

Recreational Screen Time Activities and Depressive Symptomatology Among Adolescents: A
Longitudinal Investigation of Cognitive, Behavioural, Affective, and Interpersonal Factors as
Mediators and Moderators

Marisa Murray

Thesis submitted to the Faculty of Graduate and Postdoctoral Studies in partial fulfillment of the
requirements for the degree of Doctor of Philosophy in Clinical Psychology

School of Psychology
Faculty of Social Sciences
University of Ottawa

Acknowledgements

It would be an endless task to include the many individuals who have supported me on this challenging, but most rewarding, postgraduate journey. Thank you to everyone who has played a meaningful role. First and foremost, I would like to extend my deepest gratitude to my supervisor, Dr. Gary Goldfield. Gary, your remarkable work ethic, passion for research, unwavering support, advocacy for your students, and invaluable guidance is truly admirable. Thank you for your consistent and genuine belief in my abilities and encouragement during times of self-doubt. Your words of wisdom always lead to self-reflection and challenged me to develop new perspectives. You have been such an integral part of my personal and professional development and have played a very meaningful role in my life. I am forever grateful to have had the opportunity to work with you as a leading expert in your field and as an exceptionally inspiring and supportive mentor.

An immeasurable thank you to Drs. Annick Buchholz, Martine Flament, Katherine Henderson, and Nicole Obeid, co-investigators of the Research on Eating and Adolescent Lifestyle (REAL) Study. Without your dedication to research and ceaseless generosity in allowing me to use your data, this dissertation would not have been possible. It has been an absolute pleasure to work with each one of you over the years and I look forward to future collaborations as colleagues.

To my committee members, Drs. Allison Ouimet, Hollie Raynor, Philippe Robaey, and Elisa Romano, a sincere thank you for your advisement, expertise, and feedback throughout this process. Your perspectives and thoughtful contributions were invaluable to strengthening my dissertation.

To Dr. Dwayne Schindler and Angeline Tsui, thank you for your unparalleled statistical expertise, answering of my endless questions, and most importantly, the giving of your time. You have a natural ability to make statistics seem much less intimidating than they appear, which helped to put me at ease in the midst of many storms. Thank you to Laura Hum for your phenomenal proofreading skills, which helped immensely in improving the quality of my work.

Thank you to the University of Ottawa's School of Psychology and Clinical Psychology Program for adhering to the highest professional standards and ensuring quality training. A heartfelt thank you to the many wonderful clinical supervisors and colleagues I had the pleasure of working with during my training. You have all touched my life in many positive ways and have left such a valuable impression.

To my friends, longstanding and more recently found, near and far, you have made tremendous and positive contributions to my life. Thank you for consistently encouraging work-life balance, challenging me to trust my instincts, continuously reminding me of what is important in life, providing humor during times of utter chaos, and acting as an essential source of strength during more challenging times. Over the years, our friendships often stood the test of time and distance; however, we always managed to pick up exactly where we left off.

Finally, and most importantly, to my family, no amount of praise can convey the deep and abiding appreciation I have for your boundless love and unwavering support every step of the way. To my parents, thank you for consistently challenging me to do my best and always believing that I would achieve the goals I set for myself, even those that seemed unattainable at times. In the most profound sense, thank you for teaching me the value of hard work, perseverance, and continual self-growth and development. This proved to be a lethal combination in completing my dissertation and Ph.D program. I love you both very much.

Preface

The present dissertation is manuscript-based. It contains a general introduction, two manuscripts that will be submitted for publication, and a general discussion. For the present study, I analyzed data from the longitudinal component of the Research on Eating and Adolescent Lifestyle (REAL) Study. The REAL Study is a collaborative project between the University of Ottawa's Institute of Mental Health Research (IMHR) and the Children's Hospital of Eastern Ontario (CHEO). The REAL Study's primary focus is to examine risk and protective determinants of eating disorders and obesity in adolescents in the National Capital Region of Canada. The REAL Study was funded by the University of Ottawa Medical Research Fund (UMRF) and the Provincial Centre of Excellence for Child and Youth Mental Health. The present dissertation was funded by Ontario Graduate Scholarships (OGS), allocated by the Ontario Provincial Government, from 2011-2016.

Dr. Gary Goldfield, my research supervisor and the principal investigator of the REAL Study, is a clinical scientist at the CHEO Research Institute. Dr. Goldfield oversaw the completion of the current dissertation and provided regular consultation throughout the process. Drs. Martine Flament (child and adolescent psychiatrist; formerly, IMHR, Royal Ottawa Mental Health Care Centre), Annick Buchholz (clinical psychologist; CHEO, Centre for Healthy Active Living), Katherine Henderson (clinical psychologist; Anchor Psychological Services), and Nicole Obeid (Ph.D., CHEO Eating Disorders Program) are co-investigators. Each co-investigator approved the current project.

During my undergraduate degree (2008-2009), I was involved in the REAL Study's participant recruitment, questionnaire administration and scoring, data collection, and data entry in exchange for volunteer experience and course credit. For the present research study, I was

responsible for conceptualizing the dissertation, conducting an extensive literature review, preparing and submitting three ethics applications, preparing data for statistical analyses, conducting advanced-level statistical analyses, and writing the two manuscripts.

The present research study was approved and granted renewal by the following research ethics boards: The University of Ottawa Office of Research Ethics and Integrity (File #H04-16-18), The Children's Hospital of Eastern Ontario (CHEOREB#16/78X), and The Royal Ottawa Mental Health Centre (REB#2016016). A copy of each ethics certificate (i.e., initial and renewal) is included as an appendix.

Participant questionnaires were confidential, coded numerically, and entered in a de-identified database. A password-protected master list that corresponds to each participant's name and ID number was created for identification purposes. The questionnaires and consent forms were stored in a separate locked filing cabinet, which can only be accessed by authorized research staff. The investigators of the REAL Study provided me with access to an electronic copy of the REAL Study database. The database was saved in a password-protected file on a password-protected computer.

I will submit a manuscript version of the first article, "Body Image Mediates the Relationship between Recreational Screen Time and Depressive Symptomatology in Adolescents: A Longitudinal Analysis from the REAL Study" to *Health Psychology* and a manuscript version of the second article, "A Longitudinal Investigation in the Relationship between Total Daily Recreational Screen Time and Depressive Symptomatology Among Adolescents: The Moderating Role of Interpersonal Factors and Gender" to the *Journal of Technology in Behavioral Science*.

Summary

Recreational screen time activities (e.g., computer use, television viewing, and videogame engagement) have become increasingly embedded in modern day culture, posing both physical and psychological health consequences (Babic et al., 2017; Goldfield et al., 2013). Despite the established link between recreational screen time and adolescent depressive symptomatology, little is known about mechanisms that may explain or influence this relationship. The overarching objective of the present dissertation, which includes two separate studies, was to examine cognitive, behavioural, affective, and interpersonal factors associated with the relationship between adolescents' total daily recreational screen time activities and depressive symptomatology over time. The dissertation includes archival data from the Research on Eating and Adolescent Lifestyle (REAL) Study, which examined a large sample of students from the National Capital Region of Canada. Both Study 1 and Study 2 examined a subsample of these students. Given that exposure to screen time occupies up to 10 hours of Canadian children and adolescents' waking hours (Active Healthy Kids Canada, 2013; Leatherdale & Ahmed, 2011; Leatherdale & Harvey, 2015), the independent variable examined in the model was total daily recreational screen time activities. Because trajectories of depressive symptomatology typically increase during adolescence (Duchesne & Ratelle, 2014), the dependent variable examined in the model was depressive symptomatology. The time points spanned over 7 years.

The purpose of Study 1 was to test a prospective longitudinal path analysis model. The model examined the relationship between total daily recreational screen time at baseline (T0) and depressive symptomatology at Time 4 (T4), with body image and disordered eating behaviours at Time 2 (T2) as potential mediating variables. The final sample included 304 English-speaking students (194 females, $M_{\text{age}} = 13.40$ years, $SD = 1.10$). Total daily recreational screen time at T0

was significantly predictive of depressive symptomatology at T4. Appearance (dis)satisfaction at T2 mediated the relationship between total daily recreational screen time at T0 and depressive symptomatology at T4. Total daily recreational screen time at T0 was significantly predictive of emotional eating and decreased body image satisfaction at T2. Restrained eating and appearance satisfaction were negatively associated with depressive symptomatology at T4. Results were independent of age and depressive symptomatology at T0.

The purpose of Study 2 was to test a longitudinal moderation model including total daily recreational screen time at T0 and depressive symptomatology at T4, with attachment style, coping style, and perceived social support at T0 as potential moderating variables. The final sample included 170 English-speaking students (106 females; $M_{age} = 13.01$, $SD = 0.96$). Contrary to expectation, attachment style, coping style, and perceived social support did not moderate the relationship between total daily recreational screen time at T0 and depressive symptomatology at T4. However, insecure attachment was identified as a risk factor for depressive symptomatology among males. A trend emerged in that avoidance-oriented coping appeared to be a risk factor for depressive symptomatology among females and a protective factor for males. There was also a three-way interaction between total daily recreational screen time, gender, and perceived social support. That is, when perceived social support was high, higher levels of total daily recreational screen time at T0 was associated with higher levels of depressive symptomatology at T4 for both males and females, but the relationship was significant for males only. Findings from the present dissertation offer important theoretical, methodological, and clinical implications.

List of Tables and Figures

Study 1: Body Image Mediates the Relationship between Recreational Screen Time and Depressive Symptomatology in Adolescents: A Longitudinal Analysis from the REAL Study.....	38
Table 1. Descriptive Statistics for Disordered Eating, Body Image, and Depressive Symptomatology Among Males ($n = 110$) and Females ($n = 194$).....	56
Table 2. Recreational Screen Time Activities by Gender.....	57
Table 3. Correlations Between Variables of Interest.....	59
Figure 1. Path analysis (including unstandardized regression coefficients and standard errors) of total daily recreational screen time at T0, gender, Total Daily Recreational Screen Time at T0 $\times$ Gender, body image and disordered eating behaviours at T2, and depressive symptomatology at T4, controlling for age and depressive symptomatology at T0.....	62
Table 4. Unstandardized Parameter Estimates for Main Variables in the Total Daily Recreational Screen Time Path Analysis Model.....	63
Figure 2. Path analysis (including unstandardized regression coefficients and standard errors) of separate screen time activities at T0, gender, Total Daily Recreational Computer Use at T0 $\times$ Gender, Total Daily Videogame Engagement at T0 $\times$ Gender, Total Daily Television Viewing at T0 $\times$ Gender, body image and disordered eating behaviours at T2, and depressive symptomatology at T4, controlling for age and depressive symptomatology at T0.....	66
Table 5. Unstandardized Parameter Estimates for Main Variables in Separate Recreational Screen Time Activities Path Analysis Model.....	67
Figure 3. Restrained eating at T2 by total daily recreational computer use at T0 mean minus 1 standard deviation ($M - 1SD$), mean (M), and mean plus 1 standard deviation ($M + 1SD$) for females and males.....	69
Figure 4. Restrained eating at T2 by total daily videogame engagement at T0 mean minus 1 standard deviation ($M - 1SD$), mean (M), and mean plus 1 standard deviation ($M + 1SD$) for females and males	70

Study 2: A Longitudinal Investigation in the Relationship between Total Daily Recreational Screen Time and Depressive Symptomatology Among Adolescents: The Moderating Role of Interpersonal Factors and Gender	97
Figure 1. The relationship between total daily recreational screen time at T0 and depressive symptomatology at T4, moderated by attachment style at T0.....	106
Figure 2. The relationship between total daily recreational screen time at T0 and depressive symptomatology at T4, moderated by coping style at T0.....	107
Figure 3. The relationship between total daily recreational screen time at T0 and depressive symptomatology at T4, moderated by perceived social support at T0.....	108
Table 1. Descriptive Statistics for Coping Style, Attachment Style, and Perceived Social Support Among Males ($n = 64$) and Females ($n = 106$).....	121
Table 2. Recreational Screen Time Activities by Gender.....	122
Table 3. Correlations Between Variables of Interest.....	124
Table 4. Hierarchical Regression Analysis of Total Daily Recreational Screen Time at T0 and Depressive Symptomatology at T4 and Potential Moderating Effects of Attachment Style and Gender.....	127
Figure 4. Unstandardized slopes for a significant two-way interaction between Attachment style x Gender when total daily recreational screen time is at the mean....	128
Table 5. Hierarchical Regression Analysis of Total Daily Recreational Screen Time at T0 and Depressive Symptomatology at T4 and Potential Moderating Effects of Avoidance-Oriented Coping and Gender.....	130
Figure 5. Unstandardized slopes for a significant two-way interaction between Avoidance-Oriented Coping $\times$ Gender when total daily recreational screen time is at the mean.....	131
Table 6. Hierarchical Regression Analysis of Total Daily Recreational Screen Time at T0 and Depressive Symptomatology at T4 and Potential Moderating Effects of Emotion-Oriented Coping and Gender.....	133
Table 7. Hierarchical Regression Analysis of Total Daily Recreational Screen Time at T0 and Depressive Symptomatology at T4 and Potential Moderating Effects of Task-Oriented Coping and Gender.....	135

Table 8. Hierarchical Regression Analysis of Total Daily Recreational Screen Time at T0 and Depressive Symptomatology at T4 and Potential Moderating Effects of Perceived Social Support and Gender.....	137
Figure 6. Unstandardized slopes for a significant three-way interaction between Perceived Social Support $\times$ Total Daily Recreational Screen Time at T0 $\times$ Gender when perceived social support is low.....	138
Figure 7. Unstandardized slopes for a significant three-way interaction between Perceived Social Support $\times$ Total Daily Recreational Screen Time at T0 $\times$ Gender when perceived social support is high.....	139

Table of Contents

Acknowledgements	ii
Preface	iv
Summary	vi
List of Tables and Figures	viii
List of Appendices	xiv
General Introduction	1
Statement of the Problem	1
Cognitive-Behavioural Theoretical (CBT) Framework	5
Adolescent Depression	6
Depression & Recreational Screen Time	8
Study 1 Rationale	11
Adolescent Body Image	12
Body Image, Recreational Screen Time & Depression	13
Disordered Eating Behaviours	15
Disordered Eating Behaviours & Recreational Screen Time	17
Disordered Eating Behaviours & Depression	19
Study 1 Summary	21
Study 2 Rationale	22
Attachment	23
Attachment & Gender Differences	25
Attachment & Depression	25
Attachment Style & Recreational Screen Time	26
Depression & Coping	27
Gender Differences & Coping Style	29
Recreational Screen Time & Coping Style	30
Recreational Screen Time, Depression, & Coping Style	31
Depression & Perceived Social Support	32
Gender Differences & Perceived Social Support	33
Recreational Screen Time & Perceived Social Support	33
Study 2 Summary	35
Overall Gaps in the Literature	35
The Present Investigation	36
Study Rationale	37
Study 1 Body Image Mediates the Relationship between Recreational Screen Time and Depressive Symptomatology in Adolescents: A longitudinal analysis from the REAL Study	38
Abstract	39
Introduction	41
Recreational Screen Time & Depressive Symptomatology	41
Body Image, Recreational Screen Time, & Depression	42
Disordered Eating Behaviours, Recreational Screen Time, & Depression	43
The Present Study	44
Method	45
Sample Size Calculation	45
Participants	46
Procedure and Design	46

Measures	47
Demographics	47
BMI	47
Physical Activity	48
Recreational Screen Time	48
Depressive Symptomatology	49
Appearance & Weight Dissatisfaction	50
Disordered Eating Behaviours	51
Data Analytic Plan	52
Missing Data	53
Testing of Assumptions	53
Potential Control Variables	54
Results	54
Descriptive Statistics	54
Principal Analyses	60
Discussion	71
Summary of Findings	71
Limitations & Strengths	79
Conclusion, Implications, & Future Direction	80
References	83
Study 2 A Longitudinal Investigation in the Relationship Between Total Daily Recreational Screen Time and Depressive Symptomatology Among Adolescents: The Moderating Role of Interpersonal Factors and Gender	97
Abstract	98
Introduction	99
Attachment Style & Depression	100
Recreational Screen Time & Attachment	101
Coping Style, Depression, & Recreational Screen Time	101
Perceived Social Support, Depression, & Recreational Screen Time	103
The Present Study	104
Method	109
Sample Size Calculation	109
Participants	109
Procedure and Design	110
Measures	110
Demographics	111
BMI	111
Physical Activity	111
Recreational Screen Time	111
Depressive Symptomatology	112
Attachment Style	113
Coping Style	114
Perceived Social Support	115
Data Analytic Plan	116
Missing Data	116
Testing of Assumptions	117

Potential Control Variables	118
Results	119
Descriptive Statistics	119
Principal Analyses	125
Attachment Style Model	125
Avoidance-Oriented Coping Style Model	129
Emotion-Oriented Coping Style Model	132
Task-Oriented Coping Style Model	134
Perceived Social Support Model	136
Discussion	140
Summary of Findings	140
Limitations & Strengths	146
Conclusion, Implications, & Future Direction	148
References	151
General Discussion	166
General Summary of Main Findings	166
Study 1: Summary of Findings	167
Study 2: Summary of Findings	170
General Limitations & Strengths	171
Contemporary Recreational Screen Time Data	175
Conclusion, Implications, & Future Direction	176
References (as cited in the General Introduction and General Discussion)	182

List of Appendices

Appendix	Description	
A	Consent Forms.....	210
B	Assent Forms.....	215
C	Thank You Letter.....	217
D	Demographics Questionnaire.....	218
E	Godin Leisure-Time Exercise Questionnaire.....	219
F	Leisure-Time Sedentary Activities Scale.....	220
G	Children’s Depression Inventory.....	221
H	Body Esteem Scale for Adolescents and Adults	223
I	Dutch Eating Behaviour Questionnaire.....	224
J	Sample Excel Spreadsheet Demonstrating how Coefficients and Standard Errors Were Estimated Across the 17 Databases in Study 1.....	227
K	Adolescent Relationship Questionnaire.....	228
L	Coping Inventory for Stressful Situations.....	229
M	McKnight Risk Factor Survey IV (Support/Sharing Subscale).....	230
N	University of Ottawa Ethics Certificates.....	231
O	Children’s Hospital of Eastern Ontario Ethics Certificates.....	233
P	Royal Ottawa Mental Health Centre Ethics Certificates.....	236

General Introduction

Statement of the Problem

Screen time is considered a sedentary activity, which encompasses various activities that involve output from a screen, including computer use, television viewing, and videogame engagement (U.S. National Library of Medicine, 2015). Screen time activities were introduced with good intentions, which can serve functional needs (Favotto, Michaelson, & Davison, 2017; Lohaus, Ball, Klein-Hessling, & Wild, 2005; O’Keeffe & Clarke-Pearson, 2011; Shaw & Gant, 2002); however, for many adolescents, recreational screen time is considered a routine and recurrent daily social practice. Survey research has found that 45% of American adolescents are “almost constantly” online (Anderson & Jiang, 2018) and Canadian children and adolescents spend 7.5 to over 10 hours engaged in daily screen time activities (Active Healthy Kids Canada, 2013; Leatherdale & Ahmed, 2011; Leatherdale & Harvey, 2015). These statistics well exceed the daily screen time guideline (i.e., less than 2 hours per day; Roberts et al., 2017). The American Academy of Pediatrics (2016) recommends that, for children over the age of 6, appropriate limits be placed on both the time spent on and the different types of screen time activities. The American Academy of Pediatrics (2016) further recommends that such activities not impede children’s sleep and physical activity or other health-promoting behaviours.

