially in terms of finding time, getting agreement from their children, and self-monitoring. In terms of getting buy-in from their children, insights to help parents and improve interventions may be found in looking at research on the determinants of physical activity in children and youth.

For example, Humbert and colleagues (2008) identified several important determinants of exercise in the paediatric population. These included: the importance of having fun, making exercise a social activity, community access to exercise facilities, the role of adults, having enough time to exercise, and appreciating the benefits of physical activity. As well, research comparing obese children to non-obese children suggests that in order to increase physical activity among obese children it would be important to aim at increasing exercise self-efficacy perceptions, increase awareness of, and access to, community programming of physical activity, and increasing exposure to parental modelling of physical activity (Trost, Kerr, Ward, & Pate, 2001).

Parents reported that the weekly reading and quiz provided information about living a HEALTHY lifestyle and helping to reinforce knowledge.

Finally, parents reported positive impressions of the reward system though most did not use it. Those that used the reward system said it helped them build upon their parenting skills *and* it helped them encourage and reinforce behavioural changes in their children. Certainly, previous research and clinical practice commonly employs the use of rewards and reinforcement in producing behavioural change in children (e.g., Epstein, Paluch, Roemmich, & Beecher, 2007; Abraham & Michie, 2008; Epstein et al., 1995).

Overall, the most difficult program component to follow was self-monitoring. Many reported that a lack of perceived time (discussed later) was one important obstacle in completing self-monitoring, and relatedly, many reported frustrations with feeling they had to self-monitor multiple times, whether it was to track on paper and then input into the website and/or self-monitor for themselves and also their child. This suggests that more efficient ways to log health behaviours would prove beneficial to achieving greater compliance.

Because self-monitoring is critical to success in paediatric obesity interventions (Germann, Kirschenbaum, & Rich, 2006) it would be important to develop novel and fun ways of improving self-monitoring for children. It may be useful to develop self-monitoring strategies that draw on the use of technology and that might be easier to use, most accessible, and increasingly interesting to children such as Smart Phones and/or tablets. Some preliminary research with adults suggests that dietary tracking with Smart Phones is associated with increased adherence (Cunningham, 2012). As well, research with adolescents suggests that that the use of mobile phone technology is an acceptable adjunct to obesity treatment (Woolford, Clark, Strecher, & Resnicow, 2010), therefore adolescents may also be open to mobile phone usage as a tracking device. Alternatively, the use of individually-tailored messages may improve adherence to web-based interventions.

Barriers

In terms of the study itself the most commonly reported barriers were that the number of study components was too cumbersome to take on and there were difficulties with inputting self-monitoring entries into the website. The first issue points to the need for continued research into what intervention components are most effective so that paediatric obesity interventions can be streamlined. The latter issue points to the previously discussed need to develop child and family friendly methods of tracking lifestyle/health behaviours.

Individual-level barriers.

Lack of motivation was the most commonly cited individual-level barrier. One therapeutic approach that may hold some potential in addressing this barrier is motivational interviewing. Motivational interviewing is becoming more common in healthcare, especially in terms of behaviour change, and addresses issues like readiness to change, stages of change, and helps patients identify motivation for health behaviours (Rollnick, Miller, & Butler, 2007). The research on this that does exist suggests there is some promise in the use of these strategies in paediatric obesity treatment (Barlow & Dietz, 1998; Schwartz et al., 2007).

Many parents who reported a lack of motivation stated that increased face-to-face contact may have helped. This suggestion, regardless of its merits, goes beyond entirely web-based studies unless the increased contact is done using technology. As one parent suggested, it may be helpful to use web-based 'chats' or Skype to provide this additional support. Certainly, some authors in the area of obesity have suggested the use of social networking given wide access to the Internet and portable technologies (Boucher, 2011). However, it may also be that studies which are exclusively web-based do not work for weight reduction in children. In support of this notion, existing research in adults shows that web-based

approaches may be more effective in the maintenance of weight loss/relapse prevention phase rather than be the sole intervention during the treatment/behaviour change phase (Tate et al., 2001).

The finding that many parents reported lack of time/competing demands is consistent with some barriers reported in Skelton's (2008) review. This barrier may prove to be a difficult one to overcome. It may be partly addressed by streamlining interventions. As well, the incorporation of motivational interviewing techniques, which may help families place their concerns about childhood overweight/obesity in context in comparison to other competing demands.

Family-level barriers.

The most commonly cited family barrier was the number of family commitments. This theme overlapped a great deal with the lack of time/competing demands theme, and it quite likely that the recommendations following from that theme would also help to ameliorate the difficulties posed by the current theme.

Some families reported that they did not feel well-supported by other family members in the house in making behavioural changes. This is a potentially critical, as support from family members (and others) is associated with weight loss and maintenance of weight loss (Epstein et al., 1994). This issue may highlight the importance of placing a greater emphasis on involving the entire family system in paediatric obesity treatment. Some suggestions include providing information to the entire family (either through in in-person information session or printed materials), having coaches available to support other family members in supporting household changes, and incorporating the family system into intervention components. For example, specific homework assignments could include things

like planning an active outing for the family, cooking a healthy meal or snack as a family, or simply planning a family walk following a meal.

Some parents also reported that their home environment, specifically their computer space/location, was a barrier in participation. This barrier could be partly addressed using more portable technologies already discussed, such as using Smart Phones or tablets. As well, researchers and clinicians in the field may even wish to discuss with families at the outset that having a work space that is easily accessible to work on program requirements may help them with adherence.

One mother reported that being a single parent was a barrier. We found very little research that evaluated possible associations between single-parent status and paediatric obesity treatment. However, some research does suggest that single-parent status may be related to risk for obesity (Tremblay & Willms, 2003). As well, some research suggests that being in a single-parent household is associated with a decline in physical activity for older white girls, but not similarly aged black girls. Some researchers have suggested that some potential mediating and/or moderating variables may include low income, low education, and psychosocial outcomes such as stress and a higher risk of maternal depression (Tremblay & Willms, 2003; Gable & Lutz, 2000). Gable also speculates that part of the association may be attributable to the fact that children in single parent households spend more time engaged in household tasks which may result in, firstly, taking time away from potential engagement in physical activity and, secondly, may result in more children involved in meal preparation that may emphasize prepared and packaged foods that are lower in nutritional quality. Moreover, single parents would simply have less time to allocate to behavioural change given all the competing demands involved in running the household and raising children.

Social-level barriers.

Social barriers reported by parents all related to children's friendships. Certainly, social support is a known ingredient to effective lifestyle interventions for paediatric obesity (Epstein et al., 2007; Epstein et al., 1994) and for this reason the HEALTHY study included a discussion board and chat room in an attempt to facilitate contact among participants. Other web-based studies have also included these features (White et al., 2004a; Doyle et al., 2008; Moore, 2007a; Jones et al., 2008).

Another potential avenue to help alleviate the difficulties of reduced social support in a web-based study may be to use social networking or web-facilitated coach support (e.g. Skype). For interventions that do incorporate face-to-face components there are many ways enhancing social support. For example, as will be discussed, several parents suggested incorporating educational and/or physical groups for the children in the intervention.

The issue of struggling with complying to lifestyle recommendations while with friends is more difficult. The HEALTHY website did offer education and suggestions around issues like spending time with friends and attending special events and celebrations. However, research suggests that social influences strongly affect one's food choices, because of strong cultural values attached to food and availability of foods that lack nutritional quality (Nestle et al., 1998). As well, food preferences play a large role in compliance; however, these preferences are learned early in life and are often strongly influenced by parental food behaviours and attitudes (Scaglioni, Salvioni, & Galimberti, 2008). This difficulty would most likely be best addressed by more widespread social changes with regards to the social values attached to food

. **Environmental-level barriers.**

Barriers at the environmental-level were rarely reported. This suggests that for many families the built environment has less of an impact on their ability to adhere to an intervention program for paediatric obesity. Conversely, it might suggest that families lack insight into how the physical environment impacts on their adherence.

Some families reported difficulties with access to recreational programming in rural areas. Perhaps the development of specific resources and ideas to increase activity in rural areas could be beneficial, and shared with participants who live in rural areas. Certainly, green space and opportunities to be active in rural areas are vast; therefore, a greater emphasis on activity, as opposed to recreational programming, could be stressed with these types of participants. However, it is important to note that the HEALTHY study did emphasize free living unstructured physical activity rather than recreational programmed physical activity.

Needs

The needs reported by parents fell into four over-arching categories: knowledge and education, social supports, tools for success, and program goals.

Knowledge and education.

Parents sent a clear message around the importance of needing the provision of knowledge and education, from a trusted source, in helping their overweight/obese children. The importance of psychoeducation has already been discussed, and the main recommendation stemming from this need is that education continues to be as up-to-date as possible and rely on the newest research and information in healthy living. Given that CBT is a demonstrated efficacious treatment modality for paediatric obesity, and psychoeducation is

considered essential features of CBT, this component should continue to hold value in related research. The fact that it is valued by families reinforces its importance.

Social supports.

Parents also indicated their need for social supports to be built in to paediatric obesity treatment, including lifestyle coaching and peer supports.

In referring to lifestyle coaching, parents discussed the significance of having a trust source outside of the family to offer support to families in treatment. This need was also addressed by the HEALTHY study and as mentioned many parents reported positive impressions of and experiences with their coach. However, some elements discussed by families that were less consistently addressed as part of the study referred to intensified coaching, especially in regards to building accountability and increasing motivation.

While all participants received a minimum of three reminder emails in their personal email accounts, it appears that these emails alone were insufficient to meet families' needs for reminders. However, in the study by Moore (2007) participants were sent a total of five reminder emails (one per week) and attrition was still a significant issue in that study. Doyle (2008) used frequent reminders in her study via sending weekly newsletters to parents. This could potentially alleviate problems with emails (e.g., messages going to a spam box, deleted by other family members, changes in email addresses). Doyle (2008) also suggests the delivery of reminders through innovative means, such as text messaging over cell phones.

Another strategy that might have been employed was the use of telephone reminders, as some research suggests that reminder phone calls can help facilitate a return to treatment (Cote et al., 2004). Stevens and colleagues (Stevens et al., 2008) used a highly structured and automatized reminder system involving multiple steps. One of the final steps (after potentially receiving several automated email reminders) included receiving an automated

phone message. Following preceding steps up to and including this message 97.3% of participants had logged-in. If this phone message did not prompt a log-in then a member of the research team phoned the participants; following the telephone contact from a research team member all had logged-in.

The other factor reported in intensified coaching referred to the inclusion of real-time contact, either using electronic means (e.g. chat room, Skype) or other means, such as telephone contact or face-to-face sessions. Obviously, if adhering to a strictly web-based intervention the former suggestions are in most need of further evaluation by previous research. All families in the HEALTHY study were informed that real-time contact could be offered to them if they needed and requested this type of support (via meeting in the chat room and having the coach lock it for privacy). Interestingly, no families requested this type of support.

These suggestions may point to the fact that entirely web-based interventions may not be the best approach for addressing paediatric obesity treatment. It is possible that interventions with both face-to-face and internet components may hold more promise, especially in the initial phases of developing behavioural changes. Certainly, some researchers conducting web-based studies have incorporated minimal face to face support at the outset of their interventions (White et al., 2004a; Williamson et al., 2005a; Williamson et al., 2006b) whereas other researchers have taken a more balanced approach (i.e., more equal components of face-to-face and internet interventions) (Baranowski et al., 2003; Jago et al., 2006; Rydell et al., 2005; Frenn et al., 2005). The latter 'balanced' approaches tend to be implemented in schools and or recreational groups (e.g. boy/girl scouts), and of those reported here attrition ranged from 11.5% (Baranowski et al., 2003) to 23% (Frenn et al., 2005). In one study it was difficult to ascertain the attrition rate, although it appears to be

consistent (Rydell et al., 2005). However, given that these interventions are delivered within the context of school or organized groups, one might expect attrition to be less of a problem given the time allotted to the intervention during face-to-face time and/or the vested interest of the group. Despite these factors, adherence appears to be an issue in some of these studies even though attrition is lower than fully web-based interventions conducted in the community or outside of the school-based settings. For example, Rydell and colleagues (2005) reported that only 23 to 56% of the sample ever accessed the website, depending on their age. As well, Jago and colleagues reported that up to 25% of the intervention group never accessed the intervention website. These findings are quite consistent with those from the HEALTHY study.

It is important to note that the aforementioned researchers who used minimal face-to-face contact all reference the same study (White et al., 2004a; Williamson et al., 2006b; Williamson et al., 2005a). In this study, participants were provided with four face-to-face sessions, in the first 12 weeks, of a two year study. Attrition from this study was 12% during the first six months (but 18% attrition from the intervention group) and 30% over the two-year period (36% from the intervention group). This suggests that the use of some face-to-face sessions, at least initially, holds definite promise. Parents from the HEALTHY study indicated they felt face-to-face contact was only needed initially, and they suggested a gradual phasing out of face-to-face support, which makes intuitive sense from a clinical and behaviour change point of view but needs to be balanced against the high costs of delivering face-to-face behavioural interventions.

The other form of support that parents indicated they needed was increased peer supports. The HEALTHY study did offer a discussion board and chat room to facilitate these supports; unfortunately no families used these supports.

Parents felt that it would have been helpful for their children to have contacts with other study participants, so that they could connect over the shared difficulties associated with being overweight. They suggested social activities and/or physical activity groups. This may have been helpful as Deforche and colleagues (2011) suggest positive associations between social connectedness and exercise adherence. Again, these suggestions for group meetings also imply that solely web-based interventions may not be the most promising approach for treating childhood obesity.

Tools for success.

Tools for success included incorporating tips and tricks for healthy living (e.g. portion control, parenting strategies, quick reference guide of program requirements), having a more structured physical activity program, providing meal plans and recipes, making the intervention more of a family effort, and adapting the program for various special needs. The HEALTHY study did attempt to address many of these. For example, educational material included tips and tricks to living healthier and a range of healthy recipes were provided on the website. An entirely separate section was provided for parents, which included parenting strategies and behavioural modification strategies. Also, the program was very much promoted as a family program, participants were encouraged to involve their entire family, and information in regards to the home environment was addressed. Finally, coaching attempted to address and adapt the program for individuals as needed.

Despite these efforts, it appears that what was offered in the HEALTHY study was not sufficient to meet these needs. However, there is a delicate balance between providing all the necessary information (e.g. food and activity information) and supplementary information, especially given the lack of time/competing demands.

One component that was not specifically addressed by the HEALTHY study was the suggestion to include a more structured physical activity component. In designing the HEALTHY website the focus was on increasing lifestyle activities, and activities of interest to participants, as research suggests that engaging in enjoyable and/or preferred activities more often results in long-term maintenance of those activities (Marcus et al., 2000; Sallis, Prochaska, & Taylor, 2000). Nevertheless, participants were provided with a list of potential activities in the event that they were unsure of what activities most interest them.

Relatedly, one parent suggested the use of specific meal plans. This was not adopted by the HEALTHY study as it was felt meal plans could be too restrictive on individual choice. As well, previous research has found that families in paediatric obesity treatment programs who were randomized to treatment arms with structured meal plans dropped out of treatment more quickly than participants in other arms of the same study, at an attrition rate of 83% (Savoye et al., 2007).

Program goals.

Finally, some parents referred to goals and outcomes in terms of their needs from an intervention. One quarter of those interviewed discussed their desire for the program to result in weight loss. While weight loss may be a very realistic goal for the more obese children, and an intended outcome of many interventions, maintenance of current weight may be sufficient to achieve a healthy BMI (as they grow) for children who are merely overweight.

A smaller proportion of parents referred to the fact that they hoped the program would empower their children to become more self-sufficient in maintaining behavioural changes. Hopefully, long-term maintenance of behavioural changes would result in this empowerment. Certainly, some researchers argue that regular encouragement of healthful

habits does result in child empowerment (Tsai, Boonpleng, McElmurry, Park, & McCreary, 2009).

Strengths and Limitations

The use of semi-structured interviews by a research assistant who was not involved in the initial study is a strength, in that it allowed participants to speak freely and without bias about their experience. A major limitation of the present study was that respondents were primarily female and educated. Therefore the generalizability of the results is limited. As well, a large proportion of respondents had poor adherence and early attrition, which would limit their ability to comment on the various study components and provide a more detailed account of the barriers they might have experienced had they attempted, or persisted, with the intervention for a longer period. Finally, the present study is thematic in nature, and did not investigate the relationships between the various themes.

Future Research Directions

More research is needed in order to evaluate the feasibility and efficacy of solely web-based approaches. Results from the current study suggest that the lack of time that families have, and the numerous competing demands, were among the greatest barriers for families enrolled in a web-based lifestyle program for paediatric obesity. If future research is able to streamline interventions these barriers might be mitigated. Therefore, it would be essential for future research to evaluate which program components are valued most by families, are not as time-consuming, but are also effective in producing behavioural change.

In terms of lack of time, one area of development that future researchers and clinicians may wish to consider in streamlining educational materials would be to conduct a needs assessment at the outset of their interventions. This would help in determining what is most needed and most appropriate for a given sample or group. Additionally, websites could

offer a wide variety of external links that could offer access to a greater depth and breadth of information that families could access if they sought more information on any given topic.

Other supplemental information that could be offered as well, based on the results of this study. A more structured physical activity component with specific directives on types and amount of activities could be provided as an option for participants who desire more guidance in this area. As well, websites may wish to include some flexible meal plans as supplementary information for those who desire more intensive guidance in terms of what to eat.

Portable technologies, like Smart Phones and Tablets, may also help to mitigate issues related to lack of time, especially as they pertain to self-monitoring. Many families struggled with self-monitoring, and for some it was because they first self-monitoring on paper and then inputted information into the website. If portable technologies were available, then families would only have to self-monitor once. Portable technologies also add the extra advantage of potentially being more interesting and engaging to young children and adolescents.

In terms of competing demands motivational interviewing techniques may hold some promise in helping families recognize the importance of making lifestyle changes. These techniques might help families attribute greater value to the issue of paediatric obesity in light of competing demands. On a related note, researchers and/or clinicians may wish to measure readiness for change and/or conduct motivational assessments, which could improve retention and compliance.

Another important area for future research relates to reminders to participate. Stevens and colleagues (2008) were very successful in using a highly structured reminder system. However, the time frame over which their reminder system was delivered, which culminated

in a phone call from research personnel, extended beyond one month. While it was effective in getting participants to log-in to their study website, the length of time is still of concern for short-term interventions. Therefore, future research may wish to explore reminder systems that are delivered over a shorter-time period, but that are also effective in producing a high rate of participant log-ins.

Future research may wish to also consider alternative approaches, particularly in terms of using of face-to-face support as adjunctive to web-based paediatric obesity intervention. Feedback from parents suggests that some face-to-face contact, at least initially, could help to alleviate some issues facing participants in exclusively web-based studies. Some of the discussed research also suggests the utility of these types of supports. Research may wish to evaluate what dosage of face-to-face is most beneficial, in terms of frequency and duration, while balancing the high cost of such supports. As well, future research may wish to evaluate whether the use of technology to deliver face-to-face support is as effective as in-person support. For example, using web-based conferencing, such as Skype, may be one avenue of research. This would provide families the additional support they need, but may also mitigate some of the issues related with in-person treatments, such as issues related to parking and additional time in commuting to appointments.

Finally, some of the less commonly cited barriers may also provide some ideas to future researchers and clinicians on how to improve Internet interventions. Given difficulties related to the social value attached to food, it is recommended that future researchers and clinicians continue to offer as much education and support as possible to help children make good choices. As well, the use of rewards and reinforcement (as previously discussed) would also help children to adopt and maintain healthier food choices.

Ensuring website compatibility with various Internet browsers, bandwidth considerations, and delivery over a reliable server will be important in order to reduce frustration, especially for those that have slower speed internet connections. Awareness of environmental constraints, finding appropriate clothing, cold and inclement weather, and living in a food desert may also be important for future researchers and clinicians so that these barriers could be addressed at the outset of treatment.

Summary and Conclusions

This qualitative study explored the subjective experiences of parents who participated in, or attempted to participate in, a family-based lifestyle intervention for children delivered over the internet. Impressions of the study, and its various components, were collected and discussed. Overall, parents reported very positive impressions of the study. The particularly important barriers of lack of motivation, lack of time/competing demands, and low social support should be considered in future interventions.

Results of this study indicate that parents are keen for knowledge and education on how to teach their children about healthy eating and activity. They also highlighted the need for increased social support for families and children and tools for success in order to help them achieve healthier lifestyles.