There is an increasing awareness that if screen technologies are misused (e.g., excessive time), they can lose their functional purpose and result in negative consequences. For example, screen time activities have been largely associated with less healthy food choices among Canadian adolescents (Shang et al., 2015) as well as a host of physical health issues, such as risk of overweight status and obesity (Busch, Manders, & de Leeuw, 2013; Byun, Dowda, & Pate, 2012), diabetes (Goldfield et al., 2013), sleep problems (Do, Shin, Bautista, & Foo, 2013), and

health risk behaviours (e.g., smoking, drunkenness, and illicit drug use; Carson, Pickett, & Janssen, 2011). Sedentary behaviours also tend to track throughout adolescence (Jones, Hinkley, Okely, & Salmon, 2013). As screen time activities exert increased influence in adolescents' lives, it has spurred researchers to examine the implications of their use.

Screen time is an increasingly relevant psychological and public health topic due to its prevalence in day-to-day life of individuals of all ages (Maras et al., 2015; Suchert, Hanewinkel, & Isensee, 2015). With adolescent depression prevalence rates on the rise (Mojtabai, Olfson, & Han, 2016), researchers have investigated and established a link between recreational screen time and depressive symptomatology in both cross-sectional (Benson, Williams, & Novick, 2013; Cao et al., 2011; Goldfield et al., 2016; Katon et al., 2010; Kraut et al., 1997; Kremer et al., 2014; Maras et al., 2015; Messias, Castro, Saini, Usman, & Peebles, 2011) and longitudinal samples (Babic et al., 2017; Grøntved et al., 2015; Primack, Swanier, Georgiopoulos, Land, & Fine, 2009). The relationship between recreational screen time and mental health however, may be more complex than it appears. Specifically, relationships can vary based on the form of recreational screen time being used, and researchers have proposed different underlying and interacting cognitive, behavioural, affective, and interpersonal mechanisms, which have yet to be examined in the literature (see Suchert et al., 2015). Researchers have also highlighted the need for more longitudinal studies to elucidate causal relationships between recreational screen time and mental health (Babic et al., 2017) and depressive symptomatology, specifically (Kremer et al., 2014) and have alluded to the importance of examining specific screen devices as they relate to mental health (Babic et al., 2017).

Given the strong emphasis placed on physical appearance in the Western world, research has focused on both traditional recreational screen time activities, such as television viewing, and

more novel recreational screen time activities, such as browsing social networking sites (SNSs), in relation to body image concerns and disordered eating behaviours. Disordered eating behaviours among adolescents often include restrained eating (i.e., inhibiting dietary consumption to maintain a lower body weight; Herman & Mack, 1975) and emotional eating (i.e., eating or overeating as a result of negative emotional states; van Strien, Frijters, Bergers, & Defares, 1986). The identified link between recreational screen time activities and disordered eating behaviours has largely been explained by exposure and comparison to unattainable body image ideals (Eyal & Te'eni-Harari, 2013; Haferkamp & Krämer, 2011). However, despite existing concerns, the role of body image and maladaptive eating behaviours in the relationship between recreational screen time activities and mental health among adolescents remains largely understudied.

There exists limited empirical research on the topic of interpersonal functions that recreational screen time activities may serve. According to the attachment literature, researchers have identified a negative association between attachment style (i.e., parent-infant bonds, which are highly influential for future relationships; Ainsworth & Bowlby, 1991) and screen time activities (Richards, McGee, Williams, Welch, & Hancox, 2010). With respect to coping (i.e., cognitive and behavioural strategies used to self-regulate during stressful experiences provoked by internal or external demands, which are perceived to exceed one's resources; Lazarus & Folkman, 1984), strategies that are considered more maladaptive in nature have been associated with addictive screen time activities (Cheng, Sun, & Mak, 2015). Social support (i.e., a sense that others will provide a morale boost when needed; Albrecht & Goldsmith, 2003) has also been examined in relation to screen time activities; however, findings have been mixed. That is, American research has found a positive relationship between undergraduate students' Internet

use and perceived social support (Shaw & Gant, 2002); however, Dutch research revealed that the nature of the feedback adolescents received online (i.e., positive versus negative) can either help or hinder their mental health (Valkenburg, Peter, & Schouten, 2006). Although researchers have made contributions to the literature in the area of interpersonal functioning and screen time, it is not known whether attachment style, coping style, and perceived social support influence the relationship between recreational screen time and depressive symptomatology. An investigation of the potential relationship between these variables is advantageous from both a theoretical and clinical perspective, given that attachment style (Eberhart & Hammen, 2006), coping style (Seiffge-Krenke & Klessinger, 2000), and perceived social support (Newman, Newman, Griffen, O'Connor, & Spas, 2007) are associated with adolescent depression.

The present dissertation builds on previous, primarily cross-sectional, research that has identified a link between recreational screen time and depressive symptomatology. The significance lies in its extension of the literature in the area of examining cognitive, behavioural, affective, and interpersonal mechanisms in this relationship. An identified strength of the dissertation is its longitudinal design and novelty, as it appears that previous researchers have not examined mediators or moderators in the relationship between total daily recreational screen time activities and depressive symptomatology among adolescents over time. Accordingly, these studies may yield results that could provide a better understanding of the underlying mechanisms that explain or influence the relationship between recreational screen time activities and depressive symptomatology over time, thereby better informing treatment and prevention efforts.

The General Introduction will first briefly summarize the literature on (a) cognitive-behavioural theory as a theoretical framework, (b) adolescent depression, and (c) the relationship between depression and recreational screen time activities. Second, it will state the premise of

Study 1 and summarize the literature related to this study. Third, it will state the premise of Study 2 and summarize the literature related to this study. Finally, the objectives of the two manuscripts will be explained.

Cognitive-Behavioural Theoretical (CBT) Framework. Cognitive theory (Beck, 1973; 1976) postulates that human beings have schemas, or cognitive systems, that allow for the processing and interpreting of information or experiences in a purposeful manner. In depression, negative thoughts can evoke negative emotions and behaviours, and these three factors work together in a cyclical manner to maintain depressive symptomatology. The present dissertation is informed by the CBT framework. For example, in Study 1, adolescents' behaviour (i.e., daily engagement in recreational screen time activities) can influence maladaptive cognitions (e.g., negative thoughts related to appearance and weight), affect (e.g., shame and guilt as captured by emotional eating), and maladaptive behaviours (e.g., restrained eating and emotional eating), which relate to cognitive and behavioural depressive symptomatology. CBT has been implemented widely in the body image and eating disorders literature, and it remains the most widely used evidenced-based treatment for both eating disorders and depression (Fonagy, Target, Cottrell, Phillips, & Kurtz, 2002; Gorin, Le Grange, & Stone, 2003; Weersing, Iyengar, Kolko, Birmaher, & Brent, 2006). More specifically, negative feelings about body image have been identified as a core antecedent of depression. Research has followed Beck's cognitive theory of depression, describing contributing factors such as maladaptive cognitions about weight, body shape, and eating (Cooper & Fairburn, 1992). A model proposed by Williamson, White, York-Crowe, and Stewart (2004), which follows the CBT framework, includes a component related to specific stimuli that can trigger cognitive biases and is applicable to the present studies. That is, exposure to screens presents numerous opportunities to receive, interpret, and perceive

information related to body, food, and self-evaluation. A CBT model, with a strong cognitive component, has been successfully applied to the development, maintenance, and consequences of maladaptive Internet use (see Davis, 2001, for details). Based on the identified links between recreational screen time and mental health, it is important to also examine relationships between cognitive, behavioural, and affective factors, which may explain the relationship between adolescents' daily recreational screen time and their risk for experiencing depressive symptomatology over time.

It appears that a standard theory has not been applied to explain the relationship between interpersonal factors, such as attachment style, coping style, and perceived social support, and recreational screen time. However, to demonstrate consistency across the two studies, a CBT framework was applied to Study 2 to investigate the aforementioned variables in relation to daily recreational screen time and depressive symptomatology. Implementing a CBT framework allowed me to investigate the interaction between recreational screen time and antecedent behaviours (i.e., adaptive or maladaptive coping), negative cognitions and emotions associated with secure and insecure attachment, and adequate or inadequate levels of perceived social support, which may increase or decrease adolescents' risk of developing future cognitive, behavioural, and affective depressive symptomatology. The present dissertation's main variables of interest are further discussed in the sections that follow.

Adolescent Depression. The onset of depression often occurs during adolescence (Roza, Hofstra, van der Ende, & Verhulst, 2003), particularly for females (Balázs et al., 2013; Kremer et al., 2014; McCarthy, 1990; Roza et al., 2003; Raja, McGee, & Stanton, 1992; Wade, Cairney, & Pevalin, 2002). From 2005 to 2014, the number of adolescents who experienced clinical depression increased from 8.7% to 11.3% (Mojtabai et al., 2016). Subclinical levels of

depression affect an even greater number (21%-50%) of adolescents (Balázs et al., 2013; Kremer et al., 2014). This is concerning given that subclinical depressive symptomatology is a potent risk factor for future depressive disorders (Jonsson et al., 2011; Klein, Shankman, Lewinsohn, & Seeley, 2009). During adolescence, depression often manifests in the form of low mood, heightened irritability, sleep difficulties and fatigue, diminished concentration, and social withdrawal (Crowe, Ward, Dunnachie, & Roberts, 2006). More comprehensively, according to the American Psychiatric Association (2013), depressive symptomatology includes cognitive (e.g., indecisiveness and, most severely, thoughts of death or suicide ideation), affective (e.g., feelings of guilt, worthlessness, sadness, or irritability for most of the day, which reoccurs almost on a daily basis and behavioural features (e.g., decreased interest in activities that were once perceived as pleasurable, changes in weight or appetite, sleep difficulty, decreased energy level, objective observations of psychomotor retardation or agitation). Adolescents with clinically depressive symptoms are nine times more likely to experience suicidal ideation compared to adolescents who did not exhibit depressive symptomatology. Those who report subclinical symptoms are three times more likely to experience suicidal ideation (Balázs et al., 2013). Tragically, the Canadian Mental Health Association (2015) has revealed that for individuals between the ages of 15 and 24 years, suicide accounted for 24% of deaths. Suicide was also identified as a leading cause of death among adolescents and adults. Consequently, it is crucial to identify and target risk factors for adolescent depressive symptomatology.

The etiology of adolescent depression is multifaceted, combined of a host of genetic and environmental risk factors (American Psychological Association, 2010; Andersen & Teicher, 2008), which speaks to the importance of comprehensively understanding and appropriately addressing its risk factors. Although depression can affect individuals from all socioeconomic

backgrounds, results from a meta-analysis show that individuals who were classified as being lower in socioeconomic status (SES) were at increased risk for depression (see Lorant et al., 2003, for a review). Minority groups have also been found to experience increased rates of depression (Plant & Sachs-Ericsson, 2004).

Depression & Recreational Screen Time. The reported weaker social connections with family and friends (Sanders, Field, Diego, & Kaplan, 2000) and cyber bullying (Hamm et al., 2015) that are associated with more recreational screen time activities among adolescents has, in large, prompted researchers to further explore these technologies in relation to depressive symptomatology. Results from adolescent cross-sectional clinical (Benson et al., 2013) and community-based (Goldfield et al., 2016; Katon et al., 2010; Maras et al., 2015) studies have rendered positive correlations between recreational screen time and depressive symptomatology. Longitudinal studies have demonstrated similar results in that increased recreational screen time exposure during adolescence was associated with higher levels of depressive symptomatology during early adulthood in European (Grøntved et al., 2015) and American samples (Primack et al., 2009). Specifically, Grøntved et al. (2015) found that television viewing and total daily screen time (i.e., television viewing and recreational computer use combined) was associated with increased risk of experiencing depression in early adulthood (i.e., 12-year follow-up). However, researchers did not control for baseline depression. Similarly, Primack et al. (2009) found that total daily recreational screen time (i.e., television, movies, videogames, and Internet) and television viewing during adolescence were related to depressive symptomatology at a seven-year follow-up, and these results were more pronounced among males. Specifically, individuals who reported more television viewing were at a significantly increased risk of developing depression with odds ratio ((95% confidence interval) of 1.08 [1.01-1.16]) for every

added hour of daily television viewing. Individuals who reported more media exposure in general were at a significantly increased risk of developing depression (1.05 [1.0004-1.10]) for every subsequent hour of total daily use. Compared to males, females were at a decreased risk of developing depression following exposure to media (0.93 [0.88-0.99]). Analyses were independent of baseline depression. Alarming, adolescents who report spending five or more daily hours using the Internet for recreational purposes and playing videogames have been identified as being at an increased risk for suicidality (e.g., ideation and planning; Messias et al., 2011). Researchers have also identified specific depressive symptoms (i.e., ineffectiveness and interpersonal problems) that are associated with increased recreational screen time, such as videogame engagement and television viewing (Anton et al., 2006).

SNSs, which have increased markedly in popularity in recent years, especially among adolescents (Anderson & Jiang, 2018; Lenhart, 2015) and are recognized as a convenient way to connect with others and disseminate information, can be associated with negative consequences. A recent systematic review and meta-analysis found that maladaptive Facebook use is linked to decreased psychological well-being among adolescents and young adults (see Marino, Gini, Vieno, & Spada, 2018, for a review). SNSs have specifically been associated with heightened feelings of negative affect and depression among adolescents (O’Keeffe & Clarke-Pearson, 2011; Pantic et al., 2012; Sagioglou & Greitemeyer, 2014). For example, Canadian adolescents who spent over 2 hours each day on SNSs also experienced diminished mental health, including suicidal ideation (Sampasa-Kanyinga & Lewis, 2015). With respect to gender differences, cross-sectional Australian research found that significantly more females than males had a SNS profile (76% versus 67%, respectively). Male adolescents who had a SNS profile had a significantly increased social self-concept and, though not statistically significant, higher self-esteem than

males who did not have a SNS profile (Neira & Barber, 2014). Neira and Barber (2014) explain that SNSs may be a platform for males to practice and improve social skills, which results in feelings of social competency. Conversely, female adolescents who had a social media profile reported significantly increased depressed mood and decreased self-esteem compared to females who did not have a profile. Neira and Barber (2014) explain that adolescents who devote a great deal of time and interest to these sites may be less cognizant of the lives of others that are presented online versus the lives of others in real life. As such, researchers speculate that adolescents make unrealistic comparisons to others, which after visiting these sites, may be related to depressed mood (Neira & Barber, 2014). In an experimental study, Sagioglou and Greitemeyer (2014) found that using SNSs (i.e., Facebook) resulted in negative mood, as participants felt they were wasting time by participating in an activity that had very little meaning. However, it is important to note that researchers have not established causality between screen time activities and depressive symptomatology. It is equally possible that adolescents who experience higher levels of depressive symptomatology spend more time in screen time activities.

Although not an established psychiatric diagnosis, Adolescents who struggle with “Internet addiction” (e.g., preoccupation or excessive use of the Internet, leading to behavioural issues, negative emotions, and issues with daily functioning, antecedent of Internet use) have been found to be four times more likely to experience suicidal ideation compared to their non-Internet addicted peers (Kim et al., 2006). European adolescents, between the ages of 13 and 17 years, who exhibited addictive videogame engagement, based on DSM addiction criteria (e.g., tolerance, modification of mood, salience, relapse, withdrawal, conflict, and day-to-day problems), have also reported higher levels of depressive symptomatology (Brunborg, Mentzoni,

& Frøyland, 2014). The DSM-5 has included Internet Gaming Disorder (IGD; American Psychiatric Association, 2013) as a condition that requires further study. IGD is characterized as a repetitive and recurring Internet engagement, which involves playing games, typically multiplayer games, resulting in clinically significant distress or interference with daily functioning. A diagnosis of IGD requires that five or more of the following criteria are present for 12 consecutive months: a preoccupation with online gaming, withdrawal symptoms when not gaming, tolerance, failed attempts to limit gaming time, forfeiting other activities to engage in Internet games, continuing to game regardless of negative consequences, covering up the amount of gaming time, using gaming to avoid negative moods, and jeopardizing or losing career opportunities and relationships with family and friends due to excessive gaming.

Videogames are typically considered a gendered activity (Kovess-Masfety et al., 2016) with 97% of male adolescents participating in this leisure activity (Anderson & Jiang, 2018). Cross-sectional Dutch research including adolescents and emerging adults, between the ages of 13 and 40 years identified IGD prevalence rates of over 5%, based on DSM-5 criteria, with higher rates for males, (Lemmens, Valkenburg, and Gentile (2015). Multi-country research (i.e., Canada, the United States, Germany, and the United Kingdom) on young adults between the ages of 18 and 24 years found IGD prevalence rates of less than 1% (Przybylski, Weinstein, & Murayama, 2017). However, IGD among individuals 14 to 49 years was comorbid with depression and those diagnosed with IGD experienced comorbid depression at a higher rate (i.e., 2.59 times) than those who did not have a diagnosis of IGD (Wang et al., 2018).

Study 1 Rationale

The rationale for Study 1 was that recreational screen time activities often include a social comparison element, which can result in negative thoughts and feelings about one's

weight and overall physical appearance (Eyal & Te'eni-Harari, 2013; Haferkamp & Krämer, 2011) and/or result in disordered eating behaviours (Hamel, Zaitsoff, Taylor, Menna, & Le Grange, 2012). There is also a large body of literature on the negative association between body image satisfaction and disordered eating behaviours with depression (Olivardia, Pope, Borowiecki, & Cohane, 2004; Ouwens, van Strien, & van Leeuwe, 2009; Stice, Hayward, Cameron, Killen, & Taylor, 2000). As such, these eating and body image factors may be underlying mechanisms in the relationship between total daily recreational screen time and depressive symptomatology for adolescents over time. The purpose of Study 1 was to test a model to examine whether body image and disordered eating behaviours mediate the relationship between total daily recreational screen time and depressive symptomatology over time. I will discuss the potential mediating variables in relation to recreational screen time activities and depressive symptomatology.

Adolescent Body Image. Adolescence is a developmental period accompanied by heightened vulnerability to psychological concerns (Andersen & Teicher, 2008) and drastic body changes (Markey, 2010). Body image, which is considered a multidimensional concept, including cognitions, affect, and attitudes about one's physique (Chen & Swalm, 1998; Thompson, Heinberg, Altabe, & Tantleff-Dunn, 1999), is a prevalent issue for many adolescents. Risk for adolescent body image concerns is typically viewed from a biopsychosocial perspective (Presnell, Bearman, & Stice, 2004). A large-scale longitudinal project that spanned over 10 years, revealed that body image issues for both females and males increased during adolescence (Bucchianeri, Arikian, Hannan, Eisenberg, & Neumark-Sztainer, 2013). Recent South Korean research found that almost half of the children and adolescents in their study who had a body weight in the normal range, viewed themselves as overweight (You, Shin., & Kim, 2017).

Compared to male adolescents, female adolescents have been found to report more issues related to identity, self-esteem, and self-concept, factors that are related to body image development (Calado, Lameiras, Sepulveda, Rodríguez, & Carrera, 2010). Though body image concerns are more prevalent among heavier girls, many young girls of lighter weight share these concerns (Sands & Wardle, 2003). Research also suggests that the gender gap with respect to body dissatisfaction has narrowed with a striking increase in males reporting body image concerns, some of which are related to exposure to media content (for a review, see Blond, 2008, and McCabe & Ricciardelli, 2004). Given the purpose of Study 1, the following section will (a) review the literature on recreational relationships between body image, recreational screen time, and depression, and (b) highlight research that has identified recreational screen time as a predictor of body image dissatisfaction and decreased body image satisfaction as an antecedent of depressive symptomatology.