Study #3: A systematic review of adherence and attrition in web-based interventions for paediatric obesity

Stephanie Leclair, Jakub Racek, Angela Wilson, Elizabeth Kristjansson, Gary Goldfield

Systematic Review of Adherence and Attrition in Paediatric Obesity Interventions Background

Paediatric obesity in Canada is reaching epidemic proportions and represents a serious public health concern give its association with untoward medical and psychological conditions. Recently, the Government of Ontario announced that they are undertaking a Childhood Obesity Strategy with the goal of reducing childhood obesity by 20% over five years (Blackwell, 2012). Given these recent advances this is an opportune time to gain a better understanding of paediatric obesity treatment, and specifically attrition from these interventions, in order to develop interventions that minimize barriers to completion so that participants can realize the full physical and mental health benefits.

Attrition from paediatric obesity treatment is a significant issue. Skelton and Beech (2011) conducted a systematic review of attrition from face-to-face interventions and reported attrition rates ranging from 27% to 73%, and noted that few investigators evaluate the reasons behind attrition. Web-based interventions for obesity have gained increasing popularity; the rationale for such interventions is that the convenience of this method of service delivery would enhance compliance and reduce attrition, but these issues are not well studied. One systematic review of web-based weight management programs for children and adolescents was identified (An et al., 2009); its search was conducted up to April 2009. Attrition rates ranged from 4.9% to 30%. However, this review included studies that had mixed face-to-face and web components. Given that attrition from solely web-based interventions is a demonstrated issue (Eysenbach, 2005) one might expect attrition from solely web-based interventions for paediatric obesity to be greater than it is for face-to-face treatment.

Systematic reviews are an important tool in developing evidence-based practice as they are useful in summarizing and synthesizing existing research, identifying gaps in research, and helping to form future research directions (Kitchenham, 2004). Since systematic reviews of attrition from face-to-face interventions, and blended interventions (i.e. face-to-face and web components), have been recently conducted, there is a strong need for conducting a systematic review of web-based interventions, especially since the internet is increasingly used and viewed as an acceptable modality for delivery of health-based interventions (Tufano & Karras, 2005). Furthermore, previous research suggests that conducting systematic reviews in developing areas of research is quite valuable (Fergusson, Glass, Hutton, & Shapiro, 2005).

Purpose

The purpose of this review is to evaluate attrition and adherence from exclusively web-based studies for paediatric obesity that focus on treatment. A secondary purpose is to investigate the effectiveness of these interventions in terms of changes in body composition.

Method

A systematic search of the literature was performed to include all studies of any empirical research design that attempted to deliver an exclusively web-based intervention to children and/or adolescents who are overweight and/or obese. Included studies needed to target both nutrition and physical activity, have a cognitive-behavioural component (e.g. education, goal setting, self-monitoring, etc.), be family-based, be at least six weeks in duration, report on attrition and changes in body composition, and be carried out in a developed country. However, in order to keep a liberal search strategy some inclusion criteria were not specifically searched (e.g., attrition, program length). Studies were excluded if they had web and face-to-face components and/or included adults but did not report

separate outcomes for children/adolescents. Eligible outcomes include attrition and adherence.

The comprehensive search strategy included a range of relevant health and social science peer-reviewed and grey literature. The search strategy was developed by a PhD student in library science, supervised by a doctoral level librarian experienced in systematic review searching. The search strategy was peer-reviewed by a second doctoral level librarian using the PRESS standard (Sampson et al., 2009), then adapted for the other databases. An initial search strategy was based on the aforementioned systematic review of paediatric obesity programs with a web-based component (An et al., 2009) by using their eight relevant articles and their key words. These articles were then used as seeds for a PubMed Related Article search, conducted in July 2010, and the 200 highest ranking records were retained. Seven of the eight seed articles were retrieved (the last article was not retrieved because it was a thesis; however it was obtained for the review). The search included concepts related to diet, exercise, web-based interventions, and child/adolescent and these were used to develop a more comprehensive key word search by looking at related keywords on 'www.gopubmed.net'. After a preliminary testing of the search strategy, additional potentially relevant keywords were added. Complete search strategies (including key words) are presented in Appendix M.

Following preliminary testing, our search strategy included the following electronic databases: MEDLINE (1995 to July 2010, in-process & other non-indexed citations), EMBASE (1980 to July 2010), CINAHL (1995 to 2010), Cochrane Database of Systematic Reviews (CDSR) (Issue 7, July 2010), Cochrane Central Register of Controlled Trials (CENTRAL), Cochrane Other Reviews (DARE) (1995 – 2010), and PsychINFO (1995) to

July 2010. The start date of 1995 was chosen to be consistent with An and colleagues' (2009) review as they reported healthcare consumers started to access the Internet in the late 1990s.

A total of 2503 records were identified from all sources. Records were added to a database of references to studies already identified by the authors, and duplicates were removed, yielding 1780 records for eligibility screening. As well, authors who published articles meeting the search criteria were contacted about unpublished studies and reference lists of relevant articles and reviews were also searched. This yielded one additional paper that was added to the search, resulting in a total of 1781 records for eligibility screening. References from the search were imported into a Reference Manager™ database. Two reviewers independently assessed the eligibility of each bibliographic record at multiple levels. Level one screening involved two reviewers independently assessing the titles and abstracts of studies, with any that were deemed relevant by either reviewer being retained for the next level. Level two screening involved two independent reviewers examining the full-text articles for inclusion criteria. All conflicts arising from Level two screening were resolved by a third party.

Data were extracted independently by two reviewers and input into qualitative tables developed for the review. Data included the population, study type, intervention characteristics, program length, attrition rate (and any additional information related to attrition), adherence information (if included), and body composition outcomes.

Update

An update of the search strategy was conducted in March 2012 by searching the seven aforementioned databases and relevant reference lists. Of note, many of the databases could not limit the search from July 2010, so the date parameters of the update were for 2010 to the third week of March 2012. A total of 1129 records were identified from all sources.

Once duplicates were removed (including the articles that were published prior to July 30, 2010) a total of 651 records were eligible for screening. References from the search were imported into a Reference Manager™ database. The screening procedure followed the same three steps described above for the original search. Data extraction procedures also followed the same procedure as it did for the initial review.

Results

Initial Search

A PRISMA flow diagram illustrates the number of records at each stage of the review for the initial search (see Figure 2). Of 1781 records entered into initial relevance screening, 1686 were excluded. The remaining 95 records were successfully retrieved in full-text format and were subjected to further screening for inclusion criteria. This assessment excluded 92 records, primarily for seven reasons: (a) not an intervention (n =36), (b) adult population (n =18), (c) intervention targeting only diet or only activity (n =13), (d) intervention was school-based with an instructional component (n =13), (e) the intervention was only conducted face-to-face (n =4), (f) the intervention involved a blend of face-to-face and a web-based component (n =7), and (g) one intervention was a one-month pilot project. This left three citations for the data abstraction phase (Doyle et al., 2008; Moore, 2007b). An additional three articles, which all referenced one larger research project, were identified as noteworthy in that they came quite close to meeting inclusion criteria (White et al., 2004a; Williamson et al., 2006b; Williamson et al., 2005a; Jones et al., 2008). This study had very minimal face-to-face contact in their interventions (as opposed to the other blended studies, with a more equal face-to-face component in comparison to the web-based component). Therefore, these three papers were also set aside for data abstraction, albeit to examine separately.

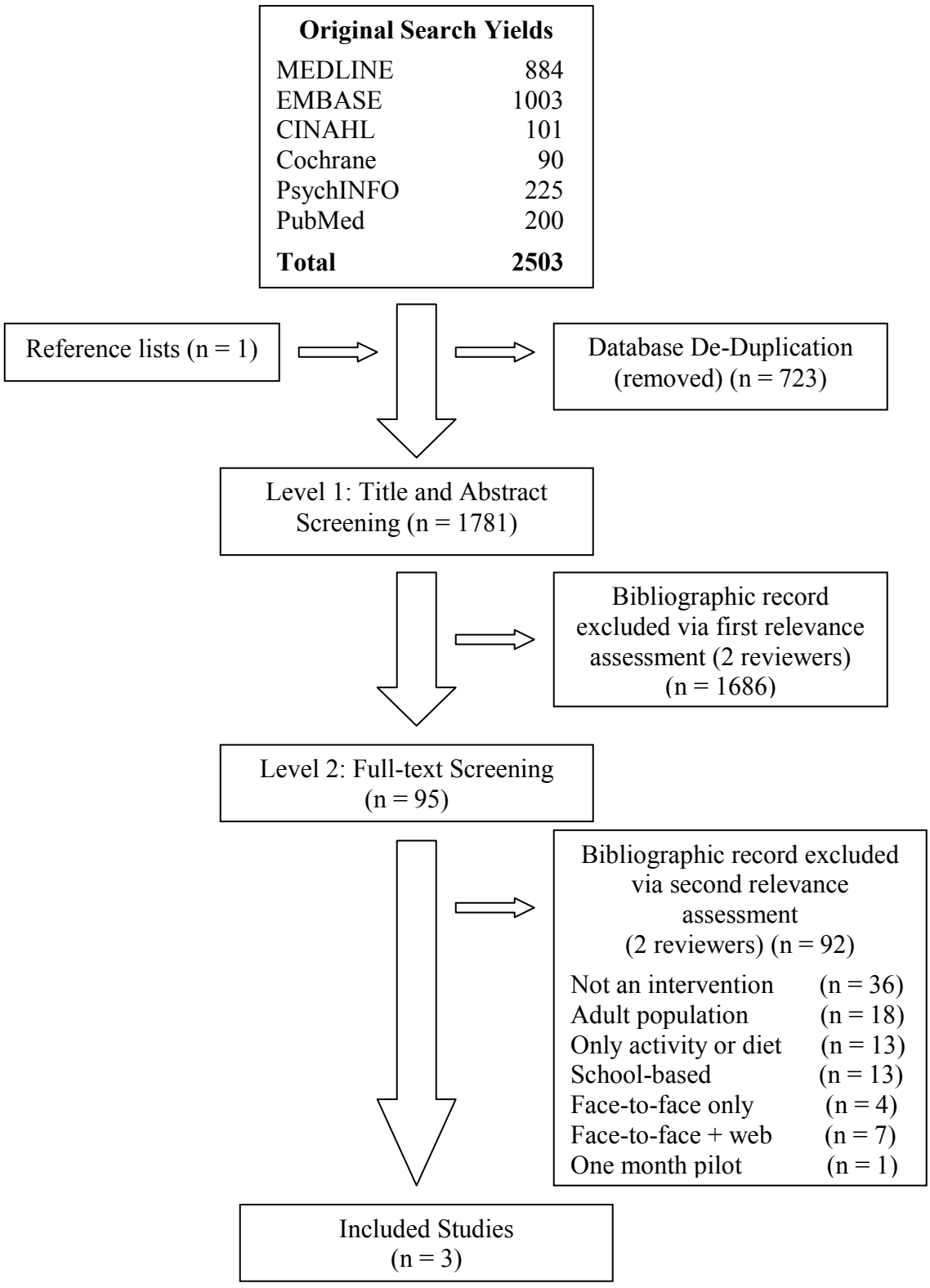

Figure 2. *PRISMA Flow Diagram of Initial Search*

The three studies identified as meeting inclusion criteria were all RCTs; two had a wait-list control group (Doyle et al., 2008; Jones et al., 2008) and the other an education-only control group (Moore, 2007b). The three noteworthy papers described the same study, which was an RCT with an education-only control group, with measurement points at six months (White et al., 2004b; Williamson et al., 2005b) and two years (Williamson et al., 2006a). All six studies were published in the United States between the years 2004 and 2008. The main program characteristics of these studies are described in Table 11.

Search Update

A PRISMA flow diagram illustrates the number of records at each stage of the review for the March 2012 update (see Figure 3). Of 651records entered into initial relevance screening, 626 were excluded. The remaining 25 records were successfully retrieved in full-text format and were subjected to further screening for inclusion criteria. This assessment excluded all records, for six reasons: (a) not an intervention (n =9), (b) adult population (n =6), (c) intervention targeting only diet or only activity (n =5), (d) intervention was school-based with an instructional component (n =2), (e) intervention was an obesity-prevention program with populations including normal weight participants (n =2), and (f) one was an internet-based social support intervention for overweight youth.

Included Studies

The three studies included in this review are more fully described in Table 12.

Doyle and colleagues (2008).

The first study was a 16-week RCT with a wait-list control group of 40 overweight adolescents and their parents (Doyle, 2008). The first eight weeks of the program were oriented towards weight loss, whereas the latter eight weeks were oriented towards

Table 11

Main Characteristics of Included and Noteworthy Web-based Intervention Studies Main Characteristics

	Education Component	Quiz	Self-Monitoring	Chat room	Discussion Board	Coach/Feedback	Recipes/Menu Ideas	Physical Activity Program	Problem-solving/ Goal-setting
Included Studies									
Doyle et al, 2008	X		X		X	X			
Jones et al, 2008	X		X		X	X		X	X
Moore, 2007	X		X			X	X	X	
Noteworthy Studies									
White, 2004 & Williamson, 2005*	X	X	X	X		X	X	X	X
Williamson, 2006	X	X	X	X		X	X	X	X

*Both articles describe the 6-month time point in the same 2-year study.

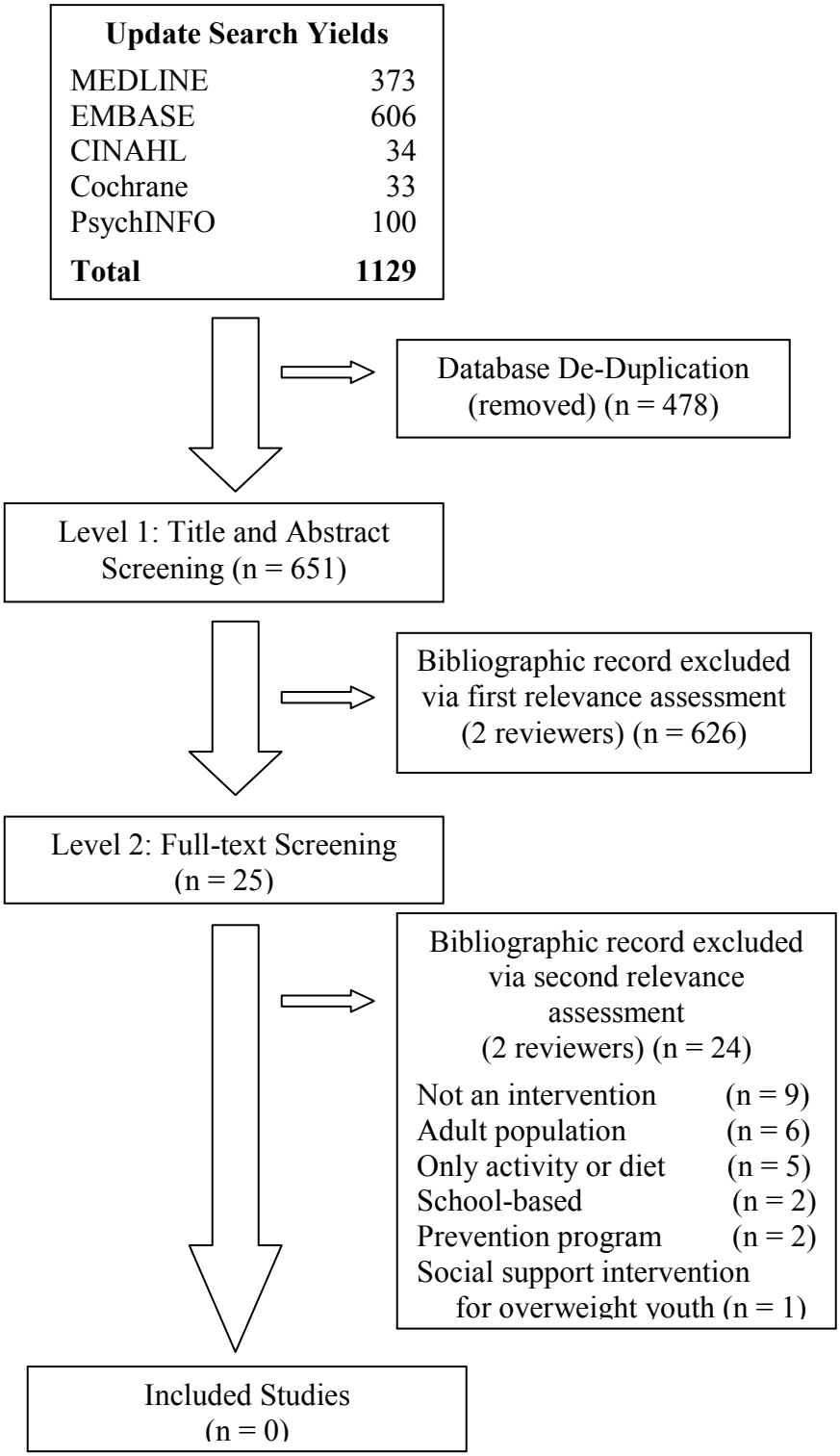

Figure 3. *PRISMA flow diagram of March 2012 update*

Table 12

Included Studies

Study	Population ($M \pm SD$)	Study 1) Type 2) Length	Attrition[1] 1) Rate* 2) Other Info.	Adherence[1]	Body Composition Outcomes
Doyle et al, 2008	*n* =40 Age: 14.9 ± 1.7 BMI: 34.8 ± 7.6 65% female, 35% male Mixed race/ethnicity	1) RCT with wait-list control 2) 16 weeks	1) 43.3% 2) NR	Measured by: (1) # of web screens accessed (2) log-on data (3) use of online journals	ANCOVA: Lower BMI z-scores in INT from BL to PT (p = .03), but not to FU (p = .29). Intention-to-treat: No differences in INT from BL to PT (p = .06) and FL to FU (p = .43). Intervention Group Weight (lbs) BL: M = 214.5, SD = 65.3 PT: M = 214.4, SD = 64.2 FU: M = 218.6, SD = 64.4 Control Group Weight (lbs) BL: M = 206.1, SD = 50.2 PT: M = 210.8, SD = 47.2 FU: M = 214.5, SD = 47.5
Jones et al, 2008	*n* =105 Binge eating at least 1x/week. Age: INT: 15 ± 1 CTL: 15.2 ± 1.1 BMI: INT: 39.9 ± 4.9 CTL: 30.6 ± 6 70% female, 30% male Primarily White (64%)	1) RCT with wait-list control 2) 16 weeks	1) 82% 2) Related to: (a) being White (p < .01) (b) depressed mood (p < .01) (c) shape concerns (p < .05).	Measured by: (1) # of main topic screens accessed (2) weeks of content screens accessed (3-6) # of food, weight, physical activity, and personal journal entries (7) # of	Completer analyses: reductions in INT from BL to FU (i) Lower BMI z-score (p < .01, effect size: 0.8), (ii) BMI change (p < .01, effect size: 0.6) Intention-to-treat: reductions in INT from BL to FU (i) Lower BMI z-score (p < .01) and BMI (p < .01) Intervention Group BMI BL: M = 30.6, SD = 4.9 PT: M = 28.8, SD = 4.7 FU: M = 29.8, SD = 5.3

Study	Population ($M \pm SD$)	Study 1) Type 2) Length	Attrition[1] 1) Rate* 2) Other Info.	Adherence[1]	Body Composition Outcomes
(Jones et al, 2008, cont'd)				discussion postings	Control Group BMI BL: M = 30.6, SD = 6 PT: M = 30, SD = 5.9 FU: M = 31.2, SD = 6.3
Moore, 2007	n =30 Ages 6-12 BMI: 28.1 ± 6.8 70% female, 30% male + Caregiver Age: 36.8 ± 6.7 BMI: 32.7 ± 9.2 Ethnically diverse 70% rural	1) RCT with education control 2) 9 month pilot + 6 week intervention	1) 85% 2) (a) Descriptive retention analysis (# lost at each step) (b) Qualitative barriers explored	Measured by: range of treatment materials accessed	Repeated measures ANOVA: no significant change in BMI z-scores from BL to PT, *ns* group x time interaction BMI was stable from BL (M = 2.4, SD = 0.3) to PT (M = 2.4, SD = 0.3) both INT and CTL therefore data was only presented for the overall sample.

[1] Attrition and adherence will be discussed in text.