Body Image, Recreational Screen Time & Depression. Among the many sociocultural sources that influence adolescent body image, the media plays a profound role in disseminating standards for physical attractiveness (Eyal & Te'eni-Harari, 2013; Munro & Huon, 2005; Stice & Shaw, 1994). SNSs are a type of recreational screen time that provides users with the opportunity to compare their perception of their physical self with virtually any other SNS user. With the rise in popularity of SNSs, there is emerging research that has examined the relationship between the use of SNSs and body dissatisfaction among adolescents (de Vries, Peter, de Graaf, & Nikken, 2016; Meier & Gray, 2014). In a German, cross-sectional, experimental study, Haferkamp and Krämer (2011) examined social comparison of physical appearance on SNSs and computer engagement among early adult females, and findings were similar to those revealed in studies that examined television viewing. To be specific, they found that after participants examined

profiles of physically attractive users, who were not models or celebrities, participants experienced fewer positive emotions and more body dissatisfaction, compared to those who were exposed to unattractive users. Findings from a more recent cross-sectional, survey study including American female adolescents aged 12 to 18 revealed that it was not the total amount of time spent online, but the amount of time participants engaged in photo activity (e.g., viewing others' photos) that was associated with body image concerns among adolescents (Meier & Gray, 2014). Meier and Gray (2014) alluded to a potential bidirectional relationship; however, more recent longitudinal Dutch research found that frequent use of SNSs predicted body dissatisfaction among adolescents at an 18-month follow-up, although, body dissatisfaction was not predictive of increased use of SNSs (de Vries et al., 2016).

Body image dissatisfaction has been identified as a risk factor for adolescent depression (Markey, 2010). There is a plethora of research on social comparison instigated by media content consumption, including its impact on negative mood (Bessenoff, 2006; Tiggemann & McGill, 2004). Longitudinal American research has identified body dissatisfaction as a significant predictor of clinical depression among female adolescents (Stice et al., 2000). Findings are not limited to females, as research on American college students has found that male body dissatisfaction, especially perceived low muscle mass, is closely related to depression (Olivardia et al., 2004). Similarly, normal-weight male adolescents who perceive themselves to be either overweight or substantially underweight report higher levels of depressive symptomatology, compared to those who perceive themselves as being in the normal weight range (Blashill & Wilhelm, 2014). Body image concerns and media exposure are often explained using upward social comparison, whereby adolescents compare themselves to characters and models presented in the media and experience feelings of inadequacy. It is interesting to note that results from a

cross-sectional study including Israeli adolescents found that although adolescents showed a preference for slender and physically attractive characters, comparing themselves to these characters resulted in negative feelings about their own body image (Eyal & Te'eni-Harari, 2013). Eyal and Te'eni-Harari (2013) examined the relationship between daily recreational screen time exposure (i.e., videogames, television, and Internet) and body image. They explained that following exposure to media ideals, adolescents hoped to achieve a similar body image, however, in time, experienced feelings of disappointment when they could not attain a similar image to their desired character. Longitudinal research on female adolescents has also identified body dissatisfaction as a risk factor for depressive symptomatology among female adolescents (Stice et al., 2000).

Disordered Eating Behaviours. Although there does not appear to exist a universal definition for disordered eating behaviours, definitions commonly include maladaptive practices related to food consumption and weight management (see Chamay-Weber, Narring, & Michaud, 2005, for a review), such as having obsessive cognitions and/or strategies around consuming too much or too little food, exercising excessively, and using diet pills and/or laxatives (Levine & Smolak, 2006). Canadian cross-sectional research, including female adolescents (mean age = 14.6 years) found that 23% of adolescents followed a diet with the goal to lose weight and 27% reported unhealthy eating practices such as bingeing and purging (Jones, Bennett, Olmsted, Lawson, & Rodin, 2001). It is important to note that disordered eating behaviours and attitudes increased gradually during adolescence. Jones et al. (2001) found that by age 15, female adolescents experienced maladaptive eating attitudes and behaviours that were equivalent in frequency to those experienced by “high-risk” groups, such as post-secondary students. More recent research has found that the prevalence of subclinical levels of eating disorders among

Norwegian adolescents were quite high for females and males, with a rate of 64.3% and 45.0%, respectively (Torstveit, Agedal-Mortensen, & Stea, 2015). These findings are concerning as disordered eating behaviours place adolescents at risk for later developing a diagnosable eating disorder (Chamay-Weber et al., 2005), which is characterized by intense body image disturbances, extreme control over food consumption, and/or dangerous behaviours to lose weight (American Psychiatric Association, 2013). Eating disorders are often persistent, co-morbid with different types of eating disorders, and are associated with a heightened mortality rate (see Arcelus, Mitchell, Wales, & Nielsen, 2011, for a review). Emotional eating and restrained eating are disordered eating behaviours that are of interest to Study 1, as they are symptomatic of diagnosable eating disorders (Wardle, 1987) and predict obesity and depression in Canadian adolescents (Goldfield et al. 2010).

Food consumption is related to both internal and external cues (Bruch, 1964). Emotions are considered external cues for eating because when individuals consume food in response to an emotional state, they do not eat in response to internal physiological signals associated with hunger (Bruch, 1964; van Strien et al., 1986). Kaplan and Kaplan's (1957) psychosomatic theory posits that overeating in relation to emotions can result from low interoceptive awareness (i.e., the inability to decipher between hunger feelings, satiety, and emotions) and is also an attempt to diminish emotional distress. Latino adolescents who engaged in emotional eating have been found to consume foods that are associated with weight gain, such as higher energy-dense sweet products (e.g., cake and ice cream), salty products (e.g., potato chips), and cola (Nguyen-Michel, Unger, & Spruijt-Metz, 2007), compared to their peers who did not engage in emotional eating.

Adolescence is considered the developmental period of highest vulnerability for engaging in disordered eating behaviours and developing an eating disorder, and the etiology is influenced

by a host of biological, individual, environmental, and sociocultural risk factors (see Striegel-Moore & Bulik, 2007 and Tylka & Subich, 2004, for a review). The media is viewed as a sociocultural factor that plays a pivotal role in shaping cognitions related to eating, which can manifest in disordered eating behaviours for children and adolescents (Calado et al., 2010; Moriarty & Harrison, 2008). Given that adolescents spend most of their waking hours engaged in recreational screen time activities that often include a media component, researchers have considered how this relates to eating behaviours.

Disordered Eating Behaviours & Recreational Screen Time. There is an abundance of research examining disordered eating behaviors in relation to recreational screen time activities. A large-scale European cross-sectional study found that media exposure was associated with increased disordered eating behaviours for both males and females; however, media content associated with disordered eating cognitions and behaviours varied by gender. That is, for males, disordered eating attitudes and behaviours were more strongly associated with television programs and health-related content, whereas for females, disordered eating attitudes and behaviours were more strongly associated with advertisements related to dieting, sports, and fashion (Calado et al., 2010). Harrison (2000) studied American preadolescents and adolescents, cross-sectionally, in grades six, nine, and twelve, and found that being exposed to overweight television characters, but not “thin ideal” characters, was significantly and positively associated with symptoms of bulimia nervosa for females in all grades and body dissatisfaction for sixth-grade males. Longitudinal American research on female preadolescents (Harrison & Hefner, 2006) and female children (Moriarty & Harrison, 2008) has identified television viewing (hours/day) as a significant antecedent to disordered eating behaviours over time. Of note, in Moriarty and Harrison’s (2008) longitudinal study, the relationship was independent of age,

perceived physique, and intensity of eating pathology, indicating that female children of different ages, varying body sizes, and variable disordered eating behaviours are influenced by media exposure and that this exposure predicts changes in disordered eating symptomatology over time. Regarding the observed gender differences, Moriarty and Harrison (2008) explain that preadolescent males may be less focused on slender television characters or dieting behaviours as their interest may be on achieving weight gain and muscle mass. This speculation is supported by numerous studies cited in a narrative review report (see Cohane & Pope, 2001, for a review). Also in support of recreational screen time preceding disordered eating are findings from a prospective, multi-wave, cross-sectional study conducted in Fiji, in which researchers found that body image dissatisfaction and disordered eating cognitions and behaviours emerged among female adolescents following the introduction of Western television shows (Becker, Burwell, Gilman, Herzog, & Hamburg, 2002).

Researchers have highlighted the importance of studying a variety of screen time activities in relation to disordered eating behaviours (Suchert et al., 2015). Tao and Liu (2009) examined excessive Internet use as it relates to eating disorders in a sample of Chinese adolescents and young adults using a cross-sectional design. They found that both male and female respondents who were categorized as “Internet dependents”, based on modified Gambling Addiction criteria from the DSM-5 (i.e., Internet preoccupation, need for longer duration, unsuccessful attempts to limit Internet use, withdrawal symptoms, and time management problems), reported higher levels of eating disorder symptomatology, such as dieting behaviours and bulimic symptomatology, than controls (i.e., those who did not exceed 10 hours/week for non-school related purposes (see Tao & Liu, 2009, for details). Research has also linked SNSs with disordered eating behaviours (Murray, Maras, & Goldfield, 2016). In general, studies

examining the relationship between recreational screen time activities and disordered eating behaviours appear to be cross-sectional in nature, and until recently, have been quite limited to more traditional forms of recreational screen time, such as television viewing.

Disordered Eating Behaviours & Depression. Many studies have investigated disordered eating behaviours in relation to depression, and findings appear to be quite mixed, which strongly suggests a bidirectional relationship. For purposes of the study, this section will include a brief review of the literature on emotional eating and restrained eating in relation to depressive symptomatology. There is a well-established link between emotional eating and depression (Ouwens et al., 2009). Cross-sectional American research including undergraduate females found that emotional eating was related to heightened emotional problems (e.g., depression, anxiety) and interpersonal problems, and suicidality (van Strien, Schippers, & Cox, 1995). Given the affective component involved in excessive overeating, there is research that links emotional eating to binge eating (e.g., Masheb & Grilo, 2006; Ricca et al., 2009; Zeeck, Stelzer, Linster, Joos, & Hartmann, 2011). An Australian cross-sectional and prospective study found that emotional eating was significantly predictive of future binge eating and overeating among children and adolescents (Allen, Byrne, La Puma, McLean, & Davis, 2008).

Results from a large-scale Swedish clinical sample including adult patients revealed that females and males diagnosed with binge eating disorder, which includes characteristics such as eating a large amount of food in a short period of time, loss of control when eating, and experiencing feelings of embarrassment and distress (American Psychiatric Association, 2013), had comorbid mood disorders (45% and 39%, respectively; Ulfvebrand, Birgegård, Norring, Högdahl, & von Hausswolff-Juhlin, 2015). Cross-sectional research has revealed that adults engage in emotional eating in response to feeling anxious, sad, angry, lonely, tired, and

occasionally feeling happy, and linked emotional eating to depressive symptomatology (Masheb & Grilo, 2006). In a community-based sample of Canadian adolescents, researchers found that those who were categorized as obese reported significantly higher levels of depressive symptomatology compared to their normal weight and overweight peers (Goldfield et al., 2010). Similarly, American survey research has identified a positive relationship between depressive symptomatology and obesity among adolescents (Katon et al., 2010). With respect to the bidirectionality of the relationship, some research has identified depression as a risk factor for obesity (see Luppino et al., 2010, for a review) and other research has identified obesity as a risk factor for depression (Luppino et al., 2010) and depressive symptomatology (Boutelle, Hannan, Fulkerson, Crow, & Stice, 2010). Further support for the latter statement comes from longitudinal American research on female adolescents between the ages of 13 and 16 years, conducted by Stice et al. (2000), which revealed that symptomatology of both bulimia and dietary restraint were predictive of depression among female adolescents over time.

Depression is also highly comorbid with restrained eating. For example, Ulfvebrand et al.'s (2015) study revealed that female patients diagnosed with anorexia nervosa restricting type and anorexia nervosa binge eating/purging type had comorbid mood disorders (33% and 49%, respectively). Similarly, they found that male patients diagnosed with anorexia nervosa restricting type and anorexia nervosa binge eating/purging type had comorbid mood disorders (38% and 42%, respectively; Ulfvebrand et al., 2015). Among female adults diagnosed with anorexia nervosa, depressive symptomatology can also be exacerbated due to malnutrition and weight loss (Pollice, Kaye, Greeno, & Weltzin, 1997). Restraint theory (Herman & Mack, 1975) posits that in order to balance internal hunger signals with intense urges to lose weight, chronic dieters restrict food intake. Restricting food will lead to disinhibited eating and susceptibility to

binges, resulting in weight gain, a concept known as “counter-regulation” (Herman & Polivy, 1980; Polivy & Herman, 1985). Goldfield et al.’s (2010) cross-sectional study found that adolescents who reported increased restrained eating also demonstrated higher adiposity. McCarthy (1990) explain that females will typically develop a sense of persistent failure and uncontrollability with respect to dieting, placing them at heightened risk for depression through the concept of helplessness. McCarthy (1990) demonstrated pathways for females experiencing depression from idealizing societal thin ideals via body dissatisfaction, dieting behaviours, and failure to achieve their dieting goal. As discussed, given the rise in male body dissatisfaction and weight control behaviours, which are often associated with idealizing sociocultural muscular physiques (McCabe & Ricciardelli, 2004), similar pathways may exist for males.

Study 1 Summary

In summary, a considerable amount of research has been devoted to examining recreational screen time activities, disordered eating behaviours, body image, and depression. However, because the majority of the studies have used a cross-sectional design, directionality cannot be inferred for most findings. Longitudinal research has established a link between screen time activities and depressive symptomatology among adolescents. The increased time that many adolescents devote to daily screen time activities exposes them to countless “ideal” images of attractiveness and endless opportunities for self-comparison behaviours, which have been linked to body image dissatisfaction and maladaptive weight control behaviours. Research has also identified body image dissatisfaction and disordered eating as predictors of depressive symptomatology. Accordingly, I examined body image and disordered eating behaviours as potential mediating variables in the relationship between daily recreational screen time activities and depressive symptomatology over time. The specific proposed rationale is that increased

recreational screen time will be associated with body image (dis)satisfaction and increased disordered eating behaviours, which will in turn be associated with increased depressive symptomatology among adolescents, over time. Findings could inform treatment and prevention strategies in this vulnerable population.

Study 2 Rationale

The rationale for Study 2 was that recreational screen time activities can limit and diminish the quality of family time and communication with family in the home (Favotto et al., 2017; Kraut et al., 1998), and instigate feelings of loneliness (Kraut et al., 1998) and “fear of missing out” (Barry, Sidoti, Briggs, Reiter, & Lindsey, 2017), which is defined as the perception that others are having fun in one’s absence (Przybylski, Murayama, DeHaan, & Gladwell, 2013), and this perception is typically accompanied by the need to remain connected to platforms that provide individuals access to this information. Qualitative research using focus groups found that peer conflicts among Spanish adolescents have been related to perceiving that they do not belong to a group (Camara, Bacigalupe, & Padilla, 2017). Certain technologies include a social comparison element (Eyal & Te’eni-Harari, 2013; Haferkamp & Krämer, 2011), which can be an added stressor for adolescents. Also, many factors that contribute to depression are interpersonal in nature and interpersonal problems are highly prevalent during adolescence (Camara et al., 2017). Accordingly, based on a review of the current literature, it is important to identify relevant interpersonal factors that act as risk or protective factors in the relationship between total daily recreational screen time and depressive symptomatology among adolescents over time. A risk factor is a variable that relates to and precedes an undesired result (Kraemer et al., 1997). By contrast, a protective factor is a variable that reduces the probability of or buffers against an individual experiencing a negative outcome (Gutierrez, Muehlenkamp, Dix-Richardson, Barrios,

& Kopper, 2004). The purpose of Study 2 was to test a model including interpersonal risk and protective factors that potentially strengthen or weaken the relationship between total daily recreational screen time activities and depressive symptomatology over time. The three potential moderating variables (i.e., attachment style, coping style, and perceived social support) were chosen because depending on their level, can increase or decrease an adolescent's risk of developing future depressive symptomatology. In the following sections, I will discuss each potential moderating variable in relation to recreational screen time activities, depressive symptomatology, and gender differences to provide further support for selecting the specific moderating variables.

Attachment. Formulated by Bowlby (1970) and influenced by subsequent work of Ainsworth (Ainsworth & Bowlby, 1991), attachment theory postulates that an individual's need to develop bonds with other people is innate (Hazan & Shaver, 1987), and that the parent-infant bond is important for appropriate emotional and cognitive development, survival, and subsequent relationships. A secure or insecure attachment style is influenced by the primary caregiver's response to the child's needs. For example, if the primary caregiver provides consistent responses and is sensitive to the child's needs, this will foster a secure attachment style. Conversely, if the primary caregiver provides inconsistent responses or rejects the child's needs, this will foster insecure attachment styles (Hazan & Shaver, 1987). Insecure infant attachment can include anxiety or avoidance. Children who develop anxious attachment styles have caregivers who displayed unpredictability in responding to the child's needs, which can result in the child becoming hypervigilant toward to caregiver and experiencing difficulty developing security with the caregiver. Conversely, children who develop avoidant attachment styles have typically had rejecting caregivers who disregarded the child's request for assistance or attention.

Children then learn to withhold their signs of distress given that they learned that demonstrating distress resulted in their caregivers withdrawing attention (Ainsworth, Blehar, Waters, & Wall, 2014).

Early attachment styles are found to be quite stable during adolescence (Cook, Heinze, Miller, & Zimmerman, 2016) and the life course, and play a pivotal role in initiating, forming, and maintaining social relations with others (Fraley & Shaver, 2000). There is a bulk of research (e.g., Fraley, 2002; Fraley & Shaver, 2000) that supports early attachment styles in predicting interpersonal functioning in adulthood. Adolescents often struggle with the issue of autonomy-dependence balance because they desire independence (e.g., developing their chosen peer and romantic relationships), but are typically still dependent on their caregivers (Moretti & Holland, 2003). Larson, Richards, Moneta, Holmbeck, and Duckett's (1996) longitudinal study identified a substantial decline in the amount of family time that European-American adolescents engaged in (i.e., from 35% in Grade 5 to 14% in Grade 12); however, they cautioned that such findings may be less pronounced among adolescents from other cultures. Irish research indicates that in general, adolescents report secure attachment with friends (Nelis & Rae, 2009).

With respect to welcoming or avoiding closeness, researchers who have studied attachment in platonic and romantic relationships have found that securely attached individuals are accepting of distance from others and do not express concerns about the need to depend on others or to allow others to depend on them. They are also more likely than their insecurely attached counterparts to seek out support (e.g., emotional and instrumental; Florian, Mikulincer, & Bucholtz, 1995). Conversely, individuals who exhibit an avoidant attachment style display a sense of nervousness when they perceive others as becoming too close to them. Individuals with

an anxious-ambivalent attachment style experience constant worry about abandonment and often seek close relationships (Fraley & Shaver, 2000; Hazan & Shaver, 1987).

Attachment & Gender Differences. Although the attachment literature suggests that secure attachment is equally important for males and females, several gender differences have been established. For example, female adolescents have reported stronger attachments with their peers compared to males (Gullone & Robinson, 2005; Raja, et al., 1992) and male adolescents have been found to have stronger attachment with parents (Gullone & Robinson, 2005; Sund & Wichstrøm, 2002). With respect to parent attachment, females and adolescents who perceived their parents as less warm exhibited more depressive symptomatology and internalizing issues, which for females, increased from grades 8 to 12 (Scaramella, Conger, & Simons, 1999). The following section will review literature on attachment style and depression.

Attachment & Depression. Depression has been a topic of investigation in the attachment literature (see Brumariu & Kerns, 2010, for a review). Secure and stable relationships have been identified as resiliency factors during times of adversity (Rutter, 1985). Cross-sectional Irish research has found that adolescents who reported secure attachment experience significantly less depressive symptomatology, compared to their insecurely attached peers. Nelis and Rae (2009) explain that feeling securely attached and supported by one's peers may act as a buffer against negative feelings for adolescents. American longitudinal research has identified secure attachment in adolescence as a resiliency factor for depression in adulthood (Cook et al., 2016). Longitudinal research including a large birth cohort sample followed from birth to age 30 found that positive attachment styles during adolescence were associated with a decreased risk of future internalizing disorders. Specifically, those who reported the highest levels of attachment showed internalizing disorder rates that were lower than half the rates of individuals who

reported the lowest levels of attachment (Jakobsen, Horwood, & Fergusson, 2012). Conversely, insecure attachment styles are considered to be a risk factor for internalizing issues, such as adolescent depression (Brumariu & Kerns, 2010; Irons & Gilbert, 2005). Sund and Wichstrøm (2002) explain that lower levels of attachment could be associated with depressive cognitive schemas (e.g., unworthy of love), which stem from adolescents feeling rejected and distorted. Insecure attachment style may also work with other factors to predict depression, highlighting the importance of examining interacting risk factors for mental health issues (Brumariu & Kerns, 2010). Longitudinal studies including large-scale samples have identified insecure attachment styles as a risk factor for subclinical depression among European adolescents (Sund & Wichstrøm, 2002) and clinical depression among late-adolescent American females transitioning to young adulthood, independent of baseline depression (Eberhart & Hammen, 2006).

Attachment Style & Recreational Screen Time. Given the rise in online forms of communication, researchers have begun to examine the associations between recreational screen time activities and attachment style. Engaging in two-way or multi-way communication may allow individuals to achieve a sense of belonging (Maslow, 1968), which is an important area of attachment. The reported benefits of online versus face-to-face communication for adolescents often include the anonymity, asynchronicity, accessibility, sense of control, and the option to disseminate information and receive feedback from numerous users (Frison & Eggermont, 2015; Valkenburg & Peter, 2011).

There is an identified relationship between recreational screen time activities and attachment style in the adolescent population. Findings from a large-scale, two-cohort, cross-sectional study comprised of New Zealand adolescents revealed a negative correlation between television viewing, computer use, and parental attachment, and peer attachment, independent of

family composition and SES in both cohorts (Richards et al., 2010). Each additional hour that adolescents spent watching television demonstrated a 13% and 24% inflation in risk for low parental and peer attachment, respectively. Among the 1987-1988 cohort, television viewing was negatively correlated with peer attachment. Among the 2004 cohort, increased time spent in recreational computer time was negatively related to parental attachment and increased videogame engagement and recreational computer time was related to decreased peer attachment. For each additional hour spent watching television or playing videogames demonstrated a 4% and 5%, respectively, increased adolescents' risk for low parental attachment. Although the findings contributed novel information to the attachment and media/communication literature, Richards et al. (2010) acknowledged that causal direction between recreational screen time and parental attachment cannot be established from these findings. For example, they suggested that increased screen time may adversely influence the development and maintenance of healthy parent-adolescent attachment. They also discussed that adolescents who exhibited weak attachment with family and peers may have engaged in recreational screen time activities to develop new attachments (e.g., virtual friendships; Lei & Wu, 2007). To date, there does not appear to exist cross-sectional or longitudinal studies that have examined attachment, recreational screen time activities, and mood collectively.

Depression & Coping. Adolescence is a particularly stressful developmental stage due to the many biological and social changes that occur (e.g., parental conflict, mood dysregulation, and risky behaviour; Arnett, 1999) and stress has been related to internalizing and externalizing behaviours during this developmental period (Anyan, & Hjemdal, 2016; Windle, 1992). A recent American study found that more than 70% of adolescents reported feeling stressed during the previous month (Debnam, Milam, Furr-Holden, & Bradshaw, 2016). Accordingly, adolescence is

also considered a period that involves the development of coping styles, which can be adaptive or maladaptive in nature (Debnam et al., 2016). Coping is defined as the ability to apply cognitive and behavioural strategies to regulate stress (Folkman, Lazarus, Gruen, & DeLongis, 1986). Coping was first dichotomized as problem-oriented (sometimes termed task-oriented or approach-focused) coping and emotion-oriented coping, with the former being a more proactive and healthier means of coping (Lazarus & Folkman, 1984), and has since included a third dimension known as avoidance-oriented coping (Amirkhan, 1990; Endler & Parker, 1990a; Endler & Parkerb). Problem-oriented coping includes a conscious attempt to control a stressor; for example, exploring options to solve a problem, considering the risk and benefits of the options, and carrying out appropriate steps to solve the problem and has been associated with less depressive symptomatology among adolescents over time (Seiffge-Krenke & Klessinger, 2000) and more adaptive means of functioning (e.g., fewer behavioural and emotional problems and higher GPAs among adolescents; Rafnsson, Jonsson, & Windle, 2006), and positive affect and life satisfaction (Wilkinson, Walford, & Espnes, 2000). Conversely, emotion-oriented coping includes attempts to manage emotional distress caused by the situation or stressor, which can include venting (Lazarus & Folkman, 1984), and specifically, emotional discharge, which includes expressing one's feelings, taking negative emotions out on other people, or using substances or food to cope has been linked to psychological distress (Billings & Moos, 1984). Avoidance-oriented coping includes efforts to avoid stressful situations by asking others for support or by participating in a distraction task (e.g., television viewing in place of exam studying; Endler & Parker, 1990b). There exists a longstanding debate about avoidance-oriented coping as an adaptive versus maladaptive coping style. According to the more recent work of cognitive and behavioural theorists however, avoidance-oriented coping is related to positive

short term outcomes and less-positive outcomes over time (see Seiffge-Krenke, 2004).

Avoidance-oriented coping and emotion-oriented coping are considered more maladaptive forms of coping and are linked to less positive affect (Wilkinson et al., 2000). An extensive meta-analysis revealed that problem-oriented coping and avoidance-oriented coping were positively and negatively related to physical and psychological health, respectively (Penley, Tomaka, & Wiebe, 2002). A longitudinal study including students from sixth to eleventh grade revealed that those who used an avoidance-oriented coping style reported the greatest depressive symptomatology, compared to those who used an adaptive coping style (i.e., approach-oriented coping) and reported the least symptomatology. Given that psychological stress experienced during adolescence is a pivotal risk factor for psychopathology, such as depression (Little & Garber, 2005; Rudolph, Flynn, Abaied, Groot, & Thompson, 2009) it is important to examine how adolescents cope with perceived stressors.

Gender Differences & Coping Style. Female adolescents report increased levels of problems and stress in interpersonal relationships compared to their male counterparts (Washburn-Ormachea, Hillman, & Sawilowsky, 2004). In early adolescence, girls and boys have been found to use more of an emotion-oriented coping style. That said, Compas, Orosan, and Grant (1993) found that females typically use more ruminative coping, which is linked to depressive symptomatology. Longstanding research examining coping style has found that females are more likely to use emotion-oriented coping and avoidance-oriented coping (Billings & Moos, 1984; Matud, 2004; Piko, 2001; Ptacek, Smith, & Dodge, 1994; Ptacek, Smith, & Zanas, 1992), while males are more likely to use problem-oriented coping (Billings & Moos, 1984; Ptacek, Smith, & Zanas, 1992). Consistent with these findings, Renk and Creasey (2003) found that both male and female adolescents who reported higher femininity (e.g., warm and

caring) also reported greater emotion-oriented coping, compared to their peers who reported lower femininity. Washburn-Ormachea et al. (2004) also showed that adolescent males and females higher in femininity more regularly used emotion-oriented coping. Conversely, males and females who reported higher masculinity also reported greater problem-focused coping (Renk & Creasey, 2003).

However, some research has found that male adolescents use distraction techniques to a greater extent than females (Camara et al., 2017). Compas, Orosan, and Grant (1993) explain that males use techniques to distract their emotions, which could buffer against interpersonal stress. Also inconsistent with the findings above, Ongen (2006) found that among Turkish adolescents, although females and males used more task-oriented and avoidance-oriented coping, respectively, females reported higher levels of depressive symptomatology compared to their male counterparts.

Recreational Screen Time & Coping Style. Many recreational screen time activities offer an avenue for social comparison (Lee, 2014), bullying (Busch et al., 2013), and neglect of functional tasks, such as missing school (Busch et al., 2013). A recent qualitative Ontario study revealed that children and adolescents described that they sometimes felt sad, angry, and stressed after using “computer-mediated communication” (Favotto et al., 2017). Recent Chinese literature has linked excessive Internet use to maladaptive coping style. For example, Chinese undergraduate students classified as having an Internet addiction, including constructs such as distraction, decreased impulse control, and social and emotional discomfort, reported using more avoidance-oriented coping (Cheng et al., 2015). Cheng et al. (2015) explained that individuals with an Internet addiction could have a greater tendency to confront stress with avoidance-oriented coping. Of greatest importance is the identification of avoidance-oriented coping as an

underlying mechanism in the relationship between Internet addiction and decreased psychosocial functioning. Cheng et al. (2015) explained that those with an Internet addiction showed a preference to escape real-life problems instead of actively confronting them. This is the first known study to identify coping style (i.e., avoidance-oriented coping) as an underlying mechanism in the relationship between Internet addiction and psychological well-being, including negative affect. This suggests that the way that individuals cope with screen exposure is related to psychological functioning. Other cross-sectional research has found that maladaptive Internet use among German adolescents and adults was associated with avoiding negative emotions, among other consequences (Beutel et al., 2011).

Recreational Screen Time, Depression, & Coping Style. Maladaptive coping during adolescence has also been associated with depression. For example, emotion-oriented coping has shown relationships with higher depressive symptomatology and substance use and lower GPA, among Icelandic adolescents (Rafnsson et al., 2006). Rafnsson et al. (2006) explain that distractions may offer adolescents a temporary break from stressful situations but does little to move them toward establishing an effective solution. Other research has found that avoidance-oriented coping was positively related to higher depressive symptomatology among adolescents over time (Seiffge-Krenke & Klessinger, 2000). Seiffge-Krenke and Klessinger (2000) explained their results in relation to the coping skills deficit model (Asarnow, Carlson, & Guthrie, 1987), which postulates that deficits in coping skills result in psychological and physical consequences. The strong and persistent effects of avoidance-oriented coping on depressive symptomatology suggests that avoidance-oriented coping during adolescence may act as a risk factor for ruminative coping during adulthood (Seiffge-Krenke & Klessinger, 2000), which researchers have identified as a coping strategy that maintains depressive symptomatology (Compas, Orosan,

& Grant, 1993). Coping style has been suggested to be a potentially relevant moderating and mediating factor in the bidirectional relationship of stress and present and future adolescent mental health (Seiffge-Krenke, 2004). Despite the pivotal role that effective coping skills play during adolescence, it appears that researchers have not examined its role in the relationship between recreational screen time activities and depressive symptomatology. Examining adolescents' coping style as a moderating variable in the relationship between total daily recreational screen time activities and depressive symptomatology could reveal novel risk and protective factors in this relationship.

Depression & Perceived Social Support. Common definitions of perceived social support include feeling valued, loved and cared for, having others to rely on (Sarason, Levine, Basham, & Sarason, 1983), as well as a sense that others will provide a morale boost when needed (Albrecht & Goldsmith, 2003). Adolescents view social support as a crucial means to confront stress and have cited emotional support (e.g., being empathic and present) as most valuable (Camara et al., 2017). According to the buffering hypothesis (Cohen & Willis, 1985), under stressful circumstances, individuals with more social support reap health benefits and improved well-being, compared to those with less social support (Cassel, 1976). Social support from peers becomes progressively more important as children move from childhood to adolescence (Furman & Buhrmester, 1992; Pendley et al., 2002). Social support contributes positively to an individual's mental health by decreasing feelings of loneliness (i.e., accounting for nearly one-third of variance in loneliness; Eldeleklioglu, 2008), depression (Jensen et al., 2014) and risk of suicidal ideation (Rigby & Slee, 1999), and improves the prognosis of depressive recovery (Parker, Holmes, & Manicavasagar, 1986). Declines in peer and parental support from eighth to ninth grade have been associated with more depressive symptomatology

(Newman et al., 2007). Conversely, adolescents who perceive greater peer and parental support report less depressive symptomatology (Weber, Puskar, & Ren, 2010).

Gender Differences & Perceived Social Support. Research examining perceived social support has revealed gender differences. In general, compared to males, female adolescents also report higher levels of perceived social support (Baldwin, Brown, Wayment, Nez, & Brelsford, 2011), especially emotional support from friends (Desjardins & Leadbeater, 2011; Weber et al., 2010). This could potentially be explained by the finding that female adolescents tend to develop more profound social bonds with peers than males. For example, female adolescents report higher levels of trust and communication with peers, compared to reports from male adolescents (Gullone & Robinson, 2005; Raja et al., 1992). Female adolescents have also been found to provide better support compared to male adolescents as females typically use emotional support tactics, whereas males use distraction (Camara et al., 2017). That said, compared to males, female adolescents have reported more interpersonal issues, which cause higher levels of stress (Compas et al., 1993; Windle, 1992). Females have also been found to report higher levels of sensitivity to interpersonal problems (Kendler, Thornton, & Prescott, 2001). Also, although female adolescents reported greater perceived social support than male adolescents, males reported higher levels of optimism and self-esteem compared to females (Weber et al., 2010). Windle (1992) identified low perceived family support and stress as predictive of problematic behaviors for females only and highlighted the importance of identifying gender differences using longitudinal approaches to elucidate developmental pathways for problematic behaviours among males and females.

Recreational Screen Time & Perceived Social Support. Research on social support and recreational screen time activities have revealed mixed results. Some studies have suggested

that the Internet can foster supportive interaction and significantly increase self-esteem and perceived social support (Shaw & Gant, 2002). For example, adolescent Facebook users report logging on to receive social support to deal with daily stress (Frison & Eggermont, 2015). Interestingly however, if adolescents received the social support they sought through Facebook communication, they reported improvements in their mood. Consequently, if adolescents do not receive the social support they needed through Facebook, their negative mood becomes exacerbated. Beutel et al. (2011) explain that if individuals rely heavily on Internet to address negative emotional states, with negative affect states, this may result in relying on reinforcing components of specific Internet activities, which may result in addictive behaviour. There is also literature that suggests screen time hinders the quality of relationships, which could affect perceived social support. For example, longitudinal research has found that Internet use has been linked to interpersonal functioning such as declines in family communication, less engagement with social circles over time (Kraut et al., 1998), and more distant social connections (Sanders et al., 2000). Given that recreational screen time activities have been associated with social isolation (O’Keeffe & Clarke-Pearson, 2011; Primack et al., 2017), potential consequences of screen time include social isolation and accompanied negative thoughts and feelings (e.g., loneliness and lower levels of perceived social support). This is concerning given the identified strong positive association between perceived social isolation and depression (Hawthorne, 2008).

Given that many adolescents seek support from their friends on Internet sites, researchers have questioned whether seeking social support online substitutes or complements face-to-face interactions. Leung (2007) found that perceived social support obtained online or in real life buffers against stressful life events and assist with mood management. Though, it should be noted that adolescents reported using the Internet in moderation (e.g., 2.22 hours per day).

Coulson (2005) explains that a benefit of online social support is its convenience. For example, support is easily accessible and available at all hours of the day and night. However, research indicates that the nature of feedback adolescents receive on SNSs has the potential to contribute either positively or negatively to their well-being. For example, receiving negative feedback was associated with lower levels of self-esteem among adolescents, whereas positive feedback was related to increased levels of self-esteem. It is encouraging to note that over 75% of adolescents reported receiving consistent positive feedback online (Valkenburg et al., 2006).

Study 2 Summary

In summary, interpersonal factors associated with recreational screen time activities appear to be emerging; however, more extensive research is needed, especially among adolescents, given that this developmental period is fraught with many social, affective, and physical changes and challenges. Despite the pivotal role that interpersonal factors play during adolescence, it appears that their function in the relationship between recreational screen time activities and depressive symptomatology has not been examined. However, given the high prevalence of clinical (Mojtabai et al., 2016) and subclinical (Kremer et al., 2014) depression in the adolescent population, it is important to elucidate factors that are linked to depressive symptomatology. The purpose of Study 2 was to examine how total daily recreational screen time activities at T0 interacts with attachment style, coping style, and perceived social support at T0 to increase or buffer an adolescent's risk for developing depressive symptomatology at T4.

Overall Gaps in the Literature

To my knowledge, although research has identified a link between recreational screen time activities and depression or depressive symptomatology among adolescents, the examination of psychosocial variables that could explain or influence this relationship remains

largely unexplored. Also, the majority of research to date has implemented a cross-sectional design, and thus the directionality of the relationships cannot be determined. As such, there is a critical need for future studies to consider implementing longitudinal designs. In addition, to my knowledge, there are no published studies, in English, that have examined body image (dis)satisfaction and disordered eating behaviours as mediating variables, and coping style, attachment style, and perceived social support as moderating variables, in the relationship between total daily recreational screen time activities and depressive symptomatology among adolescents over time.

The Present Investigation

The purpose of the present dissertation was to help address evident gaps in the literature by evaluating two objectives. The first objective was to examine a longitudinal *mediation model* including body image and disordered eating behaviours at T2 as potential mediating pathways in the relationship between total daily recreational screen time at T0 and depressive symptomatology at T4, while controlling for sociodemographic variables that significantly relate to depressive symptomatology at T4. A mediating variable explains the relationship between two variables (Vogt, 1993). It is important to note that examining each variable at all four time points would have created an overly complex model, which would have posed interpretation challenges.

The second objective was to examine a longitudinal *moderation model* including attachment style, coping style, and perceived social support at T0 as potential moderating variables in the relationship between total daily recreational screen time at T0 and depressive symptomatology at T4, while controlling for sociodemographic variables that significantly relate to depressive symptomatology at T4. A moderating variable influences a relationship between two variables, resulting in an interaction effect (Vogt, 1993). It is important to understand how

cognitive, behavioural, affective, and interpersonal risk factors place adolescents at risk for experiencing future depressive symptomatology. Given the novelty of Model 2, each moderator was tested separately because it is important to first understand how individual moderators influence the relationship between total daily recreational screen time activities and depressive symptomatology before grouping moderating variables together. In addition, the model did not examine moderating effects at all four time points, given the complexity, which would have made it difficult to interpret the results. A more complex model is deferred to subsequent research.

Study Rationale

Research has indicated that spending more than 2 hours per day in front of screens (Roberts et al., 2017) increases the risk of adolescents experiencing adverse physical (Goldfield et al., 2013) and mental health consequences, such as depressive symptomatology (Kim et al., 2006; Maras et al., 2015; Suchert et al., 2015). Given the recent prevalence of adolescent depression and recreational screen time activities, it is particularly important and relevant to identify their risk and protective factors, as well as mechanism linking these relationships in this vulnerable population. I took a longitudinal approach to examine how these factors influence the relationship between daily recreational screen time and depressive symptomatology. A better understanding of these temporal relationships may help researchers and clinicians to develop both treatment and prevention strategies designed to improve mental health in this at-risk population. Implications for each study are addressed in each manuscript and more broadly in the General Discussion of this dissertation.