***** The attrition rate was calculated based on the number of participants who dropped-out following the informed consent process, as most studies reported attrition rates following randomization (Important: rate does not include those who failed to meet inclusion criteria)

NR = not reported
BL = baseline
PT = post-treatment
FU = follow-up
INT = Intervention group
CTL = Control group

improving body image. Parental involvement largely consisted of receiving a monthly mailed newsletter, which included psychoeducation, a description of what the adolescent was learning, a description of what the adolescent was learning, and tips for supporting their adolescent in achieving lifestyle changes. As well, parents were able to speak with a doctoral student in psychology by telephone if needed. Attrition from the time of consent was reported to be 43.3%; attrition was not further evaluated. Adherence was assessed using the number of web screens accessed, log-on data, and use of online journals. Adherence to this study was not optimal: participants in the intervention group only read an average of 29.9% (*SD* = 27.3) of the study materials (range: 0 – 90.7%). Moreover, over one third of the participants in the intervention group read fewer than 10% of the informational screens. Participants reported that some social support was obtained from the discussion board, however 22.5% felt it was not enough; of these, some suggested a real-time chat room.

In terms of body composition, Doyle and colleagues (2008) report significant differences in BMI *z*-scores from baseline to post-treatment, but not to follow-up using ANCOVA among completers. The intervention group participants lost 0.14 pounds from baseline to post-intervention, but gained 4.2 pounds from post-intervention to follow-up. The control group participants gained 4.17 pounds from baseline to post-intervention, and gained an additional 3.72 pounds from post-intervention to follow-up. No significant differences were found using intention-to-treat analyses from baseline to post-treatment or from post-treatment to follow-up.

Jones and colleagues (2008).

Jones and colleagues conducted a 16-week RCT with a wait-list control group of 105 overweight (i.e., at or above the 85th percentile for BMI) adolescents who also engaged in binge-eating at least once a week for a three-month duration. Parental involvement consisted

of a parent handbook; details of what information was in this handbook were not provided. Attrition from the time of consent was reported to be 82%. Attrition was further evaluated and found to be related to being white ($p < .01$), having a depressed mood ($p < .01$), and having concerns about their body shape ($p < .05$).

In the Jones and colleagues (2008) study adherence was assessed using the number of main topic screens accessed, the weeks of content screens accessed, the number of journal entries made (i.e., food, physical activity, weight, and personal journals), and the number of discussion board postings. A number of measures were taken to improve adherence. Participants received weekly letters (unclear if mailed or emailed), and sporadic motivational messages, to reinforce their participation and to encourage those who were not complying. As well, because of low adherence in the first cohort of the study, an optional face-to-face meeting with a mentor was offered to participants in the second cohort. Participants in the second cohort met with a mentor an average of one time. Unfortunately, no information on whether this addition improved participation was provided and analyses were not separated by cohorts.

Despite these efforts and adaptations adherence appeared to be fair at best: 27% of those in the intervention group used at least one component of the online program for at least eight weeks, 42% used the program for less than eight weeks, and 31% never logged on to the website. On average, participants accessed 20.2 main topic screens (SD = 28.2, range: 0 - 94) and 4.5 weeks of content screens (SD = 5.2, range: 0 - 16). In terms of self-monitoring journals, participants recorded 21.4 food entries (SD = 30.7, range: 0 - 107), 8.4 physical activity entries (SD = 23.4, range: 0 - 157), 2.8 weight entries (SD = 4.3, range: 0 - 16), and 3 personal journal entries (SD = 5.4, range: 0 - 23). Participants were significantly more likely to use the food journal, as compared to the other journals. Finally, participants made

an average of 5.2 posts to the discussion board (*SD* = 8.6, range: 0 - 34). Adherence was not significantly related to any of the primary outcome variables.

Using completer analyses, Jones and colleagues (2008) found significant reductions in BMI *z*-scores ($p < .01$, effect size: 0.8) and BMI ($p < .01$, effect size: 0.6) were observed from baseline to 9-month follow-up in those who completed the intervention. As well, intention-to-treat analyses also revealed significant reductions in BMI *z*-scores ($p < .01$) and BMI ($p < .01$) for the intervention group from baseline to 9-month follow-up. Post-treatment body composition changes were not analyzed because they were based on self-report data. Overall, those in the intervention group had a BMI reduction of 1.8 from baseline to post-treatment and a BMI gain of 1 from post-treatment to follow-up, resulting in an overall BMI reduction of 0.82. Those in the wait-list control group had a BMI reduction of 0.65 from baseline to post-treatment and a BMI gain of 1.18 from post-treatment to follow-up, resulting in an overall BMI gain of 0.53.

Moore (2007).

Moore delivered a 6-week intervention (following a 9-month pilot period) to 30 children, age six through twelve, and their caregivers. Initial recruitment was for children at or above the 85th BMI percentile for age and sex; however because of difficulties with recruitment and attrition, the inclusion criteria were expanded to include children at or above the 75th BMI percentile. The children were primarily female (70%) and rural (70%), but were ethnically diverse. Parental involvement consisted of motivational interviewing techniques during the pilot period and providing parent training focused on skill acquisition for behavioural change and adherence. Attrition from the time of consent was reported to be 85%.

A descriptive retention analyses was provided, which described the number of participants lost at each stage of the intervention. As well, qualitative barriers at each step where attrition was greater than 50% of the remaining sample were explored. They reported four primary barriers to access and retention: (a) inadequate knowledge of the intervention prior to enrolling on the website, accounting for 77% attrition at that step, (b) refusal to provide personal information in order to screen for eligibility criteria, accounting for 70% attrition at that step, (c) burden associated with scheduling a baseline assessment, accounting for 54% attrition at that step, and (d) burden associated with post-intervention assessment, accounting for 67% attrition at that step. A number of changes were made to the program to improve retention were made over its course. These changes included: (a) broadening the inclusion criteria (i.e., age and BMI), (b) simplifying the screening process (e.g. eliminating the collection of some information), measures (e.g., dietary and physical activity measures), and materials, (c) providing additional psychoeducation and information on healthy meal choices, (d) enhanced participant support by sending personalized emails, offer email contact with a coach, and sending reminders to participate and (e) the website layout was changed in order to be more user-friendly.

In terms of body composition no significant differences in BMI *z*-scores between groups were observed from baseline to post-treatment. Overall, BMI *z*-scores remained stable for both groups from baseline (M = 2.4, SD = 0.3) to post-treatment (M = 2.4, SD = 0.3), and therefore data was only provided for the overall sample.

Noteworthy Papers

The three papers identified as noteworthy are more fully described in Table 13; all describe the same two year study of overweight African American adolescent girls, aged 11 to 15, and a participating parent. Adolescents were all at or above the 90th BMI percentile.

Table 13

Noteworthy Studies

Study	Population ($M \pm SD$)	Study 1) Type 2) Length	Attrition 1) Rate* 2) Other Info.	Adherence	Body Composition Outcomes
White et al, 2004 & Williamson et al, 2005	57 African American adolescent girls aged 11 – 15 (13.2 ± 1.4) & overweight parent (age 43.2 ± 6.2) Adolescent BMI: 36.34 ± 7.89 Parent BMI: 38.48 ± 7.18	1) RCT with education control 2) 6-month time-point	1) 18% overall (post-randomization: 18% from INT, 7% from CTL) 2) NR	Measured by: (a) log-ins (b) completed quizzes	INT: Adolescents lost significant fat mass ($p < .05$) & parents lost significant body weight ($p < .05$). CTL: Significant increase in BMI from BL ($p < .05$). Approaching significance: BMI percentile for INT girls ($p = 0.057$), and body weight for INT girls ($p = 0.055$). Changes in % body fat (± *SE*) Adolescent: INT: -1.1 ± 0.5 CTL: 0.4 ± 0.5 Parent: INT: -0.6 ± 0.3 CTL: 0.2 ± 0.3 Changes in body weight (kg) (± *SE*) Adolescent: INT: 0.7 ± 0.6 CTL: 2.3 ± 0.6 Parent: INT: -2.4 ± 0.7 CTL: -0.4 ± 0.6 Changes in BMI (± *SE*) Adolescent: INT: -0.2 ± 0.2 CTL: 0.7 ± 0.2 Parent: INT: -1 ± 0.3 CTL: -0.1 ± 0.8:
Williamson, 2006	Same as above	1) Same as above 2) Two-year time-point	1) 34% (post-randomization: 24%/ CTL; 36% / INT) 2) NR	Measured by: (a) log-ins (b) completed quizzes	Intention-to-treat: All significant changes at 6-months lost; INT and CTL participants did not differ from BL.

*Attrition rate was calculated based on the number of participants who dropped-out following the informed consent process, as most studies reported attrition rates following randomization (Important: rate does not include those who failed to meet inclusion criteria

NR = not reported
BL = baseline
PT = post-treatment
FU = follow-up
INT = Intervention group
CTL = Control group

This study was noteworthy because it was primarily delivered over the Internet; however, participants attended four face-to-face sessions over the first three months of the intervention.

White and colleagues (2004) & Williamson and colleagues (2005).

These two papers describe the 6-month time point of this study. Parents participated in all aspects of the intervention along with their children. Overall attrition was reported at 18% (measured from the time of consent). Following randomization 18% of the treatment group dropped out and 7% dropped-out from the control group; attrition was not further evaluated intervention group were also significantly more likely to log-in to the study website ($p < .001$) and averaged 557.3 log-ins ($SD = 500.4$) in comparison to the control group, who averaged 226.8 log-ins ($SD = 161.8$).

Adolescents completed an average of 9.8 quizzes out of a possible 25 ($SD = 8.2$, range: 0 - 25) and obtained scores greater than 60% on 7.7 quizzes ($SD = 7.1$, range: 0 - 24) (White et al, 2004, Williamson et al, 2005). Parents completed an average of 9 quizzes ($SD = 8.2$, range: 0 - 23) and obtained scores greater than 60% on 5.6 quizzes ($SD = 4.3$, range: 0 - 22). Quiz completion significantly decreased from the first half of the intervention to the second half of the intervention for both adolescents ($p < .001$) and parents ($p < .001$). Adolescents completed an average of 5.9 quizzes ($SD = 4.2$, range: 0 - 13) in the first half of the intervention compared to 2 quizzes ($SD = 3.9$, range: 0 - 25) in the latter half of the intervention. Parents completed an average of 5.6 quizzes ($SD = 4.3$, range: 0 - 12) in the first half of the intervention compared to 2.4 quizzes ($SD = 4.1$, range: 0 - 12) in the latter half of the intervention. Adherence was not a significant mediator of weight loss for adolescents or parents in the intervention group. However, the average quiz score was fairly consistently related to other adherence measures. Finally, adherence was also related to depressive symptomatology in adolescents ($p < .05$); a

higher frequency of depressive symptoms was related to fewer website log-ins. This finding was partially supported for parents ($p < .05$) in terms of average quiz scores, whereby a higher frequency of depressive symptoms was related to lower average quiz scores.

In terms of body composition adolescents in the intervention group lost a significant amount of body fat compared to controls ($p < .05$), and parents lost a significant amount of weight compared to controls ($p < .05$). Moreover, participants in the control group had a significant increase in BMI compared to controls ($p < .05$). Several relationships approached significance for girls in the intervention group, including a reduction in BMI percentile ($p = 0.057$) and a reduction in body weight ($p = 0.055$).

Williamson and colleagues (2006).

This study described the two-year time-point in the aforementioned study. Attrition from the two-year study was 34%, with 24% dropping out of the control group and 36% dropping out of the treatment group ($p = .34$). Only one baseline characteristic was related to drop-out; adolescents with lower scores on a sub-scale pertaining to exercise behaviours were more likely to drop-out. All families attended 100% of their four face-to-face sessions in the initial twelve weeks of the study. In terms of adherence, adolescents and parents in the intervention group logged-in to the intervention website more often during the first year of the intervention in comparison to control participants ($p < 05$); however, during the second year of the intervention, groups were fairly equal in access to their respective websites. Adolescents and parents in the intervention group were also significantly more likely to self-monitor weight and activity during the first year than during the second year. Parents in the intervention group who reported interest in and comfort with computers at baseline were slightly more likely to log-in ($p = .07$) and use email functionality ($p = .06$) during the second year of the intervention.

All significant changes in body composition that were observed at six months were lost at the two year time point and the intervention group did not significantly differ from the control group in terms of body composition.

Discussion

Four studies (described in seven articles) were included in this review. Three of the studies met all inclusion criteria, in that they were paediatric obesity interventions delivered exclusively over the internet for at least six weeks. A fourth study was included as noteworthy since the face-to-face component of this primarily web-based study was very minimal. All studies were RCTs; two had wait-list control groups and two had education control groups. Three studies had adolescent participants, whereas one reported on pre-adolescent children. All of the studies described reported on attrition, adherence, and body composition. The studies reported attrition rates fairly consistently, although many did not further evaluate attrition. Most studies reported on adherence using a range of variables; although sometimes the reporting was not always consistent. One study referenced adherence being low in respect to dietary recommendations but did not provide statistics or other examples to quantify the low adherence. Body composition changes were reported in a fairly consistent manner, using variables such as like BMI, fat mass, and body weight. Parental involvement ranged from less involved (i.e., sending a newsletter, providing a handbook), to moderately involved (i.e., motivational interviewing, skill training) to fully participating in all aspects of the intervention.

Attrition and Adherence

Attrition rates in solely web-based interventions for pediatric obesity are high. The three studies included in this review reported rates of 45%, 82%, and 85%. As expected, these rates are higher than what is observed in face-to-face interventions, with a recent review reporting rates ranging from 27% to 73% (Skelton & Beech, 2011),

although these is significant overlap. Two of the three studies investigated reasons underlying attrition studies, albeit not systematically or consistently.

Jones (2008) investigated whether baseline characteristics were related to attrition and found that being white, having a depressed mood, and having greater body shape concerns were related to attrition. In terms of ethnicity, this does contradict some research from face-to-face interventions which generally show that non-Whites are more likely to drop-out of paediatric obesity treatment earlier (de Niet, Timman, Jongejan, Passchier, & van den Akker, 2011), although findings related to ethnicity are mixed (Skelton and Beech, 2011). Findings from the Jones (2008) study are consistent with those in face-to-face research with children, which has also found depressive symptomatology to be related to attrition (Zeller et al., 2004). Research related to shape concerns and attrition could not be identified, however there is research that suggests that having a higher initial BMI is related to attrition (Barlow & Ohlemeyer, 2006; Zeller et al., 2004; Heinberg et al., 2010). It is possible that those with higher BMIs, as a group, may report higher levels of shape concerns. Conversely, research does show a high prevalence of shape concerns in non-obese populations, and particularly in eating disordered populations (Goldschmidt et al., 2010; Lampard, Byrne, McLean, & Fursland, 2011) who may present as overweight, normal weight, and underweight.

Moore (2007) did a qualitative analysis of attrition by examining the number of participants lost at each step of the intervention to come up with barriers to access, which related to pre-intervention knowledge, reluctance to provide personal information, and scheduling difficulties, and burden. Furthermore, the barriers were used to help guide several modifications to their intervention although no data is presented as to whether these changes led to increased retention in participants who were recruited later.

The one noteworthy study (White et al, 2004, Williamson et al, 2005, Williamson et al 2006), which included four face-to-face sessions during the first twelve weeks of the intervention, reported lower attrition rates than the solely web-based studies. At six months overall attrition from the study was 12% (18% from the intervention group) and at two years was 34% (36% from the intervention group). These findings may suggest that the addition of a face-to-face component may serve as a protective factor against attrition from web-based studies. However, it is also possible that the participants in this two year study had other incentives for staying in the program. Of note, participants in this program received a $700 credit to use towards the purchase of a computer (families had to contribute $300 out-of-pocket), were provided internet access over the duration of the two-year intervention, and were marginally compensated families for each of the four assessments. It is possible that these incentives contributed to lower attrition rates, however with so little research in the area more research would need to be conducted in order to clarify this.

Most of the included studies measured adherence, typically via measuring the number of screens accessed, log-in data, and the use of self-monitoring diaries. Moore (2007) reported on adherence, but only reported that there were low levels of adherence to nutritional guidelines, without providing statistics. Jones (2008) was the only author who measured the number of discussion board postings, with a low level of discussion board postings.

Generally, adherence to intervention expectations was also low. Given that adherence and attrition are related, in that attrition is an exaggerated form of non-adherence (Skelton and Beech, 2011), it is not surprising that both are low. Jones and colleagues (2008) were the only investigators who reported the number of participants who never logged in to the study website, which was 31% of participants; a further 42%

accessed the program for less than half the intervention (i.e., 8 weeks or less). The number who never logged-in is fairly consistent with the HEALTHY study (Study #1) where 24% of parent-child dyads never logged into the intervention website. In order to better understand what prevents participants from logging in to websites, it is recommended that future investigators start collecting information on barriers to accessing treatment.

Furthermore, participants in these interventions did not tend to use the psychoeducation provided to them; this was manifest in many ways. In Doyle and colleagues' (2008) study this included an average of only one third of the provided materials being read; in fact, a large proportion of the participants read less than 10% of the materials. Given this is an emerging field there is not a great deal of research to compare these numbers to. Jones and colleagues (2008) found that participants accessed an average of 20, out of possible 94, topic screens; thus on average, participants viewed about 20% of the available materials As well, some participants did not access any of the web screens. Out of a possible 16 weeks, participants accessed an average of 4.5 weeks of content screens.

In terms of self-monitoring, Jones and colleagues (2008) reported a number of statistics, including the use of self-monitoring journals. Interestingly, the basal number in each range was for each behaviour was always a zero, indicating that at least one person did not self-monitor for each behaviour. This likely reflects the high proportion of participants who never logged in to the study. Interestingly, participants were slightly more likely to self-monitor food intake as opposed to physical activity, weight, and personal journal entries. It is possible that this finding reflects greater opportunities to self-monitor food intake, as most people eat several meals a day but may not engage in physical activity and/or take body measurements at the same frequency. Alternatively, it

may suggest that most people acknowledge that diet is a crucial aspect of weight loss and plays a large role in body side, weight loss, and weight maintenance.

The fact that many participants failed to engage in self-monitoring is likely due to time constraints. Certainly, previous research on attrition from face-to-face interventions for pediatric obesity has found that, when asked, participants are likely to cite time constraints and scheduling difficulties as barriers to treatment. However, future research would be needed in order to evaluate these hypotheses.

Nonetheless, given that self-monitoring is related to success in pediatric obesity treatment (Epstein, McCurley, Wing, & Valoski, 1990), future interventions may wish to seek ways to promote and reinforce self-monitoring among children and adolescents in pediatric obesity programs. For example, Doyle and colleagues (2008) used a lottery-based system to reinforce adherence; whereby adhering to study components would enter participants into a lottery where they could win $20 gift certificates and/or telephone calls with their coach to discuss any issues arising in the program.

The one noteworthy study also reported on adherence, both at six months (White et al, 2004, Williamson et al, 2005) and two years (Williamson et al, 2006). Like the aforementioned studies, when ranges for adherence were reported the basal number was always a zero, indicating that at least one person in the intervention did not complete at least that one component measured using adherence data. At six months, adherence focused on quiz completion and quiz scores. However, a qualitative examination of the statistics does suggest slightly better adherence compared to other studies. In the aforementioned included studies, when all statistics were provided, average use (representing the mean) was typically around 20% of the upper limit of the range. In the noteworthy study the average of the various adherence measures was typically around 30% to 50% of the upper limit of the range.

These findings may suggest that blended interventions may help to promote adherence. However, this should be interpreted with caution as the comparison between quiz completion (in the noteworthy study) and other measures of adherence (e.g. web screens accessed) may not be a fair comparison. However, it is probably prudent to assume that they would be related on some level, as quiz completion would likely be preceded by accessing some form of psychoeducation on the intervention website. Unfortunately, as time progressed quiz completion also decreased. During the first three months adolescents and parents completed an average of about six quizzes (out of a possible 13), but during the latter three months this number dropped to closer to two quizzes for both parents and children. Adherence data on quiz completion were not provided for the two-year time point. Interestingly, despite poor adherence even during the first six months all families attended all four face-to-face sessions that were offered.

At two years (Williamson et al, 2006) the trend of decreasing adherence continued; however, at this time point the focus was on website log-ins. In comparison to control subjects, those in the intervention were significantly more likely to log-in to the intervention website during the first year but during the second year of the study intervention and control participants were fairly equal in their access to their respective websites. Self-monitoring among those in the intervention group also significantly decreased during the second year of the intervention. These findings suggest that even though attrition and adherence are not only poor to begin with, they become exacerbated over time. However, given the dearth of web-based interventions for pediatric obesity more research is needed to better determine rates of attrition and degree of adherence in web-based studies.