Study 1

Body Image Mediates the Relationship between Recreational Screen Time and Depressive Symptomatology in Adolescents: A Longitudinal Analysis from the REAL Study

Marisa A. Murray¹, Nicole Obeid², Katherine Henderson³, Annick Buchholz⁴, Martine Flament⁵, & Gary S. Goldfield^{1,6}

¹School of Psychology, University of Ottawa

²Eating Disorder Program, Children's Hospital of Eastern Ontario

³Anchor Psychological Services

⁴Centre for Healthy Active Living, Children's Hospital of Eastern Ontario

⁵University of Ottawa Institute of Mental Health Research

⁶Healthy Active Living & Obesity Research Group, Children's Hospital of Eastern Ontario Research Institute

Keywords: screen time; depression; adolescents; disordered eating; body image

Abstract

There is a well-established association between increased screen time activities (e.g., recreational computer use, television viewing, and videogame engagement) and depressive symptomatology among adolescents. Most studies, however, have been cross-sectional and have not examined underlying mechanisms that may explain the relationship between recreational screen time activities and depressive symptomatology. The purpose of the present study was to examine body image and disordered eating behaviours as mediating variables in the longitudinal relationship between total daily recreational screen time and depressive symptomatology over time. Three hundred and four students (194 females, $M_{age} = 13.40$, $SD = 1.10$) in Grades 7 to 12 from the National Capital Region of Canada participated in the study. The study included longitudinal data on recreational screen time activities (*Leisure-Time Sedentary Activities Scale*), depressive symptomatology (*Children's Depression Inventory*), body image satisfaction (*Body Esteem Scale for Adolescents and Adults*), and disordered eating behaviours (*Dutch Eating Behaviour Questionnaire*) from the Research on Eating and Adolescent Lifestyle (REAL) Study. Results from an Analysis of Moment Structures model revealed a direct and positive effect of total daily recreational screen time at baseline (T0) on depressive symptomatology at Time 4 (T4) (Estimate = 0.48, $SE = 0.18$, $LL = 0.12$, $UL = 0.84$), independent of age and depressive symptomatology at T0. Appearance (dis)satisfaction at Time 2 (T2) mediated the relationship between recreational screen time activities at T0 and depressive symptomatology at T4. Specifically, recreational screen time activities at T0 was significantly related to decreased appearance satisfaction at T2 (Estimate = -0.06, $SE = 0.02$, $LL = -0.10$, $UL = -0.01$), which was significantly related to increased depressive symptomatology at T4 (Estimate = -1.49, $SE = 0.62$, $LL = -2.71$, $UL = -0.28$), independent of age and depressive symptomatology at T0. This is the

first known study to document that the prospective relationship between recreational screen time and depressive symptomatology is mediated by appearance (dis)satisfaction among adolescents, thereby building on cross-sectional findings. Overall, findings offer a baseline for future researchers to continue to examine whether reducing screen time is an efficacious adjunctive strategy in improving body image satisfaction, and reducing depressive symptomatology during adolescence, a developmental period known to confer increased risk.

Introduction

Recreational screen time, a popular and predominantly sedentary pastime for adolescents of the 21st century, encompasses activities involving a user to view a screen. Screen time activities can include computer use, television viewing, and videogame engagement (U.S. National Library of Medicine, 2015). Though screen time activities can serve functional needs, epidemiological data show that Canadian children and adolescents spend approximately 8 hours per day engaged in recreational screen time activities (Leatherdale & Ahmed, 2011; Leatherdale & Harvey, 2015). This amount well exceeds the 2-hour daily screen time guidelines (Roberts et al., 2017).

Depression is a common mental health issue among adolescents that appears to be on the rise. From 2005 to 2014, the number of adolescents who are considered clinically depressed increased from 8.7% to 11.3% (Mojtabai, Olfson, & Han, 2016). An even greater number of adolescents (up to 22.9%) reported subthreshold depression (see Bertha & Balázs, 2013, for a review). Further, trajectories of adolescent depression have been found to worsen during this developmental period (Duchesne & Ratelle, 2014; Gunnell et al., 2016). Adolescent depression often manifests in the form of poor academic performance, significant irritability, and diminished concentration (Crowe, Ward, Dunnachie, & Roberts, 2006). Adolescents who experience depressive symptomatology are also at risk for future depressive disorders (Jonsson et al., 2011; Klein, Shankman, Lewinsohn, & Seeley, 2009).

Recreational Screen Time & Depressive Symptomatology

Researchers have found an association between increased screen time and depressive symptomatology in cross-sectional samples (Anton et al., 2006; Benson, Williams, & Novick, 2013; Katon et al., 2010; Maras et al., 2015; Messias, Castro, Saini, Usman, & Peeples, 2011).

Longitudinal research has also revealed a positive association between recreational screen time during adolescence and depressive symptomatology in early adulthood (Grøntved et al., 2015; Primack, Swanier, Georgiopoulos, Land, & Fine, 2009). Television was most strongly associated with depression; individuals who reported watching the most television at baseline also reported the highest levels of depression at the follow-up. Researchers have also found a cross-sectional association between recreational computer use, such as visiting social networking sites (SNSs), and heightened depressive symptomatology (Neira & Barber, 2014; O’Keeffe & Clarke-Pearson, 2011; Pantic et al., 2012; Sagioglou & Greitemeyer, 2014; Sampasa-Kanyinga & Lewis, 2015).

With respect to gender differences, among Canadian adolescents, males have reported participating in online gaming more often than females, whereas females have reported using social media sites and messaging more often than males (Leatherdale & Harvey, 2015; Steeves, 2014). In addition, males often conducted Internet searches that involved sports-related topics, whereas females often conducted Internet searches that involved entertainment or celebrity news (Steeves, 2014). Research also suggests that females consistently use recreational screen time activities to engage in social comparison behaviours (Haferkamp, Eimler, Papadakis, & Kruck, 2012; Haferkamp & Krämer, 2011; Meier & Gray, 2014). The majority of research has found that increased screen time places adolescents at risk for adverse mental health consequences (Grøntved et al., 2015; Khouja et al., 2017; Maras et al., 2015).

Body Image, Recreational Screen Time, & Depression

Body image, defined as a multidimensional concept, including cognitions and affective attitudes about physique (Chen & Swalm, 1998; Thompson, Heinberg, Altabe, & Tantleff-Dunn, 1999) is a salient concern for many adolescents. Findings from a large-scale longitudinal project that spanned over 10 years, found that body image concerns for both females and males

increased during adolescence (Bucchianeri, Arikian, Hannan, Eisenberg, & Neumark-Sztainer, 2013). South Korean research found that almost half of the children and adolescents in their study who had a body weight in the normal range viewed themselves as overweight (You, Shin, & Kim, 2017). Among the many factors that influence body image, prolonged exposure to Internet sites focused on appearance has been associated with adolescent females' weight dissatisfaction and desire to achieve a thinner body (Tiggemann & Miller, 2010). Recent research found that leisure computer time, but not academic computer time was associated with increased body dissatisfaction among Spanish female adolescents (Anez et al., 2018). Body dissatisfaction is significantly and positively associated with depression among female (Stice, Hayward, Cameron, Killen, & Taylor, 2000) and male (Blashill & Wilhelm, 2014) adolescents. The relationship between body dissatisfaction and media exposure is often explained using upward social comparison, whereby adolescents compare themselves to characters and models presented in the media, which often results in negative feelings about their bodies (Eyal & Te'eni-Harari, 2013).

Disordered Eating Behaviours, Recreational Screen Time, & Depression

Eating disorders, which are characterized by body image disturbances, excessive control over food consumption, and/or risky behaviours to lose weight (American Psychiatric Association, 2013; Striegel-Moore & Bulik, 2007), are a prevalent issue in Western societies (National Eating Disorders Association, 2011). A Canadian study on children and adolescents revealed that 30% of females and 25% of males reported dieting to lose weight, despite having a BMI in the normal range (McVey, Tweed, & Blackmore, 2005). More recent Norwegian research, including a large-scale community sample of adolescents between the ages of 15 and 17 years, revealed that 64.3% of females and 45% of males reported engaging in disordered

eating behaviours (Torstveit, Agedal-Mortensen, & Stea, 2015). Restrained eating (i.e., inhibiting dietary consumption to maintain a lower body weight; Herman & Mack, 1975) and emotional eating (i.e., overeating or bingeing as a result of negative emotional states; van Strien, Frijters, Bergers, & Defares, 1986) are of interest to the present study, as they are symptomatic of diagnosable eating disorders (Wardle, 1987) and have been shown to predict depression in adolescents (Goldfield et al., 2010). Researchers have found that disordered eating behaviours are related to increased recreational screen time (Kim & Lennon, 2007; Murray, et al., 2016). More importantly, researchers have identified disordered eating behaviours as a manifestation of maladaptive recreational screen time activities (Harrison & Hefner, 2006; Moriarty & Harrison, 2008). Additionally, researchers have also identified depressive symptomatology as a predictor of disordered eating behaviours (Ouwens, van Strien, & van Leeuwe, 2009). However, it is unknown whether disordered eating behaviours mediate the relationship between recreational screen time and depressive symptomatology among adolescents over time, highlighting the need for longitudinal mediational models. Recent longitudinal Australian research highlighted the need for longitudinal studies to elucidate causal relationships between recreational screen time and mental health (Babic et al., 2017).

The Present Study

Combined with the many hours that adolescents devote to recreational screen time activities, the rising mental health concerns in this population speak to the importance of examining variables that may help to explain the relationship between recreational screen time activities and depressive symptomatology. Identifying underlying mechanisms in this relationship is an important step toward identifying risk factors and addressing the rising mental health concerns in the adolescent population. Accordingly, the primary objective of the present

study was to examine body image (i.e., appearance satisfaction and weight satisfaction) and disordered eating behaviours (i.e., restrained eating and emotional eating) as mediating variables in the relationship between total daily recreational screen time and depressive symptomatology over time among a sample of adolescents. We anticipated that greater time spent engaged in recreational screen time at baseline (T0) would significantly antecede body (dis)satisfaction and disordered eating behaviours at Time 2 (T2), and that body image (dis)satisfaction and disordered eating behaviours at T2 would significantly antecede more severe depressive symptomatology at Time 4 (T4). The secondary objective of this study was to examine separate types of recreational screen time activities (i.e., recreational computer use, television viewing, and videogame engagement) in relation to body image, disordered eating behaviours, and depressive symptomatology. We anticipated mediation relationships to be stronger for females than for males, given the higher rates of depression, body image concerns, disordered eating behaviours, and social comparison behaviours among females.

Method

The study included data from a large cross-sectional and longitudinal research study, the Research on Eating and Adolescent Lifestyle (REAL) Study. The REAL Study's primary focus was to examine risk and protective determinants of eating disorders and obesity among adolescents from the National Capital Region of Canada.

Sample Size Calculation

A power analysis was conducted by G*Power version 3.1 (Faul, Erdfelder, Buchner, & Lang, 2009) to determine the number of participants needed to detect an effect size of $f^2 = .25$ with $\alpha = .05$ and power of .90 in a path analysis. Results indicated that a sample of 166 participants was needed.

Participants

The REAL Study included students from Grades 7 to 12. The cross-sectional component of the study included students who participated at T0 only. Students who were in Grade 7 or 9 at the beginning of data collection for the REAL Study were invited to participate in the longitudinal component of the REAL study, which involved annual or biannual participation (within three months of the T0 anniversary date) for up to seven years (i.e., from 2006-2013). Participants for the present study were drawn from the longitudinal component of the REAL Study. Three hundred and four participants (194 females), with a mean age of 13.40 years and *SD* of 1.10 at T0, were included in the final sample. The majority of this sample self-identified as a person of North American (51.7%) or European descent (29.6%), while others self-identified as either Asian (7.6%), Other (5.3%), African (1.6%), Central or South American (1.3%), Middle Eastern (1.3%), Aboriginal (1%), Caribbean (0.3%), or Oceanian (0.3%). Most participants had a measured BMI in the “normal range” ($M = 20.17$, $SD = 3.43$) and reported that their parents had a postsecondary education level (77%). Previous research has found the sample to be quite representative of the National Capital Region of Canada given the diverse location of the schools (Flament et al., 2012).

Procedure and Design

Thirty-one public and two private schools in the National Capital Region of Canada participated in the REAL Study. Research staff presented students with an overview of the study. Interested students provided signed assent and parent or guardian consent prior to participating. Students were also informed that they could withdraw from the study at any time. Students in Grade 7 to 12 completed a battery of questionnaires and research staff took measurements of each student’s height and weight in confidence during one of their regular class periods.

Research staff scored questionnaires within 24 hours. If a participant reported a high level of depression, suicidal ideation, or disordered eating behaviours, a professional member (e.g., psychologist or psychiatrist) of the research team met with the student to conduct a follow-up. Given that this was a community-based study, most participants did not require a clinical follow-up. Participants who were absent from school on the day that the questionnaires were administered were invited to complete the questionnaires at the Youth Psychiatry Research Unit at the Royal Ottawa Mental Health Centre. Participants were reimbursed for parking fees and compensated for time with CA\$20. Participating students from classes with a 70% consent rate were compensated with a pizza lunch or a ballet for a gift certificate raffle. For a more thorough description of the REAL Study's procedure, please see Goldfield et al. (2011).

Measures

The study measures were selected from the REAL Study's full questionnaire package. We selected these measures to assess psychosocial factors (i.e., disordered eating behaviours and body image) that may help to explain the relationship between recreational screen time activities and depressive symptomatology. We controlled for sociodemographic variables (i.e., parental level of education as a proxy of socioeconomic status [SES], participant age, ethnicity, gender, and BMI) and other variables (i.e., level of physical activity) that were significantly related to depressive symptomatology at T4.

Demographics. Participants answered questions about self-identified gender, school/grade, parental education, ethnicity, and date of birth to compute age (see Appendix D).

BMI. We measured participants' height in centimetres to the nearest 0.1. We measured weight in kilograms to the nearest 0.1 kg. We converted participants' height into metres to calculate BMI. $BMI = \text{weight (kg)} / \text{height (m)}^2$. It should be noted that participants who were

sensitive about the researcher weighing them were exempted from this component of the assessment; this was a rare occurrence.

Physical Activity. The *Godin Leisure-Time Exercise Questionnaire* (GODIN; Godin & Shepard, 1985) measured physical activity (see Appendix E). Participants answered questions regarding how often they engaged in levels (e.g., strenuous, moderate, and mild) of exercise for more than 15 minutes at a time. Total volume was calculated as follows: (frequency of mild exercise $\times$ 3 METS [metabolic equivalent of task]) + (frequency of moderate exercise $\times$ 5 METS) + (frequency of strenuous exercise $\times$ 9 METS). Higher total scores indicate increased volume of exercise. The GODIN has demonstrated reliability and validity, with test-retest reliability coefficients of $r = 0.94$ (Godin & Shepard, 1985). Other researchers have also found good psychometric properties for the GODIN scale (Eisenmann, Milburn, Jacobsen, & Moore, 2002). Physical activity was considered as covariate in the present study given that sedentary behaviors are both conceptually and empirically different from absence of physical activity (Healey et al., 2008).

Recreational Screen Time. The *Leisure-Time Sedentary Activities Scale* is a 6-item self-report questionnaire, created by the REAL Study team, designed to measure daily recreational sedentary screen time (see Appendix F). Participants were asked to indicate the number of hours they typically spent per day watching television, using a computer for recreational purposes, or playing videogames. Response choices were as follows: 0 (*not at all*), 1 (*less than 1 h*), 2 (*1 to 2.9 h*), 3 (*3 to 4.9 h*), 4 (*5 to 8 h*), and 5 (*more than 8 h*). Screen time can be assessed separately for weekdays and weekend days. Total daily recreational screen time and time spent engaged in separate recreational screen time activities were weighted as: [(week day $\times$ 5) + (weekend $\times$ 2)]/7. Higher scores indicate more time spent engaged in recreational screen time activities.

However, raw scale scores do not represent the total number of hours of recreational screen time activities, but instead placed participants in one of six aforementioned categories, which corresponded to the response choices (i.e., 0-5). Maras et al. (2015) used this measure and demonstrated that in a cross-sectional sample, recreational screen time scores were positively associated with BMI and negatively associated with mental health outcomes (e.g., depression and anxiety). In the present study, this measure demonstrated a good level of internal consistency with a Cronbach's alpha level of .75.

Depressive Symptomatology. The *Children's Depression Inventory* (CDI; Kovacs, 1985; see Appendix G) is a 27-item self-report questionnaire used to assess behavioural, cognitive, and emotional symptomatology of depression to identify depressive disorders in adolescents and children (Timbremont, Braet, & Dreessen, 2004). The CDI is comprised of five subscales: negative mood (e.g., item 1, "I am sad once in a while"; "I am sad many times"; "I am sad all the time"), ineffectiveness (e.g., item 3 "I do most things OK"; "I do most things wrong; I do everything wrong"), anhedonia (e.g., item 4, "I have fun in many things"; "I have fun in some things", "Nothing is fun at all"), negative self-esteem (e.g., item 14, "I look OK"; "There are some bad things about my looks"; "I look ugly") and interpersonal problems (e.g., item 12, "I like being with people"; "I do not like being with people many times"; "I do not want to be with people at all"). Participants answered items based on a 3-point scale, which ranged from 0 to 2; higher numbers represent increased markers of depression (e.g., item 6, "I think about bad things happening to me once in a while" "I worry that bad things will happen to me" "I am sure that terrible things will happen to me"). Summing the values that correspond to each chosen number results in a total score, which can range from 0-54. Additionally, researchers have used the CDI extensively, reported a high level of internal consistency ($\alpha = .71-.89$) and test-reliability ($r =$

.50-.83), and established concurrent validity (Kovacs, 1992). In the present study, the total depression score demonstrated excellent internal consistency with a Cronbach's alpha level of .91 at T0 (covariate) and .88 at T4 (dependent variable).

Kovacs (1992) initially suggested a research cutoff score of 19 to differentiate between depressed and nondepressed children and adolescents. However, Matthey and Petrovski (2002) have suggested using the CDI as a continuous measure to ensure that the inventory captures symptomatology appropriately. In the present study, participants were not categorized as depressed or nondepressed, as the CDI was used as a continuous measure.

Appearance & Weight Dissatisfaction. The *Body Esteem Scale for Adolescents and Adults* (BESAA-23; Mendelson, Mendelson, & White, 2001) is a 23-item self-report questionnaire that assesses three distinct aspects of body esteem (see Appendix H). The appearance esteem subscale measures the feelings that people have about their body (e.g., item 13, "My looks upset me"), the weight esteem subscale measures one's satisfaction with one's current weight (e.g., item 19, "My weight makes me unhappy"), and the attribution esteem subscale measures how people think others think of them, in terms of body image and physical appearance (e.g., item 2, "Other people consider me good looking"). Participants rated each item based on a 5-point Likert scale, which ranged from 0 (*Never*) to 4 (*Always*). The negative statements were reversed scored. Higher scores indicate positive body image. A total score is not calculated. The BESAA-23 has been used successfully in numerous studies including adolescents and adults (Altenburger, Tung, & Keuthen, 2014; Auerbach et al., 2014; Norwood et al., 2011). Appearance esteem and weight esteem is used interchangeably with appearance satisfaction and weight satisfaction, respectively (Norwood, Murray, Nolan, & Bowker, 2011).

Past research has demonstrated good levels of internal consistency for the three subscales

($\alpha = .92$ for appearance esteem; $\alpha = .94$ for weight esteem; $\alpha = .81$ for attribution esteem).

According to Mendelson et al. (2001), the BESAA-23 is a valid and reliable measure, demonstrating convergent validity for self-esteem measures and test-retest reliability ($r = .83-.92$; Mendelson et al., 2001). Appearance esteem ($\alpha = .90$) and weight esteem ($\alpha = .93$), which are both salient components of body image, were examined as mediating variables in the present study.

Disordered Eating Behaviours. The *Dutch Eating Behaviour Questionnaire* (DEBQ; van Strien et al., 1986) is a 33-item questionnaire that assesses three types of disordered eating behaviours: restrained eating, emotional eating, and external eating (see Appendix I). The restrained eating subscale measures restriction of food intake and includes 10 items (e.g., item 3, “How often do you refuse food or drink offered because you were concerned about your weight?”). The emotional eating subscale measures the extent to which individuals consume food to achieve comfort and/or cope with emotions and includes 13 items (e.g., item 19, “Do you have a desire to eat when things are going against you or when things have gone wrong?”). The external eating subscale measures how frequently individuals eat when presented with food cues and includes 10 items (e.g., item 32, “Do you eat more than usual when you see others eating?”). Participants responded to items based on a 5-point Likert scale, which ranged from 1 (*never*) to 5 (*very often*). Calculating the mean response for the subscale items derives a total score. Mean total scores for the three subscales can range from 1 to 5 and higher scores indicate more disordered eating behaviours. For the purposes of the present study, only the restrained eating and emotional eating subscales were used in the statistical analyses as researchers have raised concern about the predictive and discriminant validity associated with the external eating subscale (Jansen et al., 2011). Previous research has found the restrained eating and emotional

eating subscales to be reliable measures for use in adolescent populations (Banasiak, Wertheim, Koerner, & Voudouris, 2001; Norwood, Bowker et al., 2011). In the present study, both scales demonstrated excellent levels of internal consistency, with Cronbach's alpha levels of .92 for restrained eating and .93 for emotional eating.

Data Analytic Plan

We used the Statistical Package for the Social Sciences (SPSS) version 24 and the Analysis of Moment Structures (AMOS) version 24 (Arbuckle, 2016) to conduct data analyses in the present study. We screened minimum and maximum scores to verify that items were scored accurately and within the appropriate scoring range and to verify that any careless responding did not influence the data.

Each model controlled for age and depressive symptomatology at T0. The single arrows represent regression weights and the double arrows demonstrate assumed correlations between variables (see Figure 1). The single-headed arrows represent path coefficients from the independent variable (i.e., total daily recreational screen time at T0) to the mediating variables (i.e., body image and disordered eating behaviours at T2) to the dependent variable (i.e., depressive symptomatology at T4). The model displays relationships between variables of interest and direct and indirect effects of the significant relationships. Using the formulas developed by Rubin (1987) as explained by Enders (2010, p. 220), a Microsoft Excel spreadsheet was created to facilitate the calculations of averages and error terms (see Appendix J). Given the multiple imputation used in the analyses, confidence intervals (CIs) were examined to determine statistical significance. If the upper limit (*UL*) and lower limit (*LL*) did not include zero, the values were deemed statistically significant. The Gender $\times$ Total Daily Recreational Screen Time at T0 interaction was not statistically significant.

Missing Data

We conducted a missing data inventory for the variables of interest. We set selection criteria to ensure that imputation for missing data was reasonable. Specifically, participants who responded to 82 or more of the 110 (75%) scale items were retained in the sample. In total, the final sample included 304 of the 1201 participants. Among the 304 participants, there was 16.62% missing data. We conducted a Little's Missing Completely at Random (MCAR) test to further examine the missing data. Results, $\chi^2(6584) = 6526.87, p = .69$, indicated that the data were missing completely at random. We then performed multiple imputation. A total of 170 datasets were imputed and every 10th database was retained to achieve variability among the imputed datasets, resulting in 17 imputed datasets. We conducted t tests and Chi-square tests to determine whether there were significant differences in variables of interest between participants who were removed from the original database due to missing data and participants who were included in the final sample. Results indicated a significant difference on BMI scores for those who were removed ($M = 20.78, SD = 3.70$) and those who were retained ($M = 20.17, SD = 3.43$); $t(1190) = 2.56, p = .01$. However, this effect was less than half of what is considered a small effect size (Cohen's $d = 0.07$).

Testing of Assumptions

We performed data screening activities to verify that the assumptions for multiple regression had been met (Tabachnick & Fidell, 2013). We assessed normality by visual examination of normal Q-Q plots. Results suggested a normal distribution for the study variables. The linearity and homoscedasticity assumptions were satisfied by examining scatterplots of model residuals versus predicted values. The scatterplots did not demonstrate any systematic patterns, which suggests that model assumptions were satisfied.

Potential Control Variables

Prior to hypothesis testing, we examined sociodemographic variables (i.e., age, gender, parental education, BMI, and ethnicity) and anthropometric variables (e.g., physical activity) that relate theoretically to depressive symptomatology and could impact the study's results.

Significance levels of each potential covariate on depressive symptomatology were examined for each of the 17 imputed databases. We employed a systematic process whereby a covariate was included in the final model if it had a significant effect on depressive symptomatology at T4 in at least 9 out of 17 imputed datasets. Based on this process, age ($< .05$) and depressive symptomatology at T0 ($< .05$) remained in the model as covariates. Each had a significant effect on depressive symptomatology in all 17 datasets. We also included a Gender $\times$ Total Daily Recreational Screen Time covariate given the theoretical gender differences on the variables of interest.

Results

Descriptive Statistics

Table 1 presents descriptive statistics for the variables of interest. Females scored significantly higher on depressive symptomatology at T0, $t(275) = 3.39, p < .001$. Females reported higher depressive scores at T4 ($M = 9.69, SD = 4.69$); however, this increase was not significant, $t(193) = -1.55, p = .12$. There was a significant increase in reported depressive symptomatology for males from T0 ($M = 6.00, SD = 6.06$) to T4 ($M = 9.58, SD = 5.27$), $t(108) = -5.64, p < .001$. Females scored significantly higher on recreational computer use, $t(283) = 3.70, p < .001$, restrained eating, $t(296) = 6.96, p < .001$, and emotional eating, $t(301) = 5.84, p < .001$, and scored significantly lower on appearance satisfaction, $t(264) = -5.41, p < .001$, and

weight satisfaction, $t(292) = -6.97, p < .001$, compared to males. Males scored significantly higher on videogame engagement, $t(301) = -5.67, p < .001$, compared to females.

Table 2 presents a correlation matrix of variables. All variables were correlated in the expected direction. Specifically, total daily recreational screen time at T0 and depressive symptomatology at T4 were negatively correlated with appearance satisfaction and weight satisfaction, and positively correlated with restrained eating and emotional eating, at T2.

Table 3 reveals that 40% of the adolescents in the present study reported spending 3-4.9 hours engaged in recreational screen time activities per day. Participants reported television viewing (1-2.9 hours) on weekdays and weekends as their most frequent recreational screen time activity. Total daily recreational screen time on weekends and weekdays were comparable for males and females.

Table 1

*Descriptive Statistics for Disordered Eating, Body Image, and Depressive Symptomatology**Among Males (n = 110) and Females (n = 194)*

	Females	Males	Females		Males	
	<i>M (SD)</i>	<i>M (SD)</i>	Min	Max	Min	Max
Total Daily Recreational Screen Time	4.77 (2.11)	4.96 (2.14)	0.00	15.00	1.00	14.00
Recreational Computer use	1.93 (1.11)	1.52 (0.80)	0.00	5.00	0.00	5.00
Videogame Engagement	0.91 (0.92)	1.55 (0.99)	0.00	5.00	0.00	5.00
Television Viewing	1.93 (0.84)	1.89 (0.83)	0.00	5.00	0.00	5.00
Restrained Eating	1.93 (0.79)	1.42 (0.50)	1.00	4.60	0.94	3.41
Emotional Eating	2.16 (0.75)	1.66 (0.62)	1.00	4.54	1.00	4.15
Appearance Satisfaction	3.41 (0.74)	3.83 (0.60)	1.00	4.90	1.20	4.80
Weight Satisfaction	3.56 (0.92)	4.17 (0.62)	1.00	5.00	2.00	5.00
Depressive Symptoms (T0)	8.76 (7.96)	6.00 (6.06)	0.00	43.0	0.00	35.0
Depressive Symptoms (T4)	9.69 (4.70)	9.58 (5.27)	0.00	29.0	0.00	30.0
Age	13.49 (1.12)	13.24 (1.06)	11.08	15.42	11.67	15.25

Note. The standard deviation is shown in parentheses. Total Daily Recreational Screen Time (i.e., recreational computer use, videogame engagement, and television viewing), Recreational Computer Use, Videogame Engagement, and Television Viewing do not represent total hours, but instead correspond to a category located in Table 2. Restrained Eating = restricting dietary intake measured at T2, Emotional Eating = eating in response to emotions measured at T2, Appearance Satisfaction = feelings that people have about their body measured at T2, Weight Satisfaction = how satisfied individuals are with their current weight measured at T2, Depressive Symptoms (T0) = negative mood, ineffectiveness, anhedonia, negative self-esteem and interpersonal problems measured at baseline, Depressive Symptoms (T4) = negative mood, ineffectiveness, anhedonia, negative self-esteem and interpersonal problems measured at T4, Age = participants' age measured at T0.

Table 2

Recreational Screen Time Activities by Gender

Recreational Screen Time Activities	Male n(%)	Female n(%)	Total N(%)
TV Viewing on Weekdays			
0 = not at all	7(6.42)	14(7.18)	21(6.91)
1 = less than an hour	35(32.11)	55(28.21)	90(29.61)
2 = 1-2.9 hours	50(45.87)	94(48.21)	144(47.37)
3 = 3-4.9 hours	15(13.76)	28(14.36)	43(14.15)
4 = 5-8 hours	1(0.92)	2(1.03)	3(0.98)
5 = more than 8 hours	1(0.92)	2(1.03)	3(0.98)
TV Viewing on Weekends			
0 = not at all	3(2.75)	4(2.05)	7(2.30)
1 = less than an hour	15(13.76)	29(14.87)	44(14.47)
2 = 1-2.9 hours	52(47.71)	87(44.62)	139(45.72)
3 = 3-4.9 hours	30(27.52)	58(29.74)	88(28.95)
4 = 5-8 hours	6(5.51)	9(4.62)	15(4.93)
5 = more than 8 hours	3(2.75)	8(4.10)	11(3.62)
Videogame Engagement on Weekdays			
0 = not at all	22(20.18)	83(42.56)	105(34.54)
1 = less than an hour	46(42.20)	80(41.03)	126(41.45)
2 = 1-2.9 hours	31(28.44)	22(11.28)	53(17.43)
3 = 3-4.9 hours	5(4.59)	6(3.08)	11(3.62)
4 = 5-8 hours	2(1.84)	3(1.54)	5(1.65)
5 = more than 8 hours	3(2.75)	1(0.51)	4(1.32)
Videogame Engagement on Weekends			
0 = not at all	3(2.75)	60(30.77)	63(20.72)
1 = less than an hour	33(30.28)	73(37.44)	106(34.87)
2 = 1-2.9 hours	39(35.78)	40(20.51)	79(25.99)
3 = 3-4.9 hours	25(22.94)	15(7.69)	40(13.16)
4 = 5-8 hours	4(3.67)	4(2.05)	8(2.63)
5 = more than 8 hours	5(4.59)	3(1.54)	8(2.63)
Recreational Computer Use on Weekdays			
0 = not at all	9(8.26)	12(6.15)	21(6.91)
1 = less than an hour	51(46.79)	72(36.92)	123(40.46)
2 = 1-2.9 hours	42(38.53)	62(31.80)	104(34.21)
3 = 3-4.9 hours	5(4.59)	34(17.44)	39(12.83)
4 = 5-8 hours	1(0.92)	10(5.13)	11(3.62)
5 = more than 8 hours	1(0.92)	5(2.56)	6(1.97)

Recreational Computer Use on Weekends

0 = not at all	11(10.09)	20(10.26)	31(10.20)
1 = less than an hour	38(34.86)	51(26.15)	89(29.28)
2 = 1-2.9 hours	40(36.70)	54(27.69)	94(30.92)
3 = 3-4.9 hours	15(13.76)	40(20.51)	55(18.09)
4 = 5-8 hours	5(4.59)	20(10.26)	25(8.22)
5 = more than 8 hours	0(0.00)	10(5.13)	10(3.29)

Total Daily Recreational Screen Time During Week

0 = not at all	3(2.75)	2(1.03)	5(1.64)
1 = less than an hour	4(3.67)	10(5.13)	14(4.6)
2 = 1-2.9 hours	30(27.52)	58(29.74)	88(28.95)
3 = 3-4.9 hours	41(37.61)	76(38.97)	117(38.49)
4 = 5-8 hours	24(22.02)	41(21.03)	65(21.38)
5 = more than 8 hours	7(6.42)	8(4.10)	15(4.93)

Total Daily Recreational Screen Time During Weekend

0 = not at all	0(0.00)	1(0.51)	1(0.33)
1 = less than an hour	0(0.00)	6(3.08)	6(1.97)
2 = 1-2.9 hours	9(8.26)	24(12.31)	33(10.86)
3 = 3-4.9 hours	41(37.62)	71(36.41)	112(36.84)
4 = 5-8 hours	45(41.28)	73(37.44)	118(38.82)
5 = more than 8 hours	14(12.84)	20(10.26)	34(11.18)

Total Daily Recreational Screen Time Activities^a

0 = not at all	0(0.00)	1(0.51)	1(0.33)
1 = less than an hour	0(0.00)	1(0.51)	1(0.33)
2 = 1-2.9 hours	18(16.51)	26(13.33)	44(14.47)
3 = 3-4.9 hours	38(34.86)	83(42.56)	121(39.80)
4 = 5-8 hours	44(40.37)	70(35.90)	114(37.50)
5 = more than 8 hours	9(8.26)	14(7.18)	23(7.57)

^a Weighted Mean

Table 3

Correlations Between Variables of Interest

	1	2	3	4	5	6	7	8	9	10	11
AGE	-										
SCRN	.14*	-									
COMP	.22**	.76**	-								
TV	.13*	.73***	.37***	-							
VGAM	-.04	.73**	.25***	.34***	-						
DEP0	.12*	.24***	.29***	.15**	.07	-					
DEP4	.13	.37***	.34***	.19*	.32**	.54***	-				
RES	.09	.05	.14*	.07	-.10	.35***	.19*	-			
EMO	.16*	.18**	.23***	.15**	-.00	.16**	.19*	.36***	-		
APP	-.09	-.22***	-.23***	-.16**	.17	-.49***	-.55***	-.51***	-.33***	-	
WEI	-.13*	-.21***	-.28***	-.18**	-.01	-.47***	-.43***	-.68***	-.30***	.72***	-

Note. SCRN = Total Daily Recreational Screen Time; COMP = Total Daily Recreational Computer use; TV = Total Daily Television Viewing; VGAM = Total Daily Videogame Engagement; DEP0 = Depressive Symptomatology at T0; DEP4 = Depressive Symptomatology at T4; RES = Restrained Eating; EMO = Emotional Eating; APP = Appearance Satisfaction; WEI = Weight Satisfaction.

* $p < .05$, two-tailed. ** $p < .01$, two-tailed. *** $p < .001$, two-tailed.

Principal Analyses

First, we expected that total daily recreational screen time at T0 would be positively associated with depressive symptomatology at T4. When regressing total daily recreational screen time at T0 onto total depressive symptomatology at T4, controlling for age and depressive symptomatology at T0, the CI did not include zero (Estimate = 0.48, $SE = 0.18$, $LL = 0.12$, $UL = 0.84$), indicating a direct effect of total daily recreational screen time at T0 on depressive symptomatology at T4. Total daily recreational screen time at T0, age, and depressive symptomatology at T0 accounted for 6% of the variance in depressive symptomatology at T4 ($adjusted\ R^2 = 0.06$). The unique proportion of variance that total daily recreational screen time at T0 accounted for was 3% ($sr^2 = 0.03$) in depressive symptomatology at T4.

Next, we expected that total daily recreational screen time at T0 would be negatively associated with body image (i.e., appearance satisfaction and weight satisfaction) and positively associated with disordered eating behaviours (i.e., restrained eating and emotional eating) at T2, which would subsequently be related to increased depressive symptomatology at T4 among adolescents. The pathways between total daily recreational screen time and appearance satisfaction (Estimate = -0.06, $SE = 0.02$, $LL = -0.10$, $UL = -0.01$) and total daily recreational screen time and weight satisfaction (Estimate = -0.06, $SE = 0.03$, $LL = -0.11$, $UL = -0.01$) were statistically significant, indicating that an association of higher levels of total daily recreational screen time with lower levels of appearance satisfaction and weight satisfaction exists. Total daily recreational screen time at T0, age, and depressive symptomatology at T0 accounted for 25% ($adjusted-R^2 = 0.25$) and 24% ($adjusted-R^2 = 0.24$) of variance in appearance satisfaction and weight satisfaction at T2, respectively. The unique proportion of variance that total daily recreational screen time at T0 accounted for was 1% ($sr^2 = 0.01$) in both appearance satisfaction and weight satisfaction at T2. A statistically significant effect of appearance satisfaction on depressive symptomatology (Estimate = -1.49, $SE = 0.62$, $LL = -2.71$, $UL =$

-0.28) presented, indicating an association of lower levels of appearance satisfaction with a higher level of depressive symptomatology. Appearance satisfaction at T2, age, and depressive symptomatology at T0 accounted for 9% ($adjusted-R^2 = 0.09$) of variance in depressive symptomatology at T4. Appearance satisfaction at T2 accounted for 3% of the unique proportion of variance in depressive symptomatology at T4 ($sr^2 = 0.03$).

Analyses also presented an association of total daily recreational screen time at T0 with higher levels of emotional eating at T2 (Estimate = 0.08, $SE = 0.02$, $LL = 0.03$, $UL = 0.12$). Total daily recreational screen time at T0, age, and depressive symptomatology at T0 accounted for 5% ($adjusted-R^2 = 0.05$) of variance in emotional eating at T2. The unique proportion of variance that total daily recreational screen time at T0 accounted for was 2% ($sr^2 = 0.02$) in emotional eating at T2. Interestingly, restrained eating at T2 was associated with decreased depressive symptomatology at T4 (Estimate = -1.06, $SE = 0.45$, $LL = -1.94$, $UL = -0.17$). Restrained eating, age, and depressive symptomatology at T0 accounted for 5% ($adjusted-R^2 = 0.05$) of variance in depressive symptomatology at T4. The unique proportion of variance that restrained eating at T2 accounted for was less than 1% ($sr^2 = 0.001$) in depressive symptomatology at T4. Given the complexity of the corresponding visual data presented in Figure 3, all significant and nonsignificant unstandardized parameter estimates and CIs for the main variables in the total daily recreational screen time path analysis model are presented in Table 4.