Two of the included studies (Jones et al, 2008; Moore, 2007) made modifications to their interventions as a result of poor initial adherence and attrition in the hopes of

improving later adherence and attrition. Adaptations are an important and inevitable step in good implementation of interventions (Durlak and DuPre, 2008). Following poor adherence in the first cohort (of two cohorts), Jones and colleagues (2008) added an optional face-to-face meeting with a mentor, which participants in the latter cohort attended an average of one time. Moore (2007) made several modifications to inclusion criteria, psychoeducation, and study components (e.g. self-monitoring). Unfortunately, no information on whether these changes improved adherence and/or attrition was provided. It would be very important for future research to include a description of these effects in order to guide the refinement of these types of interventions, and in order to gain a better understanding of what types of treatments may be acceptable and feasible for participants to be engaged in order to maximize efficacy.

Body Composition

Results from all of the studies (included and noteworthy) do suggest that web-based interventions for pediatric obesity usually result in marginal changes in body composition in the short-term for those who do not drop out early. Typically these changes are found for BMI and/or BMI *z*-scores. The one two-year study suggests that these changes are not maintained in the long-term and that the body composition changes that take place in the short-term are lost as time progresses. These findings are somewhat consistent with a Cochrane review (Luttikhuis et al., 2009) where meta-analytic procedures demonstrated that face-to-face behavioural lifestyle interventions typically resulted in small but significant decreases in body composition in children during the short-term (measured up to six months). However, these changes were lost at one-year follow-up in the majority of studies, with only a few reporting that body composition changes were maintained. Meta-analytic procedures for adolescents demonstrated a

slightly stronger effect in the short-term and maintenance was observed at one year follow-up in the majority of studies.

These body composition findings are not consistent with Epstein's research (e.g.,Epstein et al., 1990; Epstein et al., 1994), which have demonstrated successful maintenance up to ten-year follow-up. However, it is important to note that Epstein's approaches have stringent inclusion criteria, and a run-in period during which participants were tested for compliance. This favours participants with high motivation to change and who are at the greatest likelihood of succeeding (Ebbeling, Pawlak, & Ludwig, 2002).

Strengths and Limitations

This review provides a summary and synthesis of exclusively web-based interventions for pediatric obesity. A very liberal approach to finding articles was employed in order to ensure no missed relevant research, which is a strength of this study. As well, the study focused on solely web-based studies in an attempt to separate out any effects related to face-to-face interventions. Previous reviews have either focused on only face-to-face interventions or interventions with a web-based component, even if that component was very small. Unfortunately, the review is limited by the dearth of such interventions and it is impossible to draw conclusions from such a limited number of studies. Another limitation is that many studies do not systematically evaluate reasons for attrition, either by looking at baseline characteristics related to drop-out and/or contacting families after they're dropped out in order to evaluate barriers to intervention. This is also reported to be an issue in face-to-face interventions for pediatric obesity (Skelton & Beech, 2011). Finally, the studies also did not consistently report on adherence measures.

Summary

Systematic reviews are a valuable way of examining all the research in a particular field. This review summarized the evidence regarding exclusively web-based

pediatric obesity treatment studies. An additional intervention was included because of a very small face-to-face component. Pediatric obesity continues to rise in many regions around the world and the internet may be a viable method for delivering interventions to families, especially those that may not have accessibility to other types of interventions. However, issues related to attrition and adherences are significant issues; more participants fail to access the full range of treatment components and the majority drop out early. Included in this number are a significant proportion of participants who never log-in to the intervention websites. Given the high attrition and poor adherence it is critical that future research start to more systematically study attrition and adherence in order to develop interventions that are easier for families to continue to persevere with. Eysenbach (2005) argues that the problem of attrition could be better understood in terms of diffusion research. He also offers his own model to help advance a 'Science of Attrition' (Eysenbach, 2005). Other researchers may wish to consider this model moving forward in this field.

Some very limited evidence from this review suggests that including even a minor face-to-face component may be related to better adherence and subsequently reduced attrition later in the program. Many more studies would be needed in order to clarify whether the addition of face-to-face support is helpful. There may be innovative ways to provide face-to-face support over the Internet, such as using web-based video conferencing (e.g. Skype). Future research may also wish to explore these possibilities.

While the web-based interventions that were reviewed did show marginal promise in terms of improving body composition in children and adolescents during the short-term these effects are typically lost during the long-term; however, long-term maintenance was more encouraging in adolescents. One area of future development may

be to conduct more formal evaluation of these interventions in an attempt to distinguish the most effective, and acceptable treatment components.

Once some of the issues in web-based interventions for pediatric obesity are resolved increasingly effective web-based interventions may emerge. Given that face-to-face interventions are very labour intensive and costly, developing web-based interventions that promote better attrition and adherence may be advantageous given the immense medical, psychosocial and economic burden of pediatric obesity. Alternatively, additional research may demonstrate that exclusively web-based interventions may not be the most effective or cost-effective modality for delivering pediatric obesity interventions, and may indicate promise in other areas such as prevention and/or weight loss maintenance (Tate et al., 2001). However, given so little research has been conducted in the area it would be premature to draw conclusions about the effectiveness of this approach.

General Discussion

The original purpose of this thesis was to deliver a family-based intervention for paediatric obesity over the Internet. However, following two years of recruitment, poor adherence to study components, and high attrition, the purpose was revised to explore the feasibility of such interventions. Study #1, the originally designed web-based study called HEALTHY, became exploratory in nature and sought to evaluate whether baseline characteristics were related to attrition and adherence. Outcomes and evaluation of this study were reported qualitatively. Study #2 comprised follow-up interviews with parents who consented to participate in the HEALTHY study. These interviews covered their impressions of the study, barriers in accessing the study and overall needs in seeking services for their overweight children. Study #3 was a systematic review of interventions for pediatric obesity that were delivered exclusively over the internet. This review updated the literature from when the HEALTHY study was initially proposed, and also synthesized all the studies in this small field of research.

Are Family-based Interventions delivered over the Internet Feasible?

The primary question at hand is: "Are family-based interventions for paediatric obesity delivered over the internet feasible?" Unfortunately, the answer to this question is not clear. The current thesis and other relevant research in the area suggest that these interventions may be feasible, at least for a select group of participants, although they may not be as promising as other interventions like as face-to-face treatment. This is based on the poor adherence, high attrition, and short-lived changes in body composition that are observed in these web-based studies. However, so little research has been done in the field of web-based studies for pediatric obesity that more is needed. Moreover, poor adherence and high attrition are already problematic in face-to-face interventions for paediatric obesity, although to a lesser extent. This complicates the ability to determine

what delivery modalities work best in this field. However, the Internet does offer some promise in that it resolves some issues associated with face-to-face interventions such as scheduling, time, and availability and improves access to services for those who do not live in urban centres that offer treatment programs.

One of the major methodological issues that may be a barrier to advancing treatment of overweight children and adolescents is that few investigators systematically study attrition by looking at participant characteristics related to these phenomena. Skelton and Beech (2011) reviewed face-to-face interventions for paediatric obesity over a ten-year period and identified ten research articles that did specifically examine this question. Some of the factors that emerged as more noteworthy, in that a greater number of studies found they were significantly related with higher attrition (although research is still mixed), included higher BMI status, co-morbid health problems, and some family factors related to vulnerability (e.g. single-parent status, income, ethnicity).

Study #1 looked at baseline characteristics that were related to attrition and adherence. A number of significant relationships emerged and interestingly, a larger proportion of these relationships were found to be based on the parents' baseline characteristics. In terms of parent characteristics, significant relationships emerged between earlier attrition and/or poor adherence and decreased general health, autonomous motivation, and higher BMI. In terms of child characteristics, the most robust associations occurred between physical functioning and the attrition and adherence measures. Typically, better physical functioning was associated with increased adherence and later attrition. The one exception to this was that higher physical functioning was also related with completing fewer quizzes. Other child characteristics that emerged as significantly related to earlier attrition and/or poor adherence included lower self-esteem, and lower combined psychosocial and physical QOL.

Study #3 reviewed whether investigators using web-based approaches studied attrition and adherence. All of the web-based studies did examine these phenomena, albeit not consistently. In terms of attrition, only one study out of four reported baseline characteristics associated with attrition and one study conducted a qualitative retention analysis. Baseline characteristics that were significantly related to attrition included being white, having increased symptoms of depression, and having increased shape concerns (Jones, 2008). Moore (2007) qualitatively examined the steps participants went through in her intervention and reported on steps where greater than 50% of the remaining sample dropped out. While these are useful in gaining some insight into factors related to attrition, without consistency in methods across studies it is difficult to ascertain which factors are most important to retention.

Results from Study #3 indicate that investigators do a better job of reporting on adherence from web-based studies and many investigators use similar measures of adherence to web-based studies. These measures commonly include log-in data, web screens accessed, quiz completion, and self-monitoring diaries. The consistency with which investigators are measuring adherence is a strength of the existing research. Unfortunately, it appears that most participants do not adhere well to study components and little is known about which participants adhere better.

Skelton and Beech (2011) reported that even fewer investigators actually survey and/or interview treatment participants who have dropped-out in order to gain better insight into the factors that serve as barriers to treatment. In the ten face-to-face studies they identified that systematically evaluated attrition and adherence, only three actually talked to their former research participants to try and gain a better understanding of barriers. In the current systematic review (Study #3), we found that none of the included or noteworthy papers used their own research participants to more systematically study

attrition and adherence. Cote and colleagues (2004) focused on programme factors and levels of satisfaction. Non-completers from this study reported factors like the program not meeting expectations, difficulties with insurance coverage, and the child wanting to leave the program.

Barlow and Ohlemeyer (2006) surveyed a large proportion of non-completers from their study. Common reasons for dropping-out included: the intervention was not what participants were looking for, concerns around missed school, distance of the program from the family home, scheduling conflicts, insurance coverage difficulties, lack of readiness to change in child and family, and the frequency of visits (some participants reported they were not frequent enough; others reported they were too frequent).

Kitscha and colleagues (2009) conducted telephone surveys of parents who did not return to treatment; common reasons for dropping-out included: (a) physical barriers such as scheduling, parking, and location, (b) organizational barriers such as the environment of the clinic, and (c) the educational components of the intervention such as the psychoeducation, individual emphasis (as opposed to family focus), and exercise component. Altogether, common reasons identified by Kitscha and colleagues (2009) included time commitment, missed work/school, cost (and lack of insurance), scheduling and appointment times, and educational content (Skelton & Beech, 2011).

Therefore, Study #2 can provide some important insight into what may work for families who are looking to support their overweight children in achieving a healthier lifestyle. Firstly, parents were asked about their impressions about the HEALTHY study in case they had dropped out because of issues with program features and/or personnel. Certainly, the aforementioned research does suggest that program quality and characteristics may be related to poor adherence and attrition. However, this does not seem to be the case as the majority of parents reported positive overall impressions of the

HEALTHY study. As well, the evaluation questionnaire administered to program completers in Study #1 also suggests positive impressions. The program components with the greatest positive feedback from parents (Study #2) included coach support, the Traffic Light Plan, increasing physical activity and decreasing screen time, and the reward system. These are somewhat consistent with the program components ranked as most useful by completers in Study #1 who reported coach support, education, and self-monitoring were most important; self-monitoring is the obvious discrepancy.

A large majority of parents (i.e. all but one) reported that the self-monitoring component was the most challenging intervention component, despite the fact that many acknowledged the importance of self-monitoring. Because self-monitoring is so critical to success in paediatric obesity interventions, (Germann et al., 2006) future research may wish to study different approaches to making self-monitoring more interesting and easy for children. For example, media sources and technology such as Smart Phones and/or tablets may be used, as some research suggests these are acceptable, and may improve adherence (Cunningham, 2012; Woolford et al., 2010).

Parents in Study #2 were also asked about the barriers to their participation and reported various barriers at multiple levels. At the study-level, commonly cited difficulties included feeling the various study components were too cumbersome to take on and experiencing difficulties inputting self-monitoring entries. At the individual-level, commonly cited difficulties included lack of motivation and lack of time/competing demands. At the family-level, commonly cited difficulties included the number of family commitments, not feeling well-supported by other family members in adopting behavioural change, and difficulties associated with the location of the computer in the family home or organization of the computer space. One mother reported barriers associated with being a single mother. At the social-level, commonly cited barriers

related to children's friendships; specifically having either a lack of friends available for social support or difficulties adhering to lifestyle recommendations while spending time with friends. Environmental-level barriers were not commonly cited as barriers to participation, suggesting that the built environment has less of an impact on the ability to adhere to and complete pediatric obesity treatment. However, parents living in rural areas did report that the lack of recreational programming where they lived was a barrier. Less commonly cited difficulties (i.e., mentioned by only one parent each) across the various levels are discussed at more length in Study #2.

In comparing the barriers to participation from Study #2 with the articles reviewed by Skelton and Beech (2011), some similarities emerge. These include lack of readiness to change, the time commitment, and (for some in Study #2) the heavy educational component, which some parents felt could be streamlined. As expected, many of the physical barriers commonly cited in face-to-face treatment were not mentioned by Study #2 participants, likely because part of the intent in designing web-based studies is to eliminate these types of barriers. Interestingly, one of the barriers reported in the study by Kitscha and colleagues (2009) concerned the individual emphasis of the program they were enrolled in, as opposed to having a greater family focus. The HEALTHY study did attempt to involve family by having one parent participate along with their eligible child and by encouraging involvement of all family members. However, some parents still reported barriers associated with lack of support from other family members as well as the need that interventions take a family approach.

If considered in the context of Family Systems Theory (Bowen, 1966; The Bowen Center, 2011), and the various subsystems in every family between individual members and combinations of members, the issue of greater family involvement increases in complexity and importance. Moreover, while the HEALTHY study was initially intended

to impact on the entire family system via promoting positive behavioural changes it appears this was not the case. In fact, results from Study #2 suggest that the family system actually acted as a barrier to participation in terms of demands within the family and inconsistent support from other family members in achieving and maintaining positive behavioural changes. It is possible that the family system as a whole was much too engrained in its lifestyle habits in order to be affected by a short-term intervention targeting only a portion of the family system. Future research may wish to explore the efficacy of whole family interventions, although the high cost of these types of interventions may make this less feasible. On the other hand, these types of interventions may be more feasible using a web-based approach where costs would be expected to be lower. Alternatively, delivering interventions (or components of interventions) to the family, in the family home, may also be an interesting research direction.

Finally, parents in Study #2 were asked about their needs in seeking services for their overweight children. The thirteen needs reported by parents fell into four over-arching categories: knowledge and education (i.e., healthy eating knowledge and education on active living), social supports (i.e., coaching and peer social support), tools for success (i.e., tips and tricks, physical activity component, meal plans and recipes, make it a family effort, adapting for special circumstances), and program goals (i.e., weight loss and empowerment). Within the social supports category, the coaching theme included ideas around the importance of having the coach be a trusted source outside of the family and intensified coaching to increase accountability. The main suggestions about intensified coaching were twofold: (a) to increase and improve reminders to participate, and, (b) to incorporate "real-time" contact into the coaching.

Stevens and colleagues (2008) used a highly structured and efficient reminder system, albeit in the context of web-based maintenance for adults. Participants first

received up to two email reminders (spaced one week apart), if a participant still did not log-in email reminders were follow-up with two automated phone messages (spaced one week apart). If a participant still had not logged-in following automated phone messages then a member of the research team phoned the participants. The reminder system in this study was highly effective in that by the time the second phone message was received 97.3% had logged-in, and following the telephone contact from a research team member all had logged-in. These findings may be relevant to intervention research with a paediatric population. Given their success, other research may wish to incorporate a similarly systematized and automated approach. However, in the context of paediatric obesity the delivery of emails, automated phone messages, and real-time telephone contact may wish to target parents.

A number of suggestions for future research and clinical practice were discussed at length in Study #2 based on the barriers experienced and needs in seeking services. Taken together with the other research reviewed, some ideas that hold the greatest merit include the inclusion of motivational interviewing techniques, exploring novel approaches and technology to increase accessibility (e.g., smart phones, tablets), formalized program evaluation to identify the most effective treatment components, placing a greater emphasis on the entire family system as opposed to only those enrolled in the program, and increasing social supports for participants. If an exclusively web-based approach is sought this could include intensified coaching, the use of social networking, or web-based video conferencing.

In order to overcome difficulties with high attrition and poor adherence it would be crucial for future research in the field to adopt a consistent approach to systematically studying these phenomena. As well, given that some participants do fare better in these interventions, at least in the short-term, another research direction may focus on

identifying those participants who may be better candidates for web-based studies. However, the long-term maintenance of body composition changes is an issue for the select group who do complete these interventions, thus another research direction may wish to concentrate on the maintenance of change. It is also possible that web-based interventions may not work with a paediatric population.

Alternative Approaches

Some of the other approaches for web-based studies and overweight/obesity include work in the area of prevention and blended programs that combine face-to-face interventions with the Internet. As well, some research with adults suggests the Internet may be useful for weight loss maintenance. These alternative approaches will be discussed.

Prevention.

Several studies have used web-based approaches for the prevention of overweight and obesity across various ages. Jones and colleagues (2011) delivered a ten-week online prevention program to parents of preschoolers who were either overweight or at-risk of overweight, determined by having two parents with BMI's greater than 25 (i.e., overweight and/or obese). Parents were required to read psycho-educational materials and devise weekly goals based on these modules. As well, they were monitored by a health consultant (who had a comparable role to the coach in the HEATHY study). Outcomes included perceived parental knowledge and behavioural outcomes in regards to their preschooler's food intake, activity level, and sedentary behavior. Fidelity and acceptability measures were completed at the conclusion of the study.

Jones and colleagues (2011) reported an attrition rate of 15%. Data on behavioural change was descriptive in nature, but did suggest improvements in eating behaviours and physical activity. For example, at baseline 68% of parents reported that their child ate

vegetables on a daily basis; this increased to 90% at ten-week follow-up. At baseline, 45% of parents reported regularly (i.e., 2 – 3 times/week) participating in physical activity with their child; this increased to 93% at follow-up. Seventy-five percent of the parents who completed the treatment also responded to the fidelity and acceptability questionnaire. There was high and favourable agreement among parents that the program was acceptable, relevant, and interesting. Furthermore, parents reported the time commitment per module was reasonable *(M* = 55 minutes, range: 20 – 120).

Jones and colleagues (2011) used parents as exclusive agents of change, which makes sense for preschool children. However, it may also make sense for children in other age groups. Golan and colleagues (Golan, Weizman, Apter, & Fainaru, 1998b) found that parents as the exclusive agents of change yielded healthier lifestyle changes in overweight children and greater weight loss compared to groups comprising children only or standard parent-child attendance in treatment (Golan, Weizman, Apter, & Fainaru, 1998a). More importantly, studies targeting parents as the agents of change have shown considerably less attrition; they have also shown that these health behaviour changes and weight loss effects can be maintained long-term (Golan & Crow, 2004). These findings emphasize that parents are important in optimizing healthy changes and weight loss, and also help to minimize attrition.

Thompson and colleagues (Thompson et al., 2008) also delivered a web-based prevention program over eight weeks to 8 to 10 year-old African American girls at risk of obesity. The intervention aimed to promote healthy lifestyle behaviours like fruit and vegetable consumption, reduced juice intake, water intake, and increased physical activity. Significant post-treatment differences were observed for all lifestyle behaviours ($p < .01$). Furthermore, an average of 74.5% of participants logged-in to the study website each week and attrition was less than 10%.

Chen and colleagues (2011) delivered an eight-week prevention program to normal weight and overweight adolescents of Chinese ethnicity, and whom were monitored up to an eight-month follow-up. The intervention was party based on the Transtheoretical Model and stages of change and psychoeducation was based on the adolescents' stage of change. Interventions were designed to increase self-efficacy and problem solving in regards to lifestyle behaviours, such as food intake and physical activity. At follow-up participants had significantly lower waist-to-hip ratios (effect size = -.01, p = .02) and diastolic blood pressure (effect size = -1.12, p = .02). Furthermore, significant increases were observed for physical activity (effect size = 12.46, p = .01), fruit and vegetable consumption (effect size = .14, p = .001), and knowledge related to activity (effect size = .16, p = .008) and nutrition (effect size = .18, p = .001). The attrition rate from this study was 7%.

Another interesting approach for delivering prevention programs is in the area of school-based interventions. A number of studies like this were found in the screening process for Study #3; this suggests that this is a growing area of research that may hold some promise for blended prevention programs. Typically these programs are also 'blended' (see following section) in that teachers typically reinforce the program with a lesson.

Ezendam and colleagues (2011) delivered a school cluster randomized trial to adolescents aged 12 to 13 years-old and monitored them up to four-month and two-year follow-ups. The intervention was web-based and computer-tailored. Students were allotted 15 minutes of class time to devote to eight weekly modules that addressed weight management issues and behaviours. Each module included psychoeducational materials, an assessment of an individual health behaviour, tailored feedback (comparing that student's behaviour to recommendations and peer), optional goal-setting around the

targeted behaviour, barrier identification, recommendations on how to change the behaviour, and ideas on organizing social support.

At baseline, the children in this study were 9.1% of the students were underweight, 75.2% were normal weight, and 15.6% were overweight and/or obese (Ezendam et al, 2011). The intervention did not have an effect on BMI or waist circumference at four-month follow-up, but was significantly associated with some healthier behaviour such as drinking fewer sweetened beverages and increased vegetable consumption. For students who did not meet behavioural guidelines at baseline (those deemed 'at-risk') the intervention had a significant effect on increased fruit and vegetable consumption at four months, and activity (measured by step count) at two years. Perhaps less intuitively, the at-risk group was significantly less likely to be involved in sports activity at four months. Attrition rates were reported at 15% for the intervention group and 12% for the control group. As already mentioned, delivery of programs within organization may improve adherence and/or attrition because of vested interests and/or time allotted to these programs during organizational time.

Blended programs.

Blended programs combine face-to-face treatment with a web-based component. One example of such a program was the larger program discussed in Study #3 as noteworthy (White et al., 2004a; Williamson et al., 2006b; Williamson et al., 2005a). Details from this study will not be repeated, other than to reiterate the low frequency of face-to-face contact and the lower attrition compared to the exclusively web-based studies. Blended programs may also entail school-based studies like the study conducted by Ezendam and colleagues (2011). While this program was focused on prevention, it may also be interesting for future research to deliver and evaluate school-based prevention programs to reduce overweight/obesity and or interventions for overweight

and obese children. A recent systematic review of such school-based prevention programs suggests that lifestyle interventions that combine dietary and physical activity components may prevent overweight in the long-term, while physical activity interventions, particularly in young girls, can prevent overweight in the short-term (Brown & Summerbell, 2009).

What's more, one of the parents interviewed in Study #2 mentioned the potential utility of delivering interventions in schools. This type of intervention would likely help to resolve many of the commonly reported barriers in Study #2, such as lack of time, competing demands, and decreased social support. This type of program could also address the need for having a more structured physical activity component. Alternatively, this approach could increase the potential for stigmatization, if delivered in the context of an intervention, and would take time away from learning curriculum.

Many of the programs described in the review by An and colleagues (An et al., 2009) included blended programs. Additional details can be found in this review. However, the results of this review suggest that there is some promise in using these types of interventions. Attrition from these studies ranged from 4.9% to 30%.

Maintenance.

Some interesting research by Harvey-Berino and colleagues suggests that the Internet can be an effective means of helping adults maintain their weight loss (Harvey-Berino, Pintauro, & Gold, 2002; Harvey-Berino, Pintauro, Buzzell, & Gold, 2004). In these two studies participants were either assigned to an Internet-based weight maintenance program or were assigned to continue with face-to-face sessions. No differences between group at 18-months were observed (Harvey-Berino et al., 2004). However, participants in the earlier study were more likely to attend face-to-face meetings and report feeling more satisfied with being in the face-to-face group (Harvey-

Berino et al., 2002). This finding is consistent with the parent interviews conducted in Study #2. Interestingly, differences in attrition were observed between the two groups. Similar maintenance studies conducted with children and adolescents could not be identified. Future research may wish to explore the possibility of using the Internet to support weight loss maintenance in a younger population.

Program Implementation and Evaluation

No matter the approach or research question, it is clear that program implementation and evaluation will provide valuable knowledge in advancing the field. Given the fact that research in this field is still in relative infancy, careful attention to implementation, and documentation of strategies to facilitate replication, should be undertaken. Durlak and DuPre (2008) provide a review of relevant findings and an ecological model to understand the importance of implementation and the interaction among contextual factors. Some of their more interesting findings related to adaptations and organizational capacity.

Adaptation is an inevitable process as new interventions are implemented; they should not be viewed as implementation failures (Durlak and DuPre, 2008). In fact, implementation levels typically hover around 60% with very few researchers surpassing 80%. Durlak and DuPre (2008) future state that adaptation often co-occurs with fidelity, in that adaptation deviate from fidelity. As a better understanding of essential program components emerge researchers may develop better insights around program components should be delivered with fidelity, and those that are more amenable to adaptations.

Organizational capacity was also highlighted as a particularly important by Durlak and DuPre (2008). Specifically, their findings highlight the importance of capacity building, collaboration with multiple partners, administrative support, and community involvement among other things. These findings suggest that these

interventions will be best delivered when these factors are taken into consideration, thus using high community-based approaches like participatory research operating from highly respected community agencies in collaboration.

Finally, once programs have become established and necessary adaptations have been made, Durlak and DuPre (2008) suggest that careful program evaluation should occur. They report that authors differ in how long a program should be established prior to formal program evaluation, and this naturally depends on program complexity. However, estimates range from one year (Fixsen et al., 2005) to three years (Felner et al., 2001).

Summary and Conclusion

In summary, research on the delivery of interventions for paediatric obesity over the Internet shows that there are many difficulties that seem to be common to these types of interventions. Foremost are the issues of poor adherence and high attrition. The HEALTHY study had an attrition rate of 92%. As well, Study #3 reviewed similar studies, with reported attrition rates from 43.3% to 85%. Attrition also poses a significant issue in face-to-face interventions although to a lesser extent; with a recent review reporting attrition rats up to 45% (Stuart et al., 2005).

There are many possible directions that future research could take in exploring other types of exclusively web-based studies. Ideas include the use of video conferencing (e.g. Skype) to deliver coach support, the use of tablets and Smart Phones to further increase mobility and interest, the inclusion of web-based peer buddy systems to increase social support, and program implementation and evaluation methods that could identify the most effective components of web-based programs. Areas of particular concern, as suggested by Study #2, center on the difficulties with self-monitoring and lack of, and importance of, support. Some of the innovative technologies discussed may help address

the issue of self-monitoring, if fun and interesting ways of using technology are developed. Suggestions around technology and social networking may help with addressing the latter difficulties associated with lack of support. Future research would need to determine if these approaches would improve adherence and attrition.

However, perhaps the best way to approach the problem of attrition and adherence would be for future researchers to adopt a more systematic approach to studying these phenomena. Research suggests that these difficulties are not commonly evaluated in the field of pediatric obesity treatment, whether research is web-based or delivered in person (Skelton and Beech, 2011; Study #3). Further research may wish to thoroughly evaluate baseline characteristics associated with attrition and poor adherence and also use former research participants who have dropped-out early in order to gain insights into the reasons underlying poor adherence and high attrition. Initial research in the area suggests that certain characteristics may be more related to attrition and that many families experience similar types of barriers in accessing services. Further developing knowledge in this field could possibly help researchers and clinicians identify those who would have the greatest likelihood of benefitting from exclusively web-based interventions.

Many other alternatives that use web-based technology exist, and were discussed throughout this thesis. Research into these alternatives also suggests lower attrition than has so far been observed in exclusively web-based studies. One alternative is the use of blended interventions. Notably, many parents interviewed in Study #2 indicated that the felt that some face-to-face contact may have helped them, especially in terms of increasing motivation.

Research suggests that even a minimal amount of face-to-face support may be associated with decreased attrition (White et al., 2004a; Williamson et al., 2006b; Williamson et al., 2005a). Another type of blended intervention that may hold particular

promise is school based interventions. Given that these interventions are delivered within the context of school where time is allotted to the intervention, and then reinforced by a lesson, one might expect lower rates of attrition. Certainly, existing research in this area suggests this may the case (Ezendam, Brug, & Oenema, 2011). As well, parents in Study #2 overwhelmingly reported difficulties associated with lack of time and competing demands. A school-based intervention may resolve at least some of these difficulties (as children would likely still have to follow guidelines while not at school).

Similar to school-based interventions, interventions delivered within the context of organized groups may also have similarly lower attrition rates. For example, some interventions have been delivered to groups of Boy Scouts and Girl Scouts (Rydell et al., 2005; Jago et al., 2006). While these studies report less attrition than what is typically observed in exclusively web-based studies, adherence remains a significant issue, with 23% to 56% never accessing the intervention website. This again emphasizes the need to take a more systematic approach to studying attrition and adherence.

Another potential strength of a blended approach is that such an intervention could partially address other areas of need reported by parents in Study #2. These areas of need refer to the desire for a more structures physical activity component and increased opportunities for social support. Research by Deforche and colleagues (2011) suggest positive associations between social connectedness and exercise adherence.

In conclusion, this research seems to suggest that interventions which are exclusively web-based may not be appropriate for most children due to poor adherence and high attrition. However, future research is needed to build on existing findings and advance the field.

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Appendix A

Study Title: Healthy Eating and Active Living Throughout Youth (HEALTHY) Using the Internet

PARENTAL CONSENT FORM

Investigators:

Dr. Gary Goldfield	Mental health research, CHEO Research Institute–2, [redacted]
Dr. Patrick McGrath	IWK, Dalhousie University, Halifax, NS, [redacted]
Dr. Stasia Hadjiyannakis	Endocrinology and Metabolism, CHEO, [redacted]
Dr. Denis Prud'homme	Dean, Faculty of Health Sciences, University of Ottawa, [redacted]
Dr. Ronal Sigal	Foothills Medical Center, Calgary, AB, [redacted]
Dr. Rejeanne Gougeon	Victoria Hospital, Montreal, PQ, [redacted]

Background & Rationale:

We are asking you and your child to participate in a study to see if lifestyle education plus behavioural counselling over the Internet results in weight loss. This study is for families and therefore in order to participate, both a child and at least one parent need to join our weight management program together. We also want to know if the benefits of these interventions have a positive impact on aspects of you and your child's physical and mental health. Presently, there are very few hospital-based pediatric weight management clinics across Canada even though 1 in 3 children are overweight, which means that many children who want to lose weight safely are not being given a chance to do so. The reason there are such few clinics is because they are very expensive for the government to run. We want to know if providing information over the internet may be an efficient and less expensive way of helping children lose weight. If so, we would like to use the internet to provide these services to families in the Ottawa region, and potentially all across Canada.

Study Methods and Procedures:

As a participant in this study, you and your child will receive weekly information on nutrition and physical activity on our secure website and be corresponding with a

counsellor by email who will help you and your child improve eating and exercise habits. I understand that there is a chance that I may not be helped from this study, but I know that it may help others and I still want to participate.

You will be asked to come to CHEO for 3 visits: once before the study begins, a second time immediately after completing the intervention, and a follow-up appointment 3 months after completion of the study. Each visit will take approximately 2 hours**.** You and your child will be asked to answer questions about your medical history and emotional functioning in the first session to make sure you qualify for the study. If you do not qualify for the study, the study investigators will refer your child on to other services at CHEO or in the community if needed.

During each visit, you and your child will be asked to complete questionnaires and diaries about eating habits**,** physical activity, mood, quality of life, how you feel about yourselves and your bodies, as well as getting measured for height, weight, waist circumference and body fat. Body fat will be measured simply by standing barefooted on a machine for 5 seconds. This machine is safe and feels like stepping on a normal scale.

You will be asked to record certain foods you and your child eat as well as your exercise and "screen time" (TV, computer, and video games) on a daily basis during the study period. You will be expected to spend between 15-30 minutes on the internet each day learning about the program and writing to your counsellor. Your child will have some home-work to do each week and will be given a short quiz to see if he/she has understood and remembered what he/she has learned that week.

You and your child's participation in this study is voluntary, and you are free to withdraw at any time for any reason, and this will not affect the quality of health care that your child will receive at CHEO. If you have any concerns during the study, you may contact the study investigators or the study counsellors at any time.

Risks and Benefits:

This study may or may not help your child to achieve and keep a healthy weight. You and your child may or may not receive individual benefit from participation in the study. However you will receive feedback about your child's body composition, eating and physical activity patterns, and psychological and social functioning, and lots of ways of improving these factors which may be helpful for your health, or at least in identifying areas in need of improvement. Your decision to participate or not will not affect the care you receive at CHEO.

At times you or your child may feel uncomfortable with some questions and/or tasks involved with this project. If this happens, we will do our best to help by answering any questions you or your child may have. Also, you and your child are welcome to not answer any questions that make you feel uncomfortable or withdraw from specific procedures during the assessment or from the study altogether at any time. If you or your child choose to withdraw from the study, your child's results from the clinical assessment will remain in their medical file.

Your child and you may feel hungry on the eating plan, feel sore after exercising or feel upset about watching less TV and playing fewer video games. If any problems are

encountered during these assessment visits or over the course of the intervention, appropriate measures will be put in place to ensure the safety and comfort of participants**.** Once notified, staff will immediately assess participants who might need some additional mental health services and decisions will be based on our best clinical judgment, including referrals back to your family doctor or a mental health expert. When required or permitted by law, parents will be contacted and informed of this emergency for participants**.** There is an extremely remote chance of having a heart attack while exercising however, this is exceedingly low in youth.

The knowledge gained from this study may significantly benefit other children struggling with issues related to their weight. For each study visit to CHEO, you will be reimbursed for parking expenses. Your child's participation in this study is voluntary, and you are free to withdraw them at any time for any reason, and this will not affect the quality of health care that your child will receive at CHEO.

Confidentiality:

All information that you and your child give will be numbered and will not contain your name. A list of names and matching codes will be stored separately so that no identifying information will be present in your research file from this study to ensure confidentiality. The information that you and your child provide in this study will be kept in a locked cabinet, and the only people allowed to see the information are Dr. Goldfield and his team, with the exception of the CHEO Research Ethics Board who has access to all hospital records for auditing purposes. Results of the study may be published for scientific reasons, but neither your name nor your child's name will be given out. In addition, the study website is secure and password protected, so all materials sent over the internet will remain confidential. Your personal information will be kept strictly confidential except as required or permitted by law. Limits of this confidentiality include situations of suspected child abuse, concerns of harm to self or others, and any request for information by court order. If at any time during the study a member of the research team believes that a child is showing or reporting significant levels of medical or psychological distress, the parent and the child will be contacted and assessed in order to find out whether a referral for support from a mental health practitioner or study physician is needed.

Questions about the Study:

If you have any further questions, you can contact Dr. Goldfield ([redacted]) or Dr. Hadjiyannakis ([redacted]) or Dr. Patrick McGrath at [redacted]. If nobody is able to answer your call, a voice messaging system is available and one of us will return your call.

This study has been reviewed and approved by the CHEO Research Ethics Board. The CHEO Research Ethics Board is a committee of the hospital that includes individuals from different professional backgrounds. The Board reviews all human research that takes place at the hospital. Its goal is to ensure the protection of the rights and welfare of people participating in research. The Board's work is not intended to replace a parent or child's judgment about what decisions and choices are best for them. You may contact the Chair of the Research Ethics Board, Dr. Carole gentile, for information regarding

patient's rights in research studies at [redacted], although this person cannot provide any health-related information about the study.

At the conclusion of the research study, you will be given a summary of the results if you so wish.

Children's Hospital of Eastern Ontario
Centre hospitalier pour enfants de l'est de l'Ontario

Study Title Healthy Eating and Active Living Throughout Youth (HEALTHY) using the Internet

PARENTAL CONSENT FORM

We ..... and ..... the parent/guardian(s) of ..... hereby consent to our child's participation in the above study.

☐ I agree for you to use my child's body composition and questionnaire data

☐ I agree to complete the body composition assessment and the set of questionnaires measuring eating and activity behaviour and psychological and social functioning.

☐ **I agree to participate in the intervention along with my child.**

We have read and understood the attached information sheet / had the attached information sheet verbally explained to us.

We have been fully informed of the details of the study and have had the opportunity to discuss our concerns. We understand that we are free to withdraw our child at any time or not answer questions that make us uncomfortable and that our child's medical treatment will not be affected if we do. We have received a copy of the information sheet and consent form.

_____	_____	_____
Names of Parents/Guardians	Signatures of Parents/Guardians	Date
_____	_____	_____
Name of child	Signature of Child	Date
_____	_____	
Investigator	Signature of Investigator	Date

Appendix B:

Study Title: Healthy Eating and Active Living Throughout Youth (HEALTHY) using the Internet

CHILD ASSENT FORM

Investigators:

Dr. Gary Goldfield	Mental health research, CHEO Research Institute–2, [redacted]
Dr. Patrick McGrath	IWK, Dalhousie University, Halifax, NS, [redacted]
Dr. Stasia Hadjiyannakis Ext. 2179	Endocrinology and Metabolism, CHEO, [redacted]
Dr. Denis Prud'homme	Dean, Faculty of Health Sciences, University of Ottawa, [redacted]
Dr. Ronal Sigal	Foothills Medical Center, Calgary, AB, [redacted]
Dr. Rejeanne Gougeon	Victoria Hospital, Montreal, PQ, [redacted]

Background & Rationale:

We are asking you to be in a study looking at ways of improving your eating habits and getting you more active. We want to see if learning over the internet with extra help from a coach results in healthier eating, active living and weight loss. You may already know that in Canada, 1 out of every 3 kids is overweight, and there aren't many places where these kids can get help. It can also cost a lot for kids to get help. So we want to know if helping people over the internet is a good, cheap way to help kids lose weight, so that in the future we can help more kids across Canada to get healthy.

Study methods and Procedures:

If you join this study, you will will learn about healthy food and exercise over the internet and will also talk to a coach by email who will help you out. You may or may not change your eating and activity habits or lose weight during this study, but your participation may help us to help other kids in the future.

You will be asked to come to CHEO for 3 visits: once before the study begins, a second

time after you have finished the program, and a third time for a follow-up appointment 3 months later. Each visit will take about 2 hours. The first time you come in, you will be asked lots of questions to find out if the study is right for you. If we think the study is not right for you, we can help you find help someplace else if you want.

Each time you come to CHEO for a visit, you will answer questions about things like what you've been eating, how much you've been exercising, and how you feel about yourself and your body. We will also measure things like how tall you are and how much you weigh. Your body fat will be measured by standing barefoot on a machine for 5 seconds. This machine is safe and feels like stepping on a normal scale.

You will be asked to keep track of what you eat, what exercise you do, and your "screen time" (how much time you spend on the computer, watching TV, or playing video games). You will also spend about 15-30 minutes on the internet website learning about the program and writing to your counsellor. Each week you will have some homework to do and you will be given a quiz to see if you have understood what you have learned.

Because you are choosing to be in this study, you can leave at any time for any reason, and this will not change how you are treated at CHEO. If you have any questions during the study, you can contact the study investigators or the study counsellors at any time.

Risks and Benefits:

This study may or may not help you to eat healthier, become more active or lose weight. We are doing this study because we want to see how well our treatment using the Internet works. You may or may not lose weight, but you will get information about things like how your body works, healthy eating, and exercise, which may be helpful to you in the future.

Sometimes you may feel uncomfortable with some questions and/or tasks in this study. If this happens, we will do our best to help you by answering any questions you may have. You can choose not to answer questions that make you feel uncomfortable, or you can withdraw from an activity or from the study altogether. If you choose to withdraw from the study, the information we collected from you will be kept on file. You may also feel hungry at times, or you may feel sore after exercising or feel upset about watching less TV and playing less video games. If you run into any problems during your visits or during the study, we will do our best to ensure your safety and comfort. If you need help or feel very sad or scared, you can tell your parents or a coach and a member of our team will examine you and make suggestions on how to deal with the problem. If it is a serious issue, we will contact your parents. There is a very unlikely chance of having a heart attack while exercising but this is very rare in kids, and we will try to lower this risk by making sure that you see a doctor before you begin the study.

Your participation in this study is voluntary, and you can stop at any time for any reason, and this will not affect the way you are treated at CHEO.

Confidentiality:

Confidentiality means keeping your information private. To keep your information private, we do not write names on files, only numbers. Then we keep a list of names and their numbers away from each other so no one except the study team knows who is who. We also keep your information in a locked cabinet that can only be opened with a key. The only people that are allowed to see the information are the people working on the study (Dr. Goldfield and his team) and the CHEO Research Ethics Board (who has access to all the records at CHEO).

The results of this study may be published, but your name and your parent's names will not be given out to anybody. Also, the study website is secure and password protected so that everything we send you over the internet is private.

By law, we have to keep everything private except in a few special cases. For instance, a judge can ask us to open our files if there is a court case. If at any time during the study we think a child is being harmed, or if we think a person might harm themselves or another person, then we will talk to the parent and the child to see what we can do to help. This can include contacting other people within CHEO or outside CHEO for help.