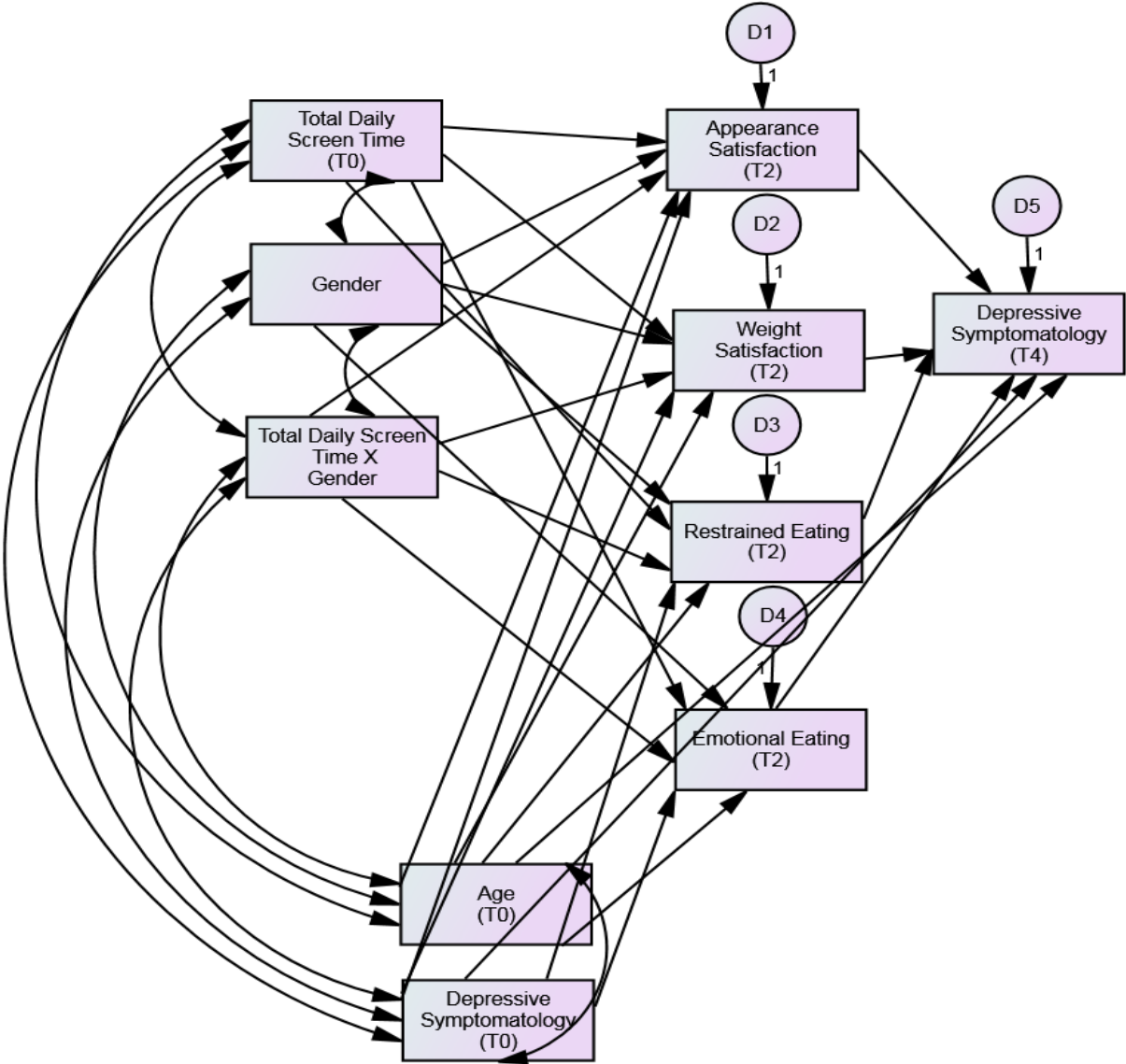


Figure 1. Path analysis (including unstandardized regression coefficients and standard errors) of total daily recreational screen time at T0, gender, Total Daily Recreational Screen Time at T0 × Gender, body image and disordered eating behaviours at T2, and depressive symptomatology at T4, controlling for age and depressive symptomatology at T0.

Table 4

*Unstandardized Parameter Estimates for Main Variables in Total Daily Recreational Screen Time**Path Analysis Model*

Regression	Weights	Unstd. Parameter Estimates	CI (Lower Limit)	CI (Upper Limit)
RES	< --- SCRN	0.01	-0.04	0.05
EMO	< --- SCRN	0.08*	0.03	0.12
WEI	< --- SCRN	-0.06*	-0.11	-0.01
APP	< --- SCRN	-0.06*	-0.10	-0.01
DEP4	< --- SCRN	0.48*	0.12	0.84
DEP4	< --- RES	-1.06*	-1.94	-0.17
DEP4	< --- EMO	-0.01	-0.08	0.80
DEP4	< --- WEI	-0.43	-1.31	0.45
DEP4	< --- APP	-1.49*	-2.71	-0.28
RES	< --- SCRN_GN	-0.02	-0.70	0.66
EMO	< --- SCRN_GN	-0.04	-0.73	0.64
WEI	< --- SCRN_GN	0.03	-0.65	0.71
APP	< --- SCRN_GN	0.03	-0.65	0.72
DEP4	< --- SCRN_GN	0.10	-0.13	0.33

Note. Indirect effects are shown in boldface. SCRN = Total Daily Recreational Screen Time; DEP4 = Depressive Symptomatology at T4; RES = Restrained Eating; EMO = Emotional Eating; APP = Appearance Satisfaction; WEI = Weight Satisfaction.

* $p < .05$.

Next, given that different screen time activities can have differential effects on adolescents mental health, we examined paths between each individual total daily recreational screen time activities (e.g., television, computer, and videogame time) at T0, body image and disordered eating behaviours at T2, and depressive symptomatology at T4, while controlling for age and depressive symptomatology at T0 (see Figure 2). When examining each recreational screen time activity individually, the model statistically controlled for the other two recreational screen time activities. For example, total daily time spent engaged in recreational computer use, television viewing, and videogame engagement at T0 were controlled for. Although there were no direct effects of separate daily recreational screen time activities at T0 on depressive symptomatology at T4, there was an association between total daily recreational computer use at T0 and increased emotional eating at T2 (Estimate = 0.11, $SE = 0.05$, $LL = 0.01$, $UL = 0.21$). Total daily recreational computer use at T0, age, and depressive symptomatology at T0 accounted for 7% ($adjusted-R^2 = 0.07$) of variance in emotional eating at T2. The unique proportion of variance that total daily recreational computer use at T0 accounted for was 3% ($sr^2 = 0.03$) in emotional eating at T2. Also, as was the case in the total daily recreational screen time model, restrained eating at T2 was significantly related to decreased depressive symptomatology at T4 (Estimate = -1.06, $SE = 0.45$, $LL = -1.94$, $UL = -0.17$). Restrained eating at T2, age, and depressive symptomatology at T0 accounted for 5% ($adjusted-R^2 = 0.05$) of variance in depressive symptomatology at T4. The unique proportion of variance that restrained eating accounted for was less than 1% ($sr^2 = 0.001$) in depressive symptomatology at T4.

Results revealed a significant Gender $\times$ Total Daily Recreational Computer Use at T0 interaction (Estimate = -.027, $SE = 0.11$, $LL = -0.48$, $UL = -0.06$) on restrained eating at T2. Gender $\times$ Total Daily Recreational Computer Use at T0, age, and depressive symptomatology at T0 accounted for 20% ($adjusted-R^2 = 0.20$) of variance in restrained eating at T2. The unique proportion of variance that Gender $\times$ Total Daily Recreational Computer Use at T0 interaction accounted for was 8% ($sr^2 =$

0.08) in restrained eating at T2. Results also revealed a Gender $\times$ Total Daily Videogame Engagement at T0 interaction (Estimate = 0.19, $SE = 0.10$, $LL = 0.003$, $UL = 0.383$) on restrained eating at T2.

Gender $\times$ Total Daily Videogame Engagement at T0, age, and depressive symptomatology at T0 accounted for 17% ($adjusted-R^2 = 0.17$) of variance in restrained eating at T2. The unique proportion of variance that Gender $\times$ Total Daily Recreational Computer Use at T0 interaction accounted for was 4% ($sr^2 = 0.04$) in restrained eating at T2. The interactions are discussed further in the next section.

Given the complexity of the corresponding data presented in Figure 2, Table 5 presents the unstandardized parameter estimates and confidence intervals for the main variables in the separate recreational screen time path analysis model.

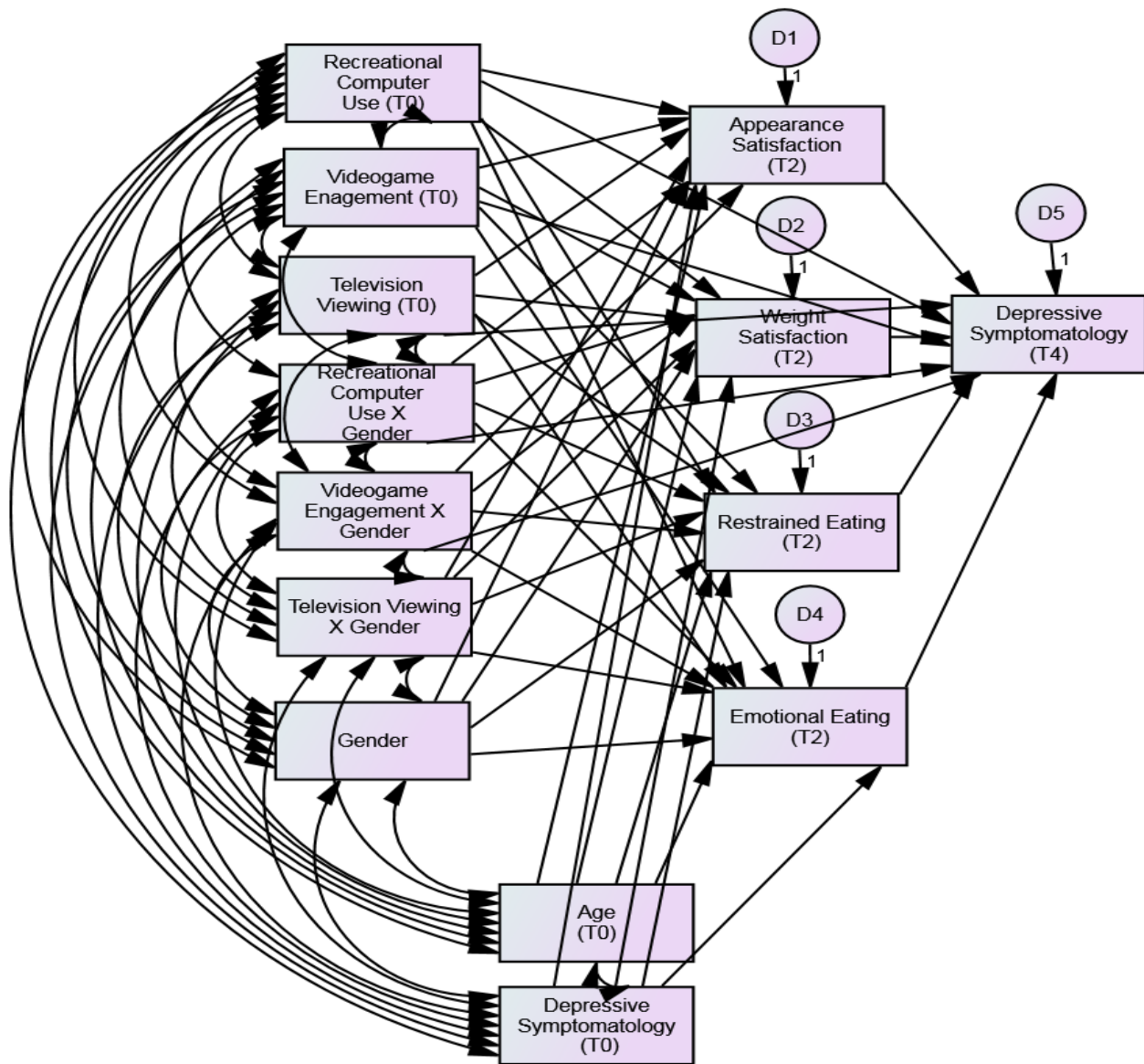


Figure 2. Path analysis (including unstandardized regression coefficients and standard errors) of separate recreational screen time activities at T0, gender, Total Daily Recreational Computer Use at T0 $\times$ Gender, Total Daily Videogame Engagement at T0 $\times$ Gender, Total Daily Television Viewing at T0 $\times$ Gender, body image and disordered eating behaviours at T2, and depressive symptomatology at T4, controlling for age and depressive symptomatology at T0.

Table 5

*Unstandardized Parameter Estimates for Main Variables in Separate Recreational Screen Time**Activities Path Analysis Model*

Regression	Weights	Unstd. Parameter Estimates	CI (Lower Limit)	CI (Upper Limit)
RES	< --- TV	0.07	-0.05	0.19
EMO	< --- TV	0.09	-0.04	0.22
WEI	< --- TV	-0.10	-0.23	0.04
APP	< --- TV	-0.09	-0.20	0.03
DEP4	< --- TV	0.14	-0.73	1.00
RES	< --- VGAM	-0.09	-0.21	0.02
EMO	< --- VGAM	0.02	-0.09	0.14
WEI	< --- VGAM	-0.01	-0.13	0.11
APP	< --- VGAM	-0.05	-0.15	0.06
DEP4	< --- VGAM	0.56	-0.29	1.40
RES	< --- COMP	0.04	-0.05	0.14
EMO	< --- COMP	0.11*	0.01	0.21
WEI	< --- COMP	-0.07	-0.19	0.05
APP	< --- COMP	-0.04	-0.13	0.04
DEP4	< --- COMP	0.23	-0.48	0.93
DEP4	< --- RES	-1.06*	-1.90	-0.17
DEP4	< --- EMO	-0.01	-0.82	0.80
DEP4	< --- APP	-1.37	-3.22	0.49
DEP4	< --- WEI	-0.43	-1.32	0.46
RES	< --- TV_GN	-0.01	-0.14	0.13
EMO	< --- TV_GN	0.01	-0.13	0.15
WEI	< --- TV_GN	0.01	-0.14	0.15
APP	< --- TV_GN	0.07	-0.08	0.22
RES	< ---VGAM_GN	0.19*	0.003	0.38
EMO	< ---VGAM_GN	0.07	-0.13	0.26
WEI	< ---VGAM_GN	-0.08	-0.29	0.13
APP	< ---VGAM_GN	-0.12	-0.29	0.06
RES	< --- COMP_GN	-0.27*	-0.48	-0.06
EMO	< --- COMP_GN	-0.16	-0.52	0.21
WEI	< --- COMP_GN	0.17	-0.06	0.41
APP	< --- COMP_GN	0.19	-0.01	0.39
DEP4	< --- VGAM_GN	0.47	-0.91	1.85
DEP4	< --- TV_GN	-0.11	-1.49	1.26
DEP4	< --- COMP_GN	-0.51	-2.14	1.11

Note. Direct effects are shown in boldface; COMP = Total Daily Recreational Computer Use; TV = Total Daily Television Viewing; VGAM = Total Daily Videogame Engagement; DEP4 = Depressive Symptomatology at T4; RES = Restrained Eating; EMO = Emotional Eating; APP = Appearance Satisfaction; WEI = Weight Satisfaction. * $p < .05$.

We conducted follow-up simple slope analyses to further examine the significant interactions at three levels: the mean, one standard deviation below the mean, and one standard deviation above the mean. Results demonstrated that at higher levels of daily recreational computer use, females engaged in higher levels of restrained eating compared to males (see Figure 3). Results also demonstrated that at higher levels of total daily videogame engagement, females engaged in higher levels of restrained eating compared to males (see Figure 4). However, for both genders, there appears to be a trend that increased total daily videogame engagement is related to lower restrained eating.

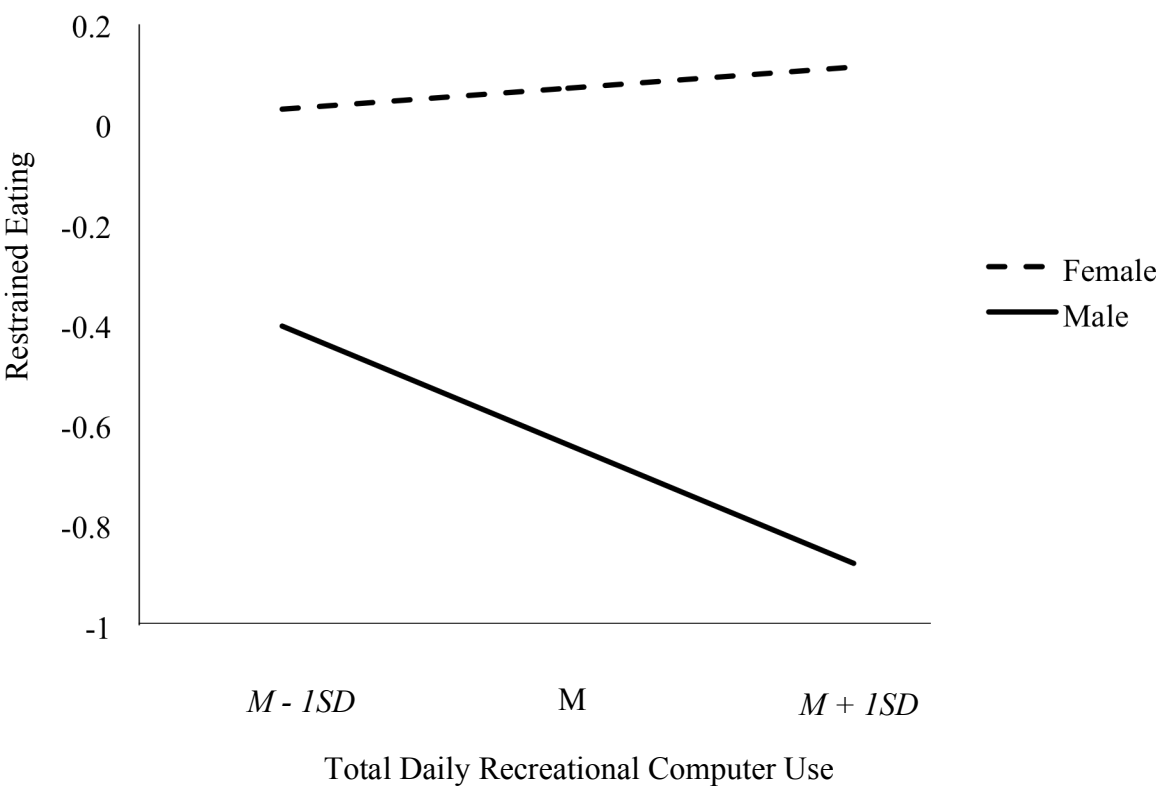


Figure 3. Restrained eating at T2 by total daily recreational computer use at T0 mean minus 1 standard deviation ($M - 1SD$), mean (M), and mean plus 1 standard deviation ($M + 1SD$) for females and males.