Questions about the Study:

If you have any further questions, you can contact Dr. Goldfield ( ) or Dr. Hadjiyannakis ( ) or Dr. Patrick McGrath at . If nobody is able to answer your call, a voice messaging system is available and one of us will return your call.

This study has been reviewed and approved by the CHEO Research Ethics Board. The CHEO Research Ethics Board is a group of people at CHEO who makes sure that people participating in research are kept safe. You may contact the head of the Research Ethics Board, Dr. Carole Gentile, for more information at ( ). If you want, at the end of this study we can send you a summary of what we found out.

Children's Hospital of Eastern Ontario
Centre hospitalier pour enfants de l'est de l'Ontario

Study Title: Healthy Eating and Active Living Throughout Youth (HEALTHY) using the Internet

ASSENT FORM

I ..... hereby consent to participate in the above study.

☐ I agree for you to use my body composition and questionnaire data

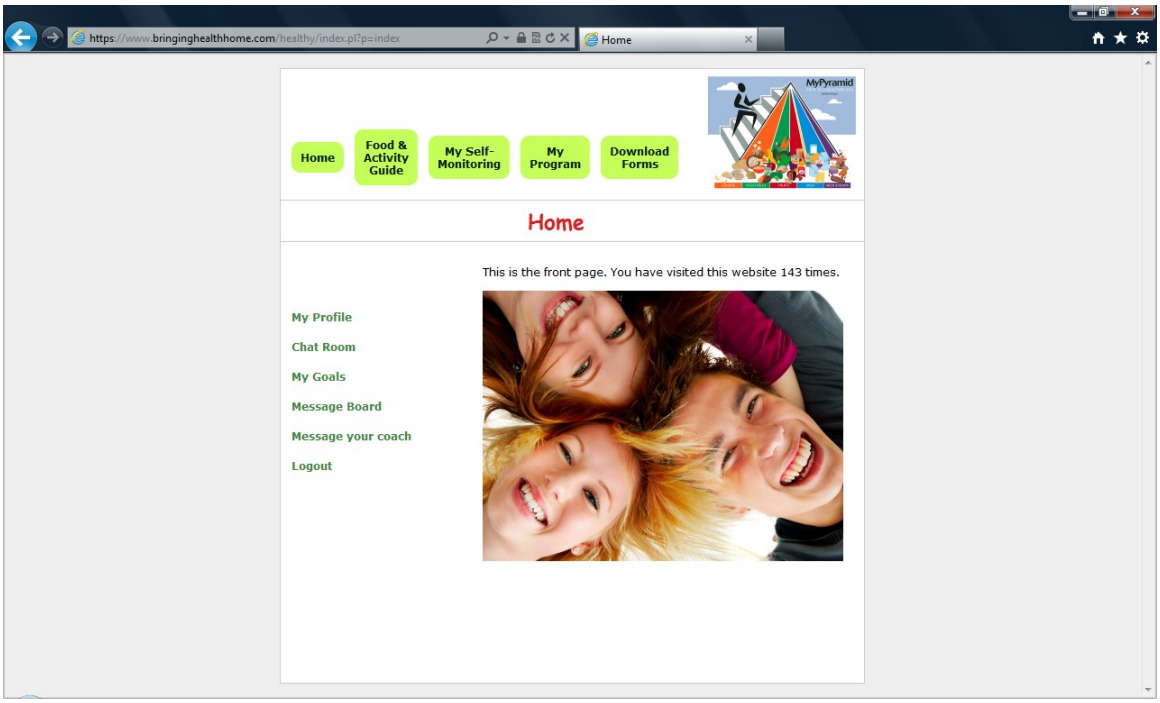
☐ I agree to complete the body composition assessment and the set of questionnaires measuring eating and activity behaviour and how I feel about myself and my body and how easy it is to do things.

I have read and understood the attached information sheet / had the attached information sheet has been explained to me out loud.

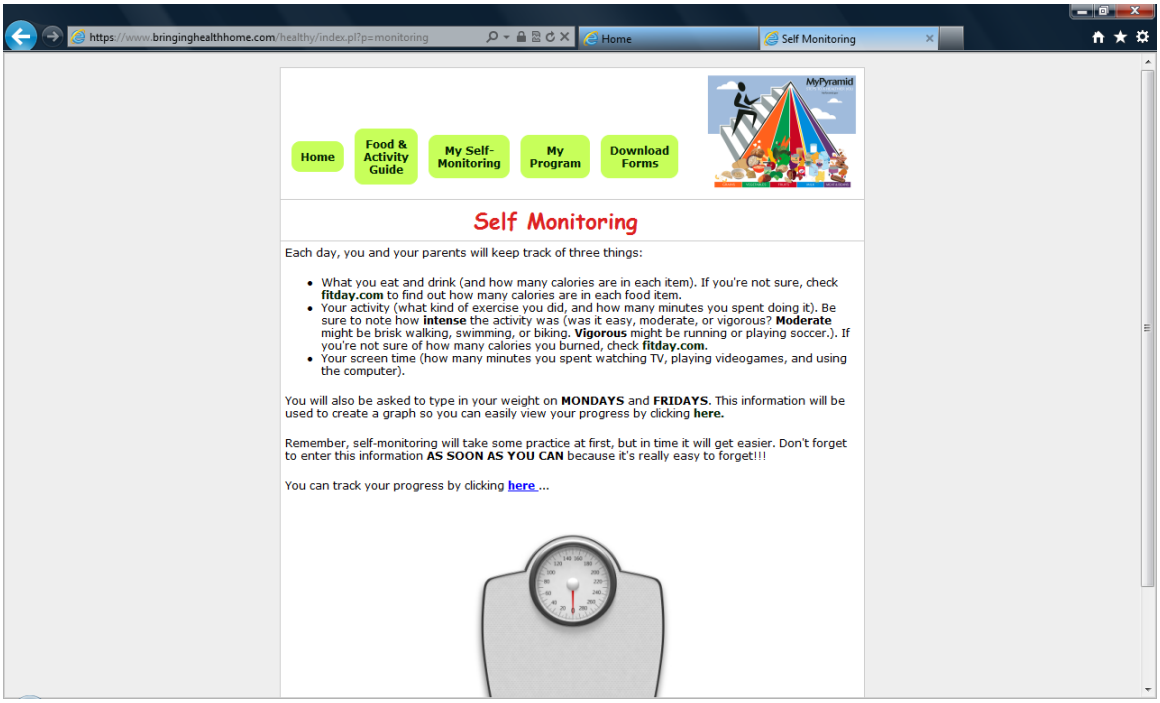
I have been fully informed of the details of the study and have had the chance to ask questions or talk about any concerns. I understand that I am free to withdraw at any time or not answer questions that make me uncomfortable and that my medical treatment will not be affected if I do. I have received a copy of the information sheet and consent form.

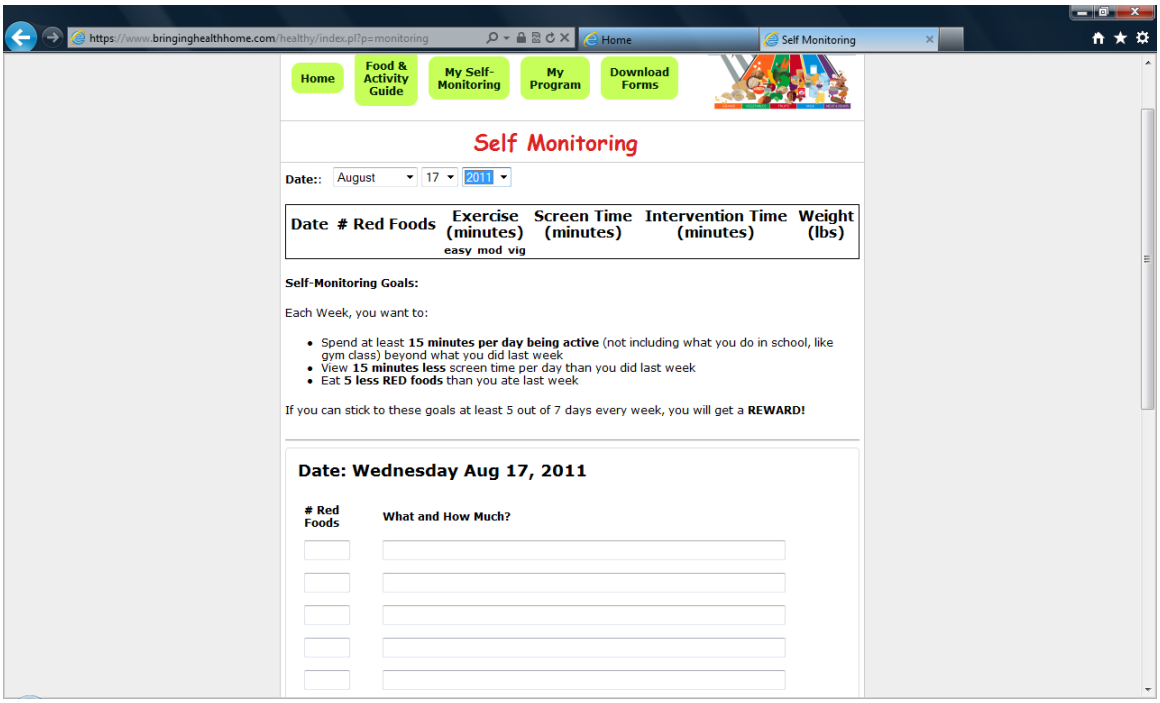
_____	_____	_____
Name of participant	Signature of participant	Date
_____	_____	
Names of Parents/Guardians	Signatures of Parents/Guardians	Date
_____	_____	
Investigator/Research Coordinator	Signature of Investigator	Date

Appendix C

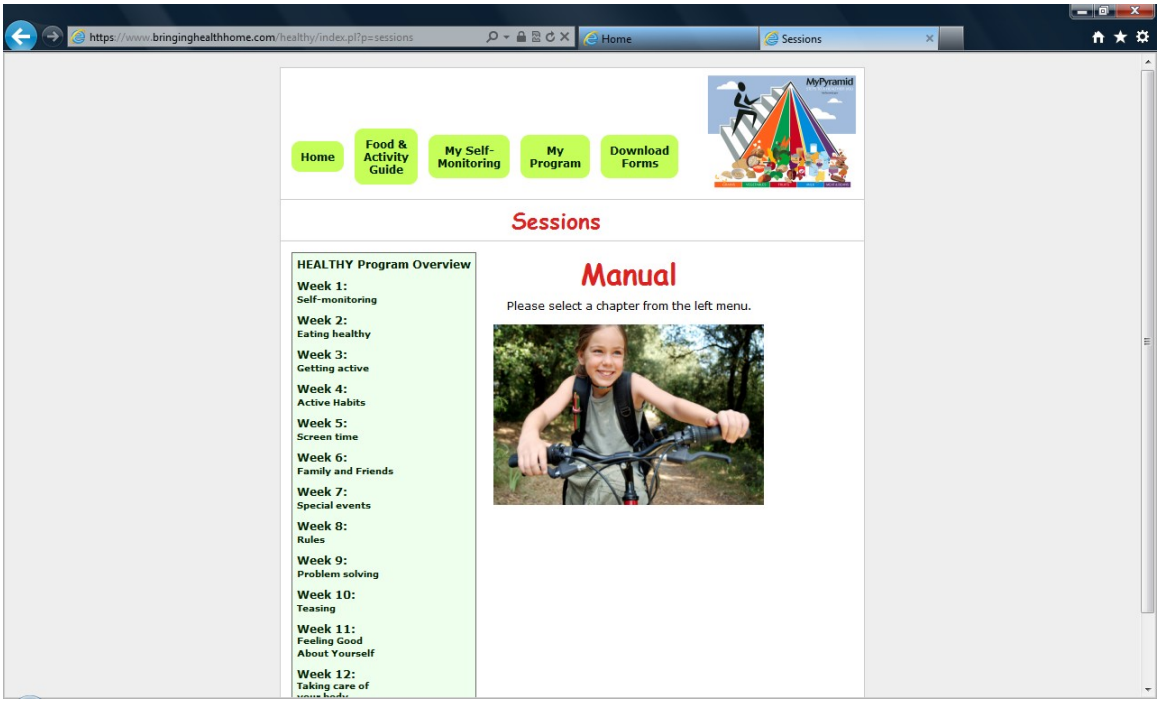

https://www.bringinghealthhome.com/healthy/index.pl?p=index
Home
Home
Food & Activity Guide
My Self-Monitoring
My Program
Download Forms
MyPyramid
Home
This is the front page. You have visited this website 143 times.
My Profile
Chat Room
My Goals
Message Board
Message your coach
Logout

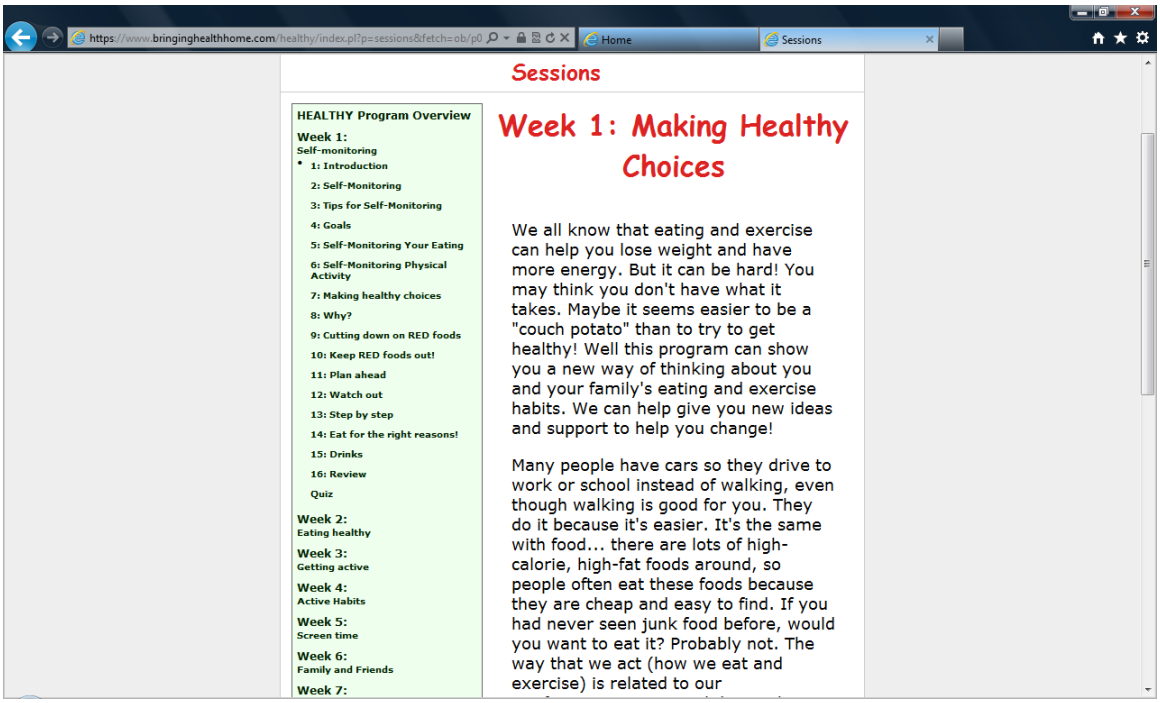
Appendix D:


https://www.bringinghealthhome.com/healthy/index.pl?p=monitoring
Home
Self Monitoring
Home
Food & Activity Guide
My Self-Monitoring
My Program
Download Forms
MyPyramid
Self Monitoring
Each day, you and your parents will keep track of three things:
What you eat and drink (and how many calories are in each item). If you're not sure, check fitday.com to find out how many calories are in each food item.
Your activity (what kind of exercise you did, and how many minutes you spent doing it). Be sure to note how intense the activity was (was it easy, moderate, or vigorous? Moderate might be brisk walking, swimming, or biking. Vigorous might be running or playing soccer.). If you're not sure of how many calories you burned, check fitday.com.
Your screen time (how many minutes you spent watching TV, playing videogames, and using the computer).
You will also be asked to type in your weight on MONDAYS and FRIDAYS. This information will be used to create a graph so you can easily view your progress by clicking here.
Remember, self-monitoring will take some practice at first, but in time it will get easier. Don't forget to enter this information AS SOON AS YOU CAN because it's really easy to forget!!!
You can track your progress by clicking here ...

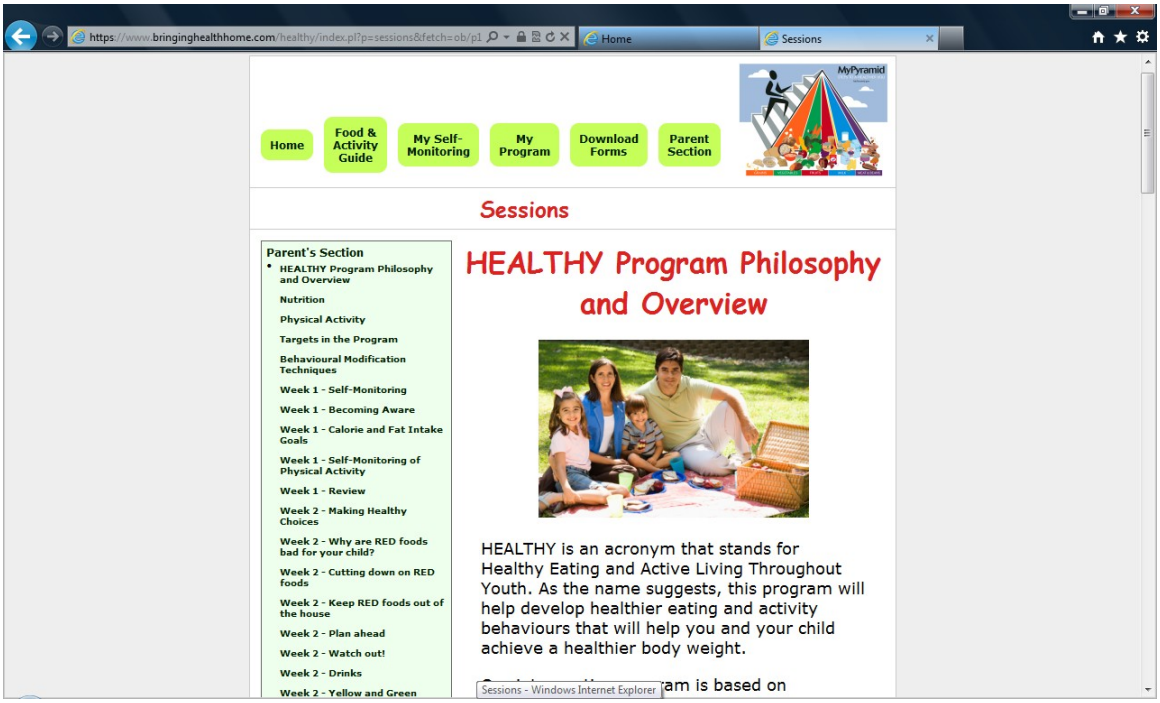

https://www.bringinghealthhome.com/healthy/index.pl?p=monitoring
Home
Self Monitoring
Home
Food & Activity Guide
My Self-Monitoring
My Program
Download Forms
Self Monitoring
Date:: August 17 2011
Date
Red Foods
Exercise (minutes) easy mod vig
Screen Time (minutes)
Intervention Time (minutes)
Weight (lbs)
Self-Monitoring Goals:
Each Week, you want to:
Spend at least 15 minutes per day being active (not including what you do in school, like gym class) beyond what you did last week
View 15 minutes less screen time per day than you did last week
Eat 5 less RED foods than you ate last week
If you can stick to these goals at least 5 out of 7 days every week, you will get a REWARD!
Date: Wednesday Aug 17, 2011
Red Foods
What and How Much?

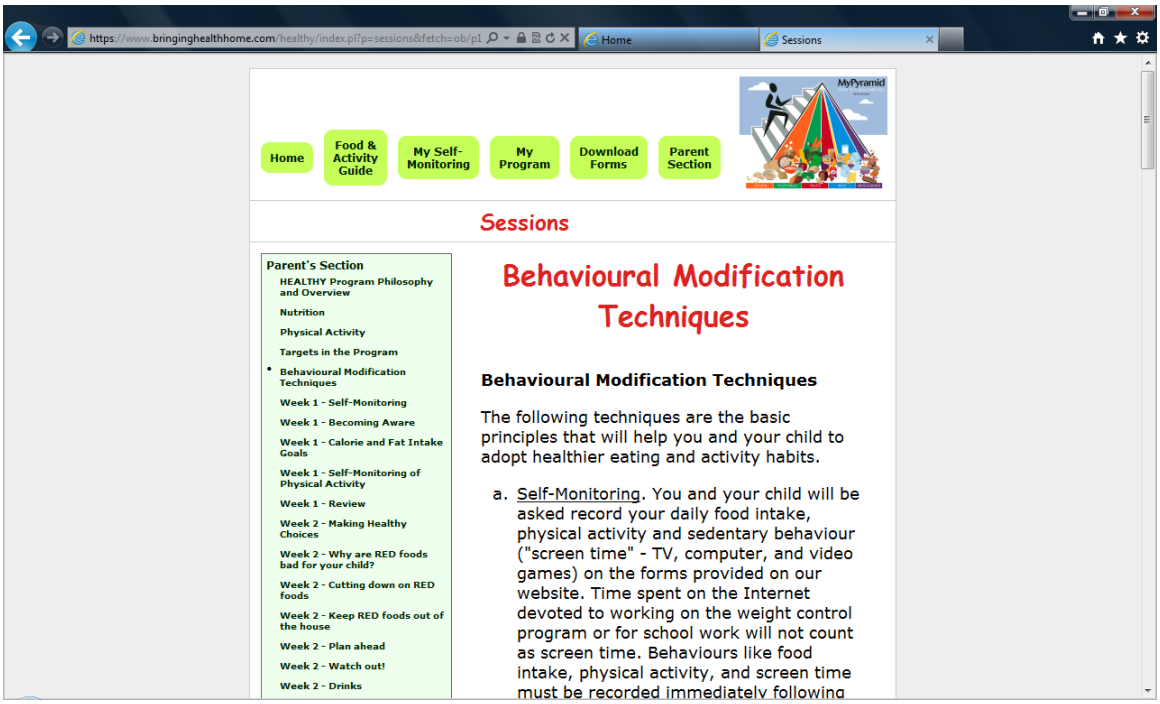
Appendix E:


https://www.bringinghealthhome.com/healthy/index.pl?p=sessions
Home
Sessions
Home
Food & Activity Guide
My Self-Monitoring
My Program
Download Forms
MyPyramid
Sessions
HEALTHY Program Overview
Week 1:
Self-monitoring
Week 2:
Eating healthy
Week 3:
Getting active
Week 4:
Active Habits
Week 5:
Screen time
Week 6:
Family and Friends
Week 7:
Special events
Week 8:
Rules
Week 9:
Problem solving
Week 10:
Teasing
Week 11:
Feeling Good About Yourself
Week 12:
Taking care of
Manual
Please select a chapter from the left menu.


https://www.bringinghealthhome.com/healthy/index.pl?p=sessions&fetch=ob/p0
Home
Sessions
Sessions
HEALTHY Program Overview
Week 1:
Self-monitoring
1: Introduction
2: Self-Monitoring
3: Tips for Self-Monitoring
4: Goals
5: Self-Monitoring Your Eating
6: Self-Monitoring Physical Activity
7: Making healthy choices
8: Why?
9: Cutting down on RED foods
10: Keep RED foods out!
11: Plan ahead
12: Watch out
13: Step by step
14: Eat for the right reasons!
15: Drinks
16: Review
Quiz
Week 2:
Eating healthy
Week 3:
Getting active
Week 4:
Active Habits
Week 5:
Screen time
Week 6:
Family and Friends
Week 7:
Week 1: Making Healthy Choices
We all know that eating and exercise can help you lose weight and have more energy. But it can be hard! You may think you don't have what it takes. Maybe it seems easier to be a "couch potato" than to try to get healthy! Well this program can show you a new way of thinking about you and your family's eating and exercise habits. We can help give you new ideas and support to help you change!
Many people have cars so they drive to work or school instead of walking, even though walking is good for you. They do it because it's easier. It's the same with food... there are lots of high-calorie, high-fat foods around, so people often eat these foods because they are cheap and easy to find. If you had never seen junk food before, would you want to eat it? Probably not. The way that we act (how we eat and exercise) is related to our

Appendix F:


https://www.bringinghealthhome.com/healthy/index.pl?p=sessions&fetch=ob/p1
Home
Sessions
Home
Food & Activity Guide
My Self-Monitoring
My Program
Download Forms
Parent Section
MyPyramid
Sessions
Parent's Section
HEALTHY Program Philosophy and Overview
Nutrition
Physical Activity
Targets in the Program
Behavioural Modification Techniques
Week 1 - Self-Monitoring
Week 1 - Becoming Aware
Week 1 - Calorie and Fat Intake Goals
Week 1 - Self-Monitoring of Physical Activity
Week 1 - Review
Week 2 - Making Healthy Choices
Week 2 - Why are RED foods bad for your child?
Week 2 - Cutting down on RED foods
Week 2 - Keep RED foods out of the house
Week 2 - Plan ahead
Week 2 - Watch out!
Week 2 - Drinks
Week 2 - Yellow and Green
HEALTHY Program Philosophy and Overview
HEALTHY is an acronym that stands for Healthy Eating and Active Living Throughout Youth. As the name suggests, this program will help develop healthier eating and activity behaviours that will help you and your child achieve a healthier body weight.
Sessions - Windows Internet Explorer


https://www.bringinghealthhome.com/healthy/index.pl?p=sessions&fetch=ob/p1
Home
Sessions
Home
Food & Activity Guide
My Self-Monitoring
My Program
Download Forms
Parent Section
MyPyramid
Sessions
Parent's Section
HEALTHY Program Philosophy and Overview
Nutrition
Physical Activity
Targets in the Program
Behavioural Modification Techniques
Week 1 - Self-Monitoring
Week 1 - Becoming Aware
Week 1 - Calorie and Fat Intake Goals
Week 1 - Self-Monitoring of Physical Activity
Week 1 - Review
Week 2 - Making Healthy Choices
Week 2 - Why are RED foods bad for your child?
Week 2 - Cutting down on RED foods
Week 2 - Keep RED foods out of the house
Week 2 - Plan ahead
Week 2 - Watch out!
Week 2 - Drinks
Behavioural Modification Techniques
Behavioural Modification Techniques
The following techniques are the basic principles that will help you and your child to adopt healthier eating and activity habits.
a. Self-Monitoring. You and your child will be asked record your daily food intake, physical activity and sedentary behaviour ("screen time" - TV, computer, and video games) on the forms provided on our website. Time spent on the Internet devoted to working on the weight control program or for school work will not count as screen time. Behaviours like food intake, physical activity, and screen time must be recorded immediately following

Appendix G:

Demographic Questionnaire (to be completed by parents)

1) What is your age? _____

2) What is your gender? (check one)
   _____Male
   _____Female

3) How old is your child that is participating in the program? _____

4) What is your child's gender?
   _____Male
   _____Female

5) What is the highest grade of school either parent has completed? (CHECK ONE)
   _____No school ors some elementary
   _____Completed elementary
   _____Some secondary
   _____Completed secondary
   _____Some post-secondary
   _____Completed post-secondary
   _____Some graduate studies
   _____Completed graduate studies

6) What is the highest grade of school of your participating child? (CHECK ONE)
   _____3rd or below
   _____4th
   _____5th
   _____6th
   _____7th
   _____8th
   _____Other: Please specify:_____

7) What is your annual household income?
   _____Under $20,000
   _____ $20,000 – $34, 999
   _____$35,000 - $49,999
   _____$50,000 – $64,999
   _____$65,000 - $79,999
   _____$80,000 – $99,999
   _____$100,000 and over

8) Is your place of residence primarily....

_____Urban
_____Rural
_____Suburban

9) How many computers does your family own? (CHECK ONE)

_____One
_____Two
_____Three or More

Appendix H:

Motivation for Exercise

There are a variety of reasons why people exercise regularly. Please indicate how true each of these reasons is for why you exercise regularly. The scale is:

1 2 3 4 5 6 7
not at all true somewhat true very true

I want to exercise on a regular basis:

1. Because I would feel bad about myself if I did not.

1 2 3 4 5 6 7
not at all true somewhat true very true

2. Because others would be angry at me if I did not.

1 2 3 4 5 6 7
not at all true somewhat true very true

3. Because I enjoy exercising.

1 2 3 4 5 6 7
not at all true somewhat true very true

4. Because I would feel like a failure if I did not.

1 2 3 4 5 6 7
not at all true somewhat true very true

5. Because I feel like it's the best way to help myself.

1 2 3 4 5 6 7
not at all true somewhat true very true

6. Because people would think I'm a weak person if I did not

1 2 3 4 5 6 7
not at all true somewhat true very true

7. Because I feel like I have no choice about exercising; others make me do it.

1 2 3 4 5 6 7
not at all true somewhat true very true

8. Because it is a challenge to accomplish my goal.

1 2 3 4 5 6 7
not at all true somewhat true very true

9. Because I believe exercise helps me feel better.

1 2 3 4 5 6 7
not at all true somewhat true very true

10. Because it's fun.

1 2 3 4 5 6 7
not at all true somewhat true very true

11. Because I worry that I would get in trouble with others if I did not.

1 2 3 4 5 6 7
not at all true somewhat true very true

12. Because it feels important to me to exercise.

1 2 3 4 5 6 7
not at all true somewhat true very true

13. Because I feel guilty if I do not exercise regularly.

1 2 3 4 5 6 7
not at all true somewhat true very true

14. Because I want others to know that I am doing what I have been told I should do.

1 2 3 4 5 6 7
not at all true somewhat true very true

15. Because it is interesting to see my own improvement.

1 2 3 4 5 6 7
not at all true somewhat true very true

16. Because feeling healthier is an important value for me.

1 2 3 4 5 6 7
not at all true somewhat true very true

Appendix I:

Motivation for Eating Healthy

There are a variety of reasons why people eat healthy. Please indicate how true each of these reasons is for why you exercise regularly. The scale is:

1 2 3 4 5 6 7
not at all true somewhat true very true

I want to eat healthy:

1. Because I would feel bad about myself if I did not.

1 2 3 4 5 6 7
not at all true somewhat true very true

2. Because others would be angry at me if I did not.

1 2 3 4 5 6 7
not at all true somewhat true very true

3. Because I enjoy eating healthy.

1 2 3 4 5 6 7
not at all true somewhat true very true

4. Because I would feel like a failure if I did not.

1 2 3 4 5 6 7
not at all true somewhat true very true

5. Because I feel like it's the best way to help myself.

1 2 3 4 5 6 7
not at all true somewhat true very true

6. Because people would think I'm a weak person if I did not

1 2 3 4 5 6 7
not at all true somewhat true very true

7. Because I feel like I have no choice about eating healthy; others make me do it.

1 2 3 4 5 6 7
not at all true somewhat true very true

8. Because it is a challenge to accomplish my goal.

1 2 3 4 5 6 7
not at all true somewhat true very true

9. Because I believe eating healthy helps me feel better.

1 2 3 4 5 6 7
not at all true somewhat true very true

10. Because it's fun.

1 2 3 4 5 6 7
not at all true somewhat true very true

11. Because I worry that I would get in trouble with others if I did not.

1 2 3 4 5 6 7
not at all true somewhat true very true

12. Because it feels important to me to eat healthy.

1 2 3 4 5 6 7
not at all true somewhat true very true

13. Because I feel guilty if I do not eat healthy.

1 2 3 4 5 6 7
not at all true somewhat true very true

14. Because I want others to know that I am doing what I have been told I should do.

1 2 3 4 5 6 7
not at all true somewhat true very true

15. Because it is interesting to see my own improvement.

1 2 3 4 5 6 7
not at all true somewhat true very true

16. Because feeling healthier is an important value for me.

1 2 3 4 5 6 7
not at all true somewhat true very true

Appendix J:

Evaluation Questionnaire

Please help us improve our program by answering some questions about the services you have received. We are interested in your honest opinion, whether they are positive or negative. Please answer all of the questions. We also welcome your comments and suggestions. Thank you very much, we really appreciate your help.

		No, definitely not	**No, not really**	**Yes, generally**	**Yes, definitely**
1	Overall, did you like the website?				
	Now, we would like to ask you how much you ***liked*** the different parts of the website….				
2	….the weekly reading				
3	….the weekly quiz				
4	….the self-monitoring				
5	….the journal section				
6	….contact with your coach				
7	….the goals section				
8	….the discussion board				
9	….the weekly chat				
10	Overall, did you find the website easy to use?				
	Now, we would like to ask you how ***easy to use*** the different parts of the website were….				
11	….the weekly reading				
12	….the weekly quiz				
13	….the self-monitoring				
14	….the journal section				
15	….contact with your coach				
16	….the goals section				
17	….the discussion board				
18	….the weekly chat				
19	Overall, did you feel like you learned from the website?				
	Now, we would like to ask you if you feel you ***learned from*** the different parts of the website were….				
20	….the weekly reading				

21	….the weekly quiz				
		No, definitely not	**No, not really**	**Yes, generally**	**Yes, definitely**
22	….the self-monitoring				
23	….the journal section				
24	….contact with your coach				
25	….the goals section				
26	….the discussion board				
27	….the weekly chat				
28	Overall, did you feel like learned healthier habits from using the website?				
	Now, we would like to ask you if you feel you ***learned healthier habits from*** the different parts of the website were….				
29	….the weekly reading				
30	….the weekly quiz				
31	….the self-monitoring				
32	….the journal section				
33	….contact with your coach				
34	….the goals section				
35	….the discussion board				
36	….the weekly chat				
37	Overall, did you find the website easy to understand?				
	Now, we would like to ask you how ***easy to understand*** the different parts of the website were….				
38	….the weekly reading				
39	….the weekly quiz				
40	….the self-monitoring				
41	….the journal section				
42	….contact with your coach				
43	….the goals section				
44	….the discussion board				
45	….the weekly chat				
46	Overall, did you like your coach?				
	Now, we would like to ask you different questions about your coach. **Did your coach….**				

47	….show personal interest in you?				
		No, definitely not	**No, not really**	**Yes, generally**	**Yes, definitely**
48	….help you?				
49	….answer your questions?				
50	….motivate you?				

51. Can you please order the parts of the program from MOST HELPFUL (1) to LEAST HELPFUL (8). Each number can only be used once.

Part	**Rank (1-8)**
Education	
Quiz	
Self-monitoring	
Journal	
Coach	
Goal Section	
Discussion Board	
Weekly Chat	

If there are any other questions or comments you have for use, please write them in the space below. If you run out of space please continue on the back of the page. THANK YOU!!!

Appendix K:

Semi-Structured Interview – Parent version

Introduce focus of the interview: *"As you know we'll be talking about the Internet study – including your impressions of the study, barriers to participation, and your needs in receiving help with your child's weight difficulties"*

Impressions: "Let's start with your first impressions"

1) Do you remember how you first learned about the study?

   → *Probe: newspaper ad, family physician, Facebook, word of mouth, clinic visit at CHEO*

   a. If so, did this affect your impression of the study?

   b. Did you feel your referral source/ad gave you a good idea about what was involved in participating in the HEALTHY study?"

   c. What did you think or feel about the study at this point?

   d. Why did you decide to contact the HEALTHY study?

2) Thinking back to when you first contacted the HEALTHY study and first spoke to the coordinator…

   a. Do you feel that you were you given enough information about the study and what was required for you and your child's participation?

      i. IF NO: What additional information would have helped you make a decision?

   b. Were you given the chance to ask questions about the HEALTHY Study?

3) During your first visit to CHEO you were met in the lobby, escorted to the laboratory where you reviewed the information sheet and consent forms. After this you and your child answered a number of questionnaires separately, you were weighed and measured, and you were given a tour of the website. Thinking back to this visit…

   a. What were your general impressions of the HEALTHY study?(Positives, negatives)

   → *Probe: impressions of: laboratory/equipment, research personnel, questionnaire data, website*

   b. Were you comfortable being measured in the lab?

i. IF NO: Is there something we could have done to make it more helpful?

c. Based on this visit, did you have enough information on the HEALTHY study?

i. IF NO: What other information would have been helpful?

d. At this point, was there anything about the HEALTHY study that led you to think the study was not right for your family?

e. Do you feel an in-person information session *before you decided to participate* would have been helpful in deciding if the study was a good fit for your family?

Ok, now we'll talk about the program features. I'll list off the program features and ask you how you and your child feel about each one (both pros and cons).

Keep in mind that even if you didn't participate in the intervention you can talk about how you felt about them when they were discussed with you at your initial visit.

For each: How did you feel about….

f. Coach support via regular email (*Pros & Cons*)

g. Daily Self-monitoring (*Pros & Cons*)

i. Paper versus Computer (*Pros & Cons*)

h. The Traffic Light Plan (*categorizing foods into green, yellow, and red foods, with the goal of decreasing red foods*) (*Pros & Cons*)

i. Increasing Physical Activities to Meet Canada's Physical Activity Guidelines (*Pros & Cons*)

j. Decreasing Screen time (leisurely time on TV, computer, or playing video games) (*Pros & Cons*)

k. The Weekly Readings (*Pros & Cons*)

l. The Weekly Quiz (*Pros & Cons*)

m. Reward System (*extra activities, etc*) (*Pros & Cons*)

4) Did you ever log-on to the HEALTHY website?

a. IF NO: SKIP TO BARRIERS SECTION

b. IF YES: Let's talk briefly about the HEALTHY website

i. What were your overall impressions of the site?

→*Probe: like/dislike, user-friendly, engaging?*

ii. Is there anything you think should have been included in the website?

iii. Was there anything on the website that you feel was unnecessary?

Barriers: "Let's move on now to talk about things that got in the way of participating in the HEALTHY study.

5) Was there anything, or numerous things, that prevented you from participating?

→*PROBE: 'How so?'*

- *In what way was _____ a barrier?*
- *How did _____ get in the way of participation?*

RATE: every barrier from 0 to 6, where 0 is not at all a barrier and 6 is a very significant barrier.

i. Is there anything you think could have helped your family in overcoming this barrier?

ii. IF YES:

- EXPLORE: How so? In what way?
- **RATE**: How helpful would this have been, from 0 to 6, 0 being not at all helpful, and 6 being extremely helpful

6) Was the length of the program a barrier in any way? Or did it help?

- How so?

RATE: from 0 to 6, where 0 is not at all a barrier and 6 is a very significant barrier.

i. Is there anything that could have helped your family overcome this barrier?

ii. IF YES:

- EXPLORE: How so? In what way?

- **RATE**: How helpful would this have been, from 0 to 6, 0 being not at all helpful, and 6 being extremely helpful

7) Was the fact that the HEALTHY program was delivered over the internet serve as a barrier in any way?

   - How so?

   RATE: from 0 to 6, where 0 is not at all a barrier and 6 is a very significant barrier.

   i. Is there anything that could have helped your family overcome this barrier?

   ii. IF YES:

   - EXPLORE: How so? In what way?

   - **RATE**: How helpful would this have been, from 0 to 6, 0 being not at all helpful, and 6 being extremely helpful.

8) Ok, now we'll talk about a few different types of barriers. For each barrier you mention I'll ask you to rate it from 0 to 6 just as before.

   Now we're going to talk about four different types of barriers: individual, family, social, and environmental…

****FOR ALL BARRIERS DISCUSSED IN THIS SECTION****

- EXPLORE: "How did ___ affect partcipation?" "What do you mean"

RATE: from 0 to 6, where 0 is not at all a barrier and 6 is a very significant barrier, 3 is neutral.

a. Individual barriers are barriers within yourself or your child that made participation difficult.

   - Ex: lack of interest or motivation could be an individual barrier….
   - **RATE**
   - Anything else you can think of?

   i. Is there anything that could have helped your family overcome this barrier?

   ii. IF YES:

   - EXPLORE: How so? In what way?