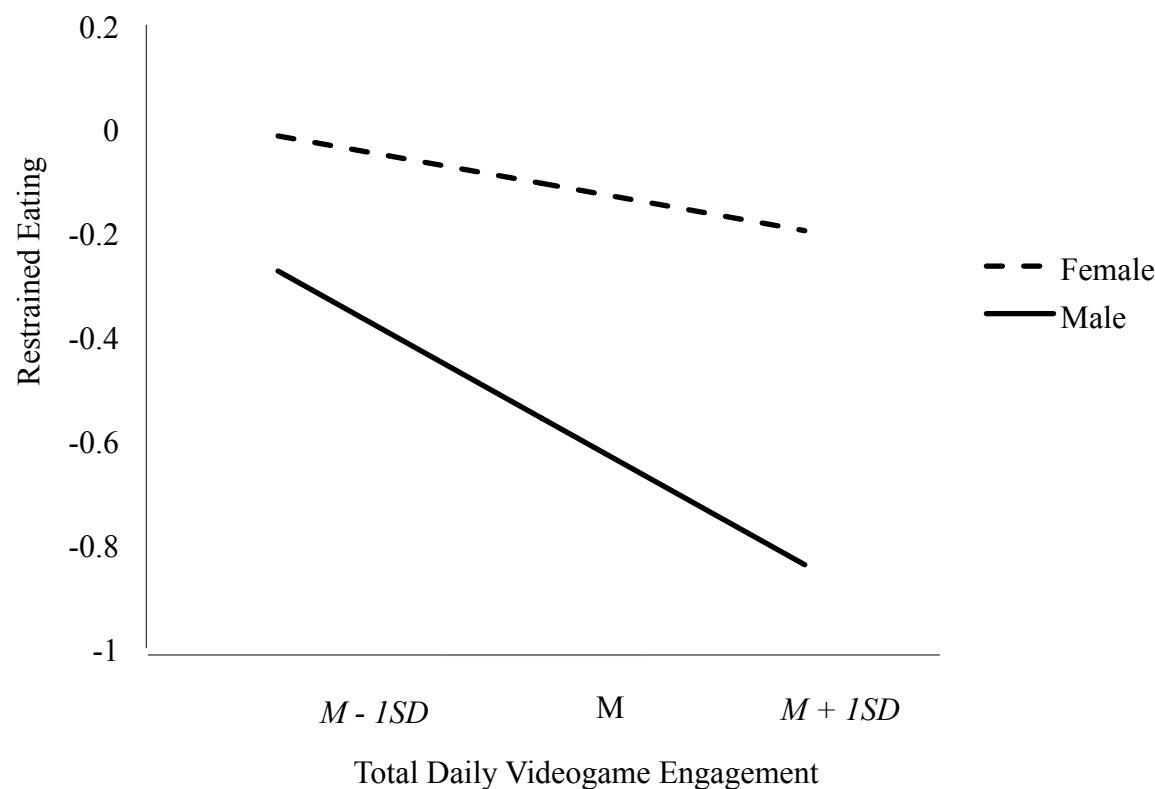


Figure 4. Restrained eating at T2 by total daily videogame engagement at T0 mean minus 1 standard deviation ($M - 1SD$), mean (M), and mean plus 1 standard deviation ($M + 1SD$) for females and males.

Discussion

The relationship between recreational screen time activities and mental health issues is a research area that has gained momentum in recent years. Researchers have investigated and established a link between increased recreational screen time activities and higher levels of depressive symptomatology in both cross-sectional (Benson et al., 2013; Cao et al., 2011; Goldfield et al., 2016; Katon et al., 2010; Maras et al., 2015; Messias et al., 2011; Nakamura et al., 2012) and longitudinal samples (Grøntved et al., 2015; Primack et al., 2009). Researchers have also highlighted the need to identify underlying mechanisms in this relationship, especially in longitudinal samples (Maras et al., 2015; Suchert, Hanewinkel, & Isensee, 2015). Accordingly, the focus of the present study was to extend current mental health and recreational screen time research by evaluating a longitudinal model of adolescent-relevant cognitive, affective, and behavioural factors that potentially mediate the relationship between recreational screen time activities and depressive symptomatology over time. The most notable finding was that appearance (dis)satisfaction at T2 mediated the positive relationship between recreational screen time activities at T0 and depressive symptomatology at T4, independent of depressive symptomatology and age at T0. The significance of this finding will be discussed below.

Summary of Findings

The present study contributes important preliminary information about prevalent mental health concerns among adolescents. Findings revealed several gender differences on the main variables of interest, which were in line with previous research. As expected, females reported significantly higher levels of disordered eating behaviours (McVey et al., 2005; Torstveit et al., 2015) and lower levels of body image satisfaction (Jones, Bennett, Olmsted, Lawson, & Rodin, 2001) compared to their male counterparts. Regarding recreational screen time activities, males and females reported significantly higher levels of total daily videogame engagement (Kovess-Masfety et al., 2016) and recreational computer use, respectively. Though recreational computer use between genders is quite comparable in

the literature, researchers have found that females report using social media sites to a greater extent than males (Lenhart, 2015). In the present study, females reported significantly higher levels of depressive symptomatology at T0. Depressive symptomatology increased for females and males over time, supporting the growing rates of adolescent depression (Mojtabai et al., 2016). However, the increase was significant for males only. Nevertheless, these findings highlight the importance of examining risk factors for depression during this vulnerable developmental period. In addition, given that the Gender $\times$ Total Daily Recreational Screen Time at T0 interaction was not significant, this supports the importance of including both males and females in recreational screen time research.

Consistent with previous research, there was a positive relationship between total daily recreational screen time at T0 and depressive symptomatology at T0 (Gunnell et al., 2016; Maras et al., 2015). As expected, we observed a small, but significant and positive direct effect of total daily recreational screen time at T0 on depressive symptomatology at T4, independent of participants' age and depressive symptomatology at T0. This finding is in line with recent longitudinal research that has identified longer duration of recreational screen time as a risk factor for developing depression in adulthood (Grøntved et al., 2015; Khouja et al., 2017; Primack et al., 2009). This can be explained in part by the displacement hypothesis (Kraut et al., 1998), which holds that involvement in sedentary screen time activities reduce individuals' participation in more active or productive tasks, which in turn can affect quality of life.

Regarding body image, adolescents who reported higher total daily recreational screen time at T0 reported less satisfaction with their appearance and weight at T2. The most notable and novel finding was that appearance satisfaction at T2 was also significantly and negatively related to depressive symptomatology at T4. Accordingly, this study identified appearance (dis)satisfaction as an underlying mechanism in the relationship between total daily recreational screen time at T0 and depressive symptomatology at T4 among adolescents, independent of age and depressive

symptomatology at T0. This finding is consistent with previous cross-sectional research in which adolescent males who reported lower satisfaction with their bodies also reported a significantly greater amount of television time, compared to adolescent males who felt more positively about their bodies (Neumark-Sztainer, Goeden, Story, & Wall, 2004). Findings from the present study are also in line with longitudinal research, which identified a positive association between SNSs and body dissatisfaction (de Vries, Peter, de Graaf, & Nikken, 2016), as well as with research that has linked body dissatisfaction with depressive symptomatology among adolescents (Blashill & Wilhelm, 2014; Stice et al., 2000). To our knowledge, however, this is the first study to demonstrate that appearance dissatisfaction helps to explain the relationship between total daily recreational screen time and depressive symptomatology among adolescents, over time.

SNSs allow users to present themselves in the most favourable light (Gonzales & Hancock, 2011) and provide avenues for social comparison to ideal characters in television shows and movies (Eyal & Te'eni-Harari, 2013), and even virtual characters in videogames (Sylvia, King, & Morse, 2014). Accordingly, it is not surprising that research has linked recreational screen time activities to body dissatisfaction via upward social comparison and decreased feelings about body image (Cattarin, Thompson, Thomas, & Williams, 2000; Eyal & Te'eni-Harari, 2013; Smith, Hames, & Joiner, 2013; Sylvia et al., 2014). It is understandable that there exists an association between negative feelings about appearance and the depressive symptomatology measured in the present study (i.e., negative self-esteem, negative mood, anhedonia, interpersonal difficulties, and ineffectiveness). However, it remains unclear why appearance satisfaction mediated the relationship between total daily recreational screen time and depressive symptomatology while weight satisfaction did not. Perhaps the countless images that recreational screen time activities expose adolescents to and the feedback they receive while engaging in recreational screen time activities could contribute to a more global negative perception of body image, instead of only one facet, such as weight. Possibly, many adolescents

perceive having the means to modify concerns with weight through diet and exercise, whereas modifying facial features are typically less viable during adolescence, which over time, through repeated comparison, becomes associated with depressive symptomatology. Future research could further explore this finding.

Contrary to expectations, disordered eating behaviours at T2 did not mediate the relationship between total daily recreational screen time at T0 and depressive symptomatology at T4. However, several indirect effects emerged. As expected, those who engaged in increased levels of total daily recreational screen time at T0 reported increased emotional eating two years later, independent of age and depressive symptomatology at T0. It is important to distinguish between mindless eating and emotional eating as previous research has found an association between recreational screen time and boredom, which is associated with increased eating (Chapman et al., 2014). However, emotional eating involves using food to cope with unpleasant emotions, and thus this finding is very important given that emotional eating is associated not only with weight gain (Nguyen-Michel, Unger, & Spruijt-Metz, 2007) but also with mental health issues, such as depression (Goossens, Braet, Van Vlierberghe, & Mels, 2009; Lazarevich, Irigoyen Camacho, Velázquez-Alva, & Zepeda Zepeda, 2016). Although not studied in the present study, it is plausible that the content viewed during recreational screen time may have impacted this relationship, and thus this would be an important topic to explore in future research. The finding that emotional eating at T2 did not predict depressive symptomatology at T4 is still in line with previous research including adolescent samples. For example, Nguyen-Rodriguez, Unger, and Spruijt-Metz (2009) found that an association of emotional eating with depressed mood among adolescents did not exist.

Contrary to expectations, total daily recreational screen time did not significantly predict restrained eating. This is an important finding as it suggests that prevention efforts may be best focused on emotional eating in response to recreational screen time. An unexpected finding was that restrained

eating at T2 was significantly and negatively related depressive symptomatology at T4 for adolescents. Though past research has found malnutrition and weight loss to be factors that exacerbate depression (Pollice, Kaye, Greeno, & Weltzin, 1997), results may present differently in a community-based sample. A plausible explanation for this finding is that restrained eaters may be better at regulating their emotions (e.g., very controlled). Restrained eaters may also feel a sense of empowerment following restrictive eating behaviours, and thus report less depressive symptomatology. This is an important topic to address in prevention and treatment programs given that adolescent females who score very high on restraint are more susceptible to future diagnosable eating disorders (Patton, Johnson-Sabine, Wood, Mann, & Wakeling, 1990) and binges, resulting in weight gain, a concept known as “counter regulation” (Herman & Polivy, 1980; Polivy & Herman, 1985). Research has found that females who engaged in counter regulation developed a sense of constant failure and uncontrollability, placing them at heightened risk for depression through the concept of helplessness (McCarthy, 1990).

It is also important to acknowledge research that has found that not all restrained eating is maladaptive in nature. For example, in contrast to “rigid restraint” in which individuals follow a pattern of strict dieting rules to freely consuming foods that are higher in saturated fat, “flexible restraint” has been identified as a more adaptive means of weight-loss. Specifically, foods that are higher in saturated fat are acceptable in smaller quantities instead of prohibited altogether, resulting in dieting that is more sustainable over time (Westenhoefer et al., 2013). “Flexible restraint” has been associated with individuals’ awareness of fat, energy, and sugar content, which can assist in weight management, compared to “rigid restraint”, which typically involves a body shape preoccupation (Westenhoefer et al., 2013). As such, given that our study included a community sample with a fairly low restrained eating mean score, it may be that adolescents engaged in more “flexible restraint”, which in turn contributed to increased positive feelings and cognitions about their bodies/ability to

sustain a desired weight and less depressive symptomatology over time. It is also important to note that several of the questions on the Restrained Eating Subscale of the DEBQ (van Strien et al., 1986), are closely related to general dieting, and could have been answered by adolescents in an adaptive dieting-context. For example, consuming higher quantities of fruits and vegetables, which may be considered “slimming foods” according to the DEBQ (van Strien et al., 1986), can similarly be viewed as a healthy means of weight control (Mostafavi-Darani, Daniali, & Azadbakht, 2013). As such, it is important to understand the context of adolescents’ “restrained eating”. It is equally important to be cognizant that restrained eating behaviours are a well-documented risk factor for future diagnosable eating disorders (Chamay-Weber et al., 2005) and should be monitored accordingly.

Analyses did not reveal any direct effects of separate recreational screen time activities at T0 on depressive symptomatology at T4. This is contrasted with cross-sectional findings, which identified positive relations between videogame engagement and recreational computer use and depressive symptomatology among adolescents (Maras et al., 2015), which may be explained by the lower base rates of the individual recreational screen time activities versus the total screen time activities. These findings are also contrasted with previous longitudinal research (Grøntved et al., 2015; Primack et al., 2009), which found an association between television viewing and depressive symptomatology over time. Given the direct effect of total daily recreational screen time on depressive symptomatology over time, our findings suggest that recreational screen time activities likely work in combination to predict depressive symptomatology during adolescence. However, our analyses revealed two indirect effects in the separate recreational screen time activity model. First, as was the case in the total recreational screen time model, recreational computer use at T0 significantly predicted emotional eating at T2. Although we did not examine the specific activities that adolescents engage in during recreational computer use, our findings suggest that adolescents may be using food to cope with negative affect that they experience during computer time. Studying factors that contribute to emotional eating is crucial

given that emotional eating places children and adolescents at risk for binge eating and obesity (Allen, Byrne, La Puma, McLean, & Davis, 2008). Also, as in the total recreational screen time model, we found a significant and negative association between restrained eating and depressive symptomatology, which warrants future investigation.

Lastly, although we did not identify any gender differences in our total daily recreational screen time model, when recreational screen time activities were examined individually (i.e., separate recreational screen time model), recreational computer use and videogame engagement interacted with gender to predict restrained eating. Specifically, for females, an association exists between increased recreational computer use at T0 and higher levels of restrained eating at T2. This finding is somewhat consistent with research including young adults in which excessive time on SNSs was related to increased restrained eating via less satisfaction with body image (Murray et al., 2016). For males in the present study, however, the reverse was true; increased recreational computer use at T0 was associated with decreased levels of restrained eating at T2. Though we cannot speak to the specific activities that adolescents engage in during their recreational computer use (e.g., online shopping, chatting, emailing, Internet gaming, using SNS), females have been found to use the computer to email and chat to a greater extent than their male peers (Leatherdale & Harvey, 2015). Females have also been found to use social media sites for self-comparison purposes and to obtain information, whereas males tend to use these sites to view others' profiles and search for friends (Haferkamp et al., 2012). Researchers have demonstrated that adolescent females also spend more time on SNSs (Lenhart, 2015), which is in line with the present study's finding that females spent significantly more time engaged in recreational computer use than males.

Consistent with previous research (Kovess-Masfety et al., 2016; Lenhart, 2015), males in the present study spent significantly more time playing videogames compared to females. Traditionally, the majority of research on videogames has investigated negative effects of engagement, namely

aggressive behaviours (see Anderson et al., 2010, for a review). In the present study, for both females and males, more videogame time was related to less restrained eating; however, this effect was more pronounced among males. These findings suggest that videogames may offer adolescents a means of coping that is associated with reduced restrained eating. Some research has found that casual videogame engagement includes a stress-reduction and relaxation component (Russoniello, O'Brien, & Parks, 2009). Limited research to date has typically associated higher levels of videogame engagement with less healthy eating behaviours, such as higher consumption of high-fat, sugar, and calorie food and beverages, among Canadian children (Tomlin et al., 2014). Similarly, Chaput et al. (2011) found that for adolescent males, one session of videogames was related to higher food consumption, despite their appetite sensations. Another explanation for our finding is that videogames release dopamine, and this increased sense of pleasure may lead to reduced desire to restrained eating. Other research has found that videogames act as a social outlet, in which individuals feel secure, close to others, and perceive that they belong (Kowert & Oldmeadow, 2015). Although videogames, like other recreational screen time activities, offer an avenue to view and compare oneself to virtual characters, the focus is primarily on strategy and less so on character due to the interactive nature of multiplayer games, which may be related to decreased restrained eating. It should also be noted that most adolescents in the final sample reported less daily time playing videogames (less than 1 hour per day), which lends support to the notion that those who exercise moderation in playing videogames have better self-regulation that results in less of a need to restrain eating for the purposes of weight loss. This finding is in line with results from a recent large-scale ($N > 3000$), cross-sectional European study including children, which demonstrated that increased videogame time (e.g., greater than 5 hours per week) was related to fewer mental health concerns and interpersonal problems as well as increased academic and intellectual functioning (Kovess-Masfety et al., 2016).

Limitations & Strengths

Findings from the present study contribute important information to a growing body of literature but are subjected to several limitations. First, most notably, any study that uses a convenience sample will have limited generalizability. As such, results from the present study cannot be deemed representative of the entire population of Canadian adolescents, although the demographics of the sample closely resemble that of the city (Flament et al., 2012). Second, the main variables of the present study were assessed using self-report measures, which are susceptible to issues of memory recall and social desirability. As well, the average number of hours that participants reported engaging in recreational screen time activities each day (i.e., 3-5 hours) is below that of what is reported in the literature (e.g., up to 8 hours; Leatherdale & Ahmed, 2011; Leatherdale & Harvey, 2015), but still above the recommended less than 2 hours of daily screen time (Leatherdale & Ahmed, 2011; Rideout et al., 2010; Roberts et al., 2017). This lower reported value could be due to the increase in popularity of recreational screen time activities in recent years or that adolescents may have underreported their total daily engagement in recreational screen time activities due to social desirability bias or because that it is hard to gauge. However, it is equally important to consider that we did not include questions to assess smartphone usage, which came into effect in 2008, which can be considered both an explanatory factor of reduced recreational screen time and a limitation to our study. Third, the variables that defined recreational screen time activities in the present study were limited to recreational computer use, videogame engagement, and television viewing. It is quite possible that other forms of recreational screen time activities, such as text messaging and smartphone apps, are related to the variables of interest. As well, the data do not provide information on the content that adolescents are viewing on televisions, computers, or in videogames, which would have provided additional information regarding how recreational screen time activities contribute to the development of depressive symptomatology over time. Finally, given the novelty of the research, we made an effort

to keep the model simple; however, measuring body image and eating behaviours at T0 would have provided valuable information.

Despite the considered caveats, the present study included well-validated questionnaires to assess mental health factors and employed a longitudinal sample and an advanced statistical procedure. The study is also timely and addresses important cognitive, behavioural, and emotional areas of adolescent mental health. The majority of research in this area has been cross-sectional in nature and has not examined potential mediational pathways. As such, limitations of the study are balanced with the methodological strengths, and theoretical and practical contributions.

Conclusion, Implications, & Future Direction

Given that associations between recreational screen time and mental health issues have been elucidated in the present study, it is clear that continued research in this area is crucial, especially as recreational screen time activities become increasingly ingrained in the daily lives of adolescents. Consistent with previous studies, the present study provides support for the role that recreational screen time activities play in adolescent mental health. In sum, the current body of research demonstrates an association between recreational screen time activities and increased risk for body image concerns, emotional eating, and depressive symptomatology over time. To our knowledge, no previous study has investigated a model incorporating appearance satisfaction, weight satisfaction, restrained eating, and emotional eating behaviours as mediating variables in the relationship between total daily recreational screen time and depressive symptomatology among adolescents over time. Also to our knowledge, this is the first known study to identify appearance (dis)satisfaction