- **RATE**: How helpful would this have been, from 0 to 6, 0 being not at all helpful, and 6 being extremely helpful

b. Family barriers are factors within the family or household that affected participation.
    - For example, this could include the impact of other people in the house, lack of time due to other parental committments or family income.
    - **RATE**
    - Anything else?
        i. Is there anything that could have helped your family overcome this barrier?
        ii. IF YES:
            - EXPLORE: How so? In what way?
            - **RATE**: How helpful would this have been, from 0 to 6, 0 being not at all helpful, and 6 being extremely helpful

c. Social barriers are barriers within your social environment.
    - For example, this could include the influence of family and friends, lack of support within the family.
    - **RATE**
    - Any others?
        i. Is there anything that could have helped your family overcome this barrier?
        ii. IF YES:
            - EXPLORE: How so? In what way?
    - **RATE**: How helpful would this have been, from 0 to 6, 0 being not at all helpful, and 6 being extremely helpful

d. Environmental barriers are typically geographic,

- …and could include things such as your neighborhood environment, such as safety and access to transportation, grocery stores, recreational opportunities.
- **RATE**
- Anything else that you can think of?

  i. Is there anything that could have helped your family overcome this barrier?

  ii. IF YES:

  - EXPLORE: How so? In what way?
  - **RATE**: How helpful would this have been, from 0 to 6, 0 being not at all helpful, and 6 being extremely helpful

~~9) Having discussed these barriers, is there anything you think that could have assisted your family in overcoming these barriers?~~

~~EXPLORE: How so/In what way~~
~~RATE: How helpful would this have been on a scale of 0 to 6, where 0 is not at all helpful and 6 is extremely helpful~~

10) Did you feel/would have felt uncomfortable talking to your coach about these barriers?

  i. Is there anything that could have helped your family overcome this barrier?

  ii. IF YES:

  - EXPLORE: How so? In what way?
  - **RATE**: How helpful would this have been, from 0 to 6, 0 being not at all helpful, and 6 being extremely helpful

Needs: "Ok, now we're moving on to the final part of the interview. This part has to do with the needs of families seeking support for pediatric weight issues.

11) In general, what do you feel are your families needs in seeking support? In other words, what did you want out of the HEALTHY program?

→PROBE: types of services/professionals, targets (e.g. diet, exercises, others?), homework, more contact, coaching by telephone in addition to emails, more tips such

as the plate technique, or having a glass of water if you feel hungry after a meal then waiting half an hour
RATE: 0 to 6, where 0 is 'Not at all important' and 6 is 'Very Important'

a. How did the HEALTHY intervention meet your needs?

b. How did the HEALTHY intervention not meet your needs?

c. Based on your needs, how do you think the HEALTHY program could have been improved?

d. Are there things that you think were missing from the HEALTHY intervention?

e. Based on your needs, do you think any of the program components were not necessary?

(Since many never tried the intervention some probes may be needed (e.g. self-monitoring, traffic light diet etc.)

12) If you had a wish-list for what you would hope a program would look like, what kinds of things would be on that list?

EXPLORE: meaning, "how-so"
RATE EACH: 0 to 6, where 0 is 'Not at all important' and 6 is 'Very Important'

13) Is there anything else you'd like to mention that we haven't already touched on?

That concludes the interview.
THANK YOU SO MUCH FOR YOUR TIME TODAY _____
I really appreciate your feedback

Appendix L

Telephone Interview Verbal Consent Form

Background: Your family had expressed interest in the Eating and Active Living Throughout Youth (HEALTHY) study, a 12-week internet-based treatment for families with at least one child aged 8 to 12 who was struggling with their weight. Since the time that the study began a number of families struggled with participating in the HEALTHY study. We would like to understand the factors involved with these difficulties so that treatments can be improved for families like yours in the future.

Purpose: To gain insight into your perceptions of the HEALTHY study, barriers to your participation or insight into what got in the way of participating, and your needs in receiving help for your child's weight. The interview will take 15 to 30 minutes.

Confidentiality: Interviews will be tape recorded in order to ensure that we accurately capture your responses. Once interviews are transcribed to paper they will be assigned an anonymous identification number and the voice recording will be destroyed. All your responses will be kept confidential and private; they will be used to evaluate the HEALTHY study as well as provide directions for future research and treatment. If the results are presented or published your name will not be presented and any potentially identifying information will be removed.

Right to Refuse: Your participation is completely voluntary, and you have the right to refuse to answer any questions, and to end the interview at anytime. If you decide not to participate in the interview or to stop the interview early, it will never affect that way you're treated at CHEO.

Do you have any questions before we proceed?

Do you agree to participate? (Interviewer to circle)

YES

NO

Date: _____ Time: _____

Interviewer name: _____

Interviewer signature: _____

Appendix M

SYSTEMATIC REVIEW SEARCH PROCESS

1. The search strategy was based on the subject headings assigned to the 8 articles from An's review in the selected databases. Both relevant and non-relevant articles from the review (as identified by S.L.) were included, since the exclusion criteria (e.g. program duration) are not reflected in indexing.

An JY, Hayman LL, Park YS, Dusaj TK, Ayres CG. (2009). Web-based weight management programs for children and adolescents: a systematic review of randomized controlled trial studies. Advances in Nursing Science, 32(3):222-40.

Relevant & potentially relevant articles:

a. Celio A. *Early Intervention of Eating- and Weight-related Problems via the Internet in overweight Adolescents: A Randomized Controlled Trial* [dissertation]. San Diego: Joint Doctoral Program in Clinical Psychology, University of California, San Diego/San Diego State University; 2005. [thesis, not in PubMed; **Psyc.]**

b. Doyle AC, Goldschmidt A, Huang C, Winzelberg AJ, Taylor B, Wilfley DE. Reduction of overweight and eating disorder symptoms via the Internet in adolescents: a randomized controlled trial. *J Adolesc Health*. 2008;43:172–179. [18639791; Emb.; CIN; Coch; Psyc.]

c. Haerens L, Deforche B, Maes L, Stevens V, Cardon G, Bourdeaudhuij I. Body mass effects of a physical activity and healthy food intervention in middle schools. *Obesity*. 2006;14(5):847–853. [16855194; Coch; Psyc.]

d. White MA, Martin PD, Newton RL, et al. Mediators of weight loss in a family-based intervention presented over the Internet. *Obes Res*. 2004;12(7):1050–1059. [15292468; Coch; Psyc.]

Non-relevant articles:

e. Baranowski T, Baranowski JC, Cullen KW, et al. The Fun, Food, and Fitness Project (FFFP): the Baylor GEMS Pilot Study. *Ethn Dis*. 2003;13(1)(suppl 1):30–39. [12713209; Emb.; Coch]

f. Marks JT, Campbell MK, Ward DS, Ribisl KM, Wildemuth BM, Symons MJ. A comparison of Web and print media for physical activity promotion among adolescent girls. *J Adolesc Health.* 2006;39:96–104. [16781967; Emb.; CIN; Coch; Psyc.]

g. Williamson DA, Davis MP,White MA, et al. Efficacy of an Internet-based behavioral weight loss program for overweight adolescent African-American girls. *Eat Weight Disord.* 2005;10(3):193–203. 33. [16277142; Emb.; Coch; Psyc.]

h. Williamson DA, Walden HM, White MA, et al. Two-year Internet-based randomized controlled trial for weight loss in African-American girls. *Obesity.*2006;14(7):1231–1243. [16899804; Coch; Psyc.]

2. Using PubMed ID of each article (7 found in PubMed), subject heading were retrieved from www.gopubmed.com and placed in 4 sections agreed upon by M.S., S.L., and M.M:

Concept	**Diet**	**Exercise**	**Web-based**	**Child/ adolescent**	overweight (combine with diet?)	other (potentially relevant)
Subj. heading	Eating, Feeding behavior, Diet, food habits, Diet records,	Motor activity, Exercise,	Computer-Assisted Instruction, Internet, technology	Students, Adolescent, Humans, Child, adolescent behavior	Body Mass Index, Weight Loss, Eating Disorders, Overweight, Obesity, Health Promotion, Body Weight, Body Composition	Parents, family, Patient Compliance, Behavior Therapy, health education, life style, health promotion, child behavior, intervention studies, adolescent behavior

3. After preliminary testing of the MEDLINE search strategy, the potentially relevant "overweight" headings were added to the "diet" section to broaden the search. Free text keywords were also added to each section for the sake of expanding the search and capturing all potentially relevant articles. The "child filter" kindly provided by M.S. was used as the major source of keywords for the "child" section.

4. After the MEDLINE search was finalized, tested and peer-reviewed (M.S.), it was adapted for the other databases (EMBASE, CINAHL, Cochrane, and PsycINFO). Subject headings were searched individually for each database to account for variations in indexing.

5. The searches were run on each database in the order of higher recall as suggested by M.S.: MEDLINE, EMBASE, CINAHL, Cochrane, PsycINFO. No limits were placed on language of publication or study design, however, publication dates were limited to 1995-current, as stipulated by the systematic review rationale.

6. Seven articles from An's review were used as seeds for a PubMed Related Article search, and the 200 highest ranking records were retained.

7. Search results from each database were exported into an individual Reference Manager file, de-duplicated, then combined into a single database and de-duplicated again. When removing duplicates priority was given to citations from MEDLINE, then EMBASE, etc. in the order of import. Only identical articles were removed; no decision was made at this stage on multiple reports of the same study (main findings, conference abstract, additional analysis of subgroups, etc.)

Search log in Excel spreadsheet shows databases searched, dates, download and post-de-duplication counts, keywords used to tag the record sets in RM, RM file names and names of the files containing the downloaded records. A total of 1780 records (post de-duplication) were identified from all sources.

SEARCH STRATEGIES

1. MEDLINE

Database: Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R) 1950 to Present
Additional limits: yr=1995-current
Result: 884 hits
Search date: July 28, 2010
Search name (Ovid saved searches): [Medline05-final]

((Students or Adolescent or exp Child or Adolescent Behavior).sh. OR *(child* or adoles* or girl* or boy* or youth or juvenile or teen* or pediatric* or paediatric* or pubert* or pubescen* or prepubescen* or student* or elementary school or grade school* or public school* or primary school* OR secondary school or middle school* or highschool* or high school* or preschool* or pre-school* or schoolchild* or school child* or school age or elementary student* or school student* or pupil*).mp.)*

AND

((Eating or exp Diet or Diet, Reducing or exp Feeding Behavior or Diet Records or exp Body Weight Changes or exp Overweight or Body Composition).sh. OR *(eating* or diet* or nutrition or food* or intak* or BMI or obes* or overweight or body mass or weight loss or weight management or weight maintenance).mp.)*

AND

((Motor activity or exp Exercise or exp Exercise Therapy or exp Life Style).sh. OR (*physical activit* or exercise* or inactivity or lifestyle* or life style* or sedentary behavio*).mp.)*

AND

((Computer-Assisted Instruction or exp Computer Systems or exp Technology).sh. OR *(web* or web-based or internet or online or computer*).mp.)*

Re-run March 2012:

Database: Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R) 1946 to Present
Additional limits: yr=2010-current
Result: 373 hits
Search date: March 23, 2012
Search name (Ovid saved searches): [Medline rerun 2012]

((Students or Adolescent or exp Child or Adolescent Behavior).sh. OR *(child* or adoles* or girl* or boy* or youth or juvenile or teen* or pediatric* or paediatric* or pubert* or pubescen* or prepubescen* or student* or elementary school or grade school* or public school* or primary school* OR secondary school or middle school* or highschool* or high school* or preschool* or pre-school* or schoolchild* or school child* or school age or elementary student* or school student* or pupil*).mp.)*

AND

((Eating or exp Diet or Diet, Reducing or exp Feeding Behavior or Diet Records or exp Body Weight Changes or exp Overweight or Body Composition).sh. OR *(eating* or diet* or nutrition or food* or intak* or BMI or obes* or overweight or body mass or weight loss or weight management or weight maintenance).mp.)*

AND

((Motor activity or exp Exercise or exp Exercise Therapy or exp Life Style).sh. OR (*physical activit* or exercise* or inactivity or lifestyle* or life style* or sedentary behavio*).mp.)*

AND

((Computer-Assisted Instruction or exp Computer Systems or exp Technology).sh. OR *(web* or web-based or internet or online or computer*).mp.)*

2. EMBASE

Database: EMBASE 1980 to 2010 Week 29 (via Ovid)
Additional limits: yr=1995-current
Result: 1003 hits
Search date: July 28, 2010
Search name (Ovid saved searches): [Embase04-final]

((exp adolescent or exp adolescence or exp child).sh OR *(child* or adoles* or girl* or boy* or youth or juvenile or teen* or pediatric* or paediatric* or pubert* or pubescen* or prepubescen* or student$ or elementary school or grade school* or public school* or primary school* OR secondary school or middle school* or highschool* or high school* or preschool* or pre-school* or schoolchild* or school child* or school age or elementary student* or school student* or pupil*).mp)*

AND

((exp nutrition or exp weight, mass and size or exp body weight or exp body composition).sh OR *(eating* or diet* or nutrition or food* or intak* or BMI or obes* or overweight or body mass or weight loss or weight management or weight maintenance).mp)*

AND

((lifestyle modification or exp physical activity or fitness or exp recreation).sh OR (*physical activit$ or exercise$ or inactivity or lifestyle* or life style* or sedentary behavio*).mp)*

AND

((Internet or computer aided design or exp computer assisted therapy).sh OR *(web* or web-based or internet or online or computer*).mp)*

Re-run March 2012:

Database: EMBASE 1980 to 2012 Week 11 (via Ovid)
Additional limits: yr=2010-current
Result: 606 hits
Search date: March 23, 2012
Search name (Ovid saved searches): [Embase rerun 2012]

((exp adolescent or exp adolescence or exp child).sh OR *(child* or adoles* or girl* or boy* or youth or juvenile or teen* or pediatric* or paediatric* or pubert* or pubescen* or prepubescen* or student$ or elementary school or grade school* or public school* or primary school* OR secondary school or middle school* or highschool* or high school* or preschool* or pre-school* or schoolchild* or school child* or school age or elementary student* or school student* or pupil*).mp)*

AND

((exp nutrition or exp weight, mass and size or exp body weight or exp body composition).sh OR *(eating* or diet* or nutrition or food* or intak* or BMI or obes* or overweight or body mass or weight loss or weight management or weight maintenance).mp)*

AND

((lifestyle modification or exp physical activity or fitness or exp recreation).sh OR (*physical activit$ or exercise$ or inactivity or lifestyle* or life style* or sedentary behavio*).mp)*

AND

((Internet or computer aided design or exp computer assisted therapy).sh OR *(web* or web-based or internet or online or computer*).mp)*

3. CINAHL

Database: CINAHL (via EBSCO)
Additional limits: year limit: 1995-2010
Result: 101 hits
Search date: July 29, 2010
Search name (saved searches): [Cinahl01-final]

MH (Adolescence OR Child+)

AND

MH (Eating Behavior+ OR Food Habits OR Weight Control OR Body Weight+ OR Body Weight Changes+ OR Body Mass Index OR Adolescent Nutrition OR Child Nutrition OR Diet+)

AND

MH (Physical Activity OR Exercise+ OR Life Style+)
AND
MH (Internet OR Computer Assisted Instruction OR Therapy, Computer Assisted OR World Wide Web)

Re-run March 2012:

Database: CINAHL (via EBSCO)
Additional limits: yr=2010-current
Result: 34 hits
Search date: March 23, 2012

4. Cochrane

Database: The Cochrane Library Issue 7 of 12, Jul 2010 (via Wiley InterScience)
Additional limits: databases: Cochrane Reviews, Clinical Trials (CENTRAL), Other reviews (DARE), year limit: 1995-2010
Result: 90 hits
Search date: July 29, 2010
Search name (saved searches): [Cochrane01]

#1 MeSH descriptor **Adolescent**, this term only 66349
#2 MeSH descriptor **Child** explode all trees 13
#3 MeSH descriptor **Diet** explode tree **2** 7493
#4 MeSH descriptor **Feeding Behavior** explode tree **2** 3177
#5 MeSH descriptor **Nutrition Therapy** explode all trees 5601
#6 MeSH descriptor **Exercise** explode all trees 7312
#7 MeSH descriptor **Motor Activity** explode tree **2** 4008
#8 MeSH descriptor **Internet**, this term only 832
#9 MeSH descriptor **Therapy, Computer-Assisted**, this term only 418
#10 MeSH descriptor **Computer-Assisted Instruction**, this term only 598
#11 (child* or adoles* or kid* or girl* or boy* or youth or juvenile or teen* or pediatric* or paediatric* or pubert* or pubescen* or prepubescen* or student* or elementary school or grade school* or public school* or primary school* OR secondary school or middle school* or highschool* or high school* or preschool* or pre-school* or schoolchild* or school child* or school age or elementary student* or school student* or pupil*):ti,ab,kw 133473
#12 (eating* or diet* or nutrition or food* or intak* or BMI or obes* or overweight or body mass or weight loss or weight management or weight maintenance):ti,ab,kw 57158
#13 (physical activit* or exercise* or inactivity or lifestyle* or life style* or sedentary behavio*):ti,ab,kw 32988
#14 (web* or web-based or internet or online or computer*):ti,ab,kw 15896
#15 MeSH descriptor **Adolescent Behavior**, this term only 557
#16 MeSH descriptor **Child Behavior**, this term only 607
#17 MeSH descriptor **Body Weight Changes** explode all trees 3383
#18 MeSH descriptor **Overweight** explode all trees 5414

#19 MeSH descriptor **Body Composition** explode all trees 2253
#20 MeSH descriptor **Leisure Activities** explode all trees 7389
#21 MeSH descriptor **Life Style** explode all trees 1719
#22 (((#1 OR #2 OR #15 OR #16) OR #11) AND ((#3 OR #4 OR #5 OR #17 OR #18 OR #19) OR #12) AND ((#6 OR #7 OR #20 OR #21) OR #13) AND ((#8 OR #9 OR #10) OR #14)), from 1995 to 2010

Re-run March 2012:

Database: The Cochrane Library Issue 7 of 12, Jul 2010 (via Wiley InterScience)
Additional limits: databases: Cochrane Reviews, Clinical Trials (CENTRAL), Other reviews (DARE), year limit: 1995-2010
Additional limits: yr=2010-current
Result: 3 hits
Search date: March 23, 2012

5. PsycINFO

Database: PsycINFO 1806 to July Week 4 2010 (via OVID)
Additional limits: yr=1995-current
Result: 225 hits
Search date: July 29, 2010
Search name (Ovid saved searches): [Psyc01-final]

((Adolescent attitudes or Adolescent development or Child Attitudes or exp Childhood Development).sh. OR *(child* or adoles* or girl* or boy* or youth or juvenile or teen* or pediatric* or paediatric* or pubert* or pubescen* or prepubescen* or student* or elementary school or grade school* or public school* or primary school* OR secondary school or middle school* or highschool* or high school* or preschool* or pre-school* or schoolchild* or school child* or school age or elementary student* or school student* or pupil*).mp.)*

AND

((Exp Body Weight or Body Mass Index or Diets or Nutrition or Food intake or Food or Weight Control or exp Eating Behavior).sh. OR *(eating* or diet* or nutrition or food* or intak* or BMI or obes* or overweight or body mass or weight loss or weight management or weight maintenance).mp.)*

AND

((Exp Motor Processes or Physical Fitness or exp Lifestyle).sh. OR (*physical activit* or exercise* or inactivity or lifestyle* or life style* or sedentary behavio*).mp.)*

AND

((Internet or Websites or Computers or Online Therapy or Computer Assisted Therapy).sh. OR *(web* or web-based or internet or online or computer*).mp.)*

Re-run March 2012:
Database: PsycINFO 1806 to March Week 2 2012 (via OVID)
Additional limits: yr=2010-current

Result: 100 hits

Search date: March 23, 2012

Search name (Ovid saved searches): [Psycinfo rerun 2012]

((Adolescent attitudes or Adolescent development or Child Attitudes or exp Childhood Development).sh. OR *(child* or adoles* or girl* or boy* or youth or juvenile or teen* or pediatric* or paediatric* or pubert* or pubescen* or prepubescen* or student* or elementary school or grade school* or public school* or primary school* OR secondary school or middle school* or highschool* or high school* or preschool* or pre-school* or schoolchild* or school child* or school age or elementary student* or school student* or pupil*).mp.)*

AND

((Exp Body Weight or Body Mass Index or Diets or Nutrition or Food intake or Food or Weight Control or exp Eating Behavior).sh. OR *(eating* or diet* or nutrition or food* or intak* or BMI or obes* or overweight or body mass or weight loss or weight management or weight maintenance).mp.)*

AND

((Exp Motor Processes or Physical Fitness or exp Lifestyle).sh. OR (*physical activit* or exercise* or inactivity or lifestyle* or life style* or sedentary behavio*).mp.)*

AND

((Internet or Websites or Computers or Online Therapy or Computer Assisted Therapy)**.**sh. OR *(web* or web-based or internet or online or computer*).mp.)*

6. **PubMed Related Articles** (Search date: July 29, 2010)

#12 **Related Citations** for **PubMed** (Search **18639791 16855194 15292468 12713209 16781967 16277142 16899804[uid]**) 00:00:44 1504

#1 Search **18639791 16855194 15292468 12713209 16781967 16277142 16899804[uid]** 00:00:43 7

The 200 top ranked records were downloaded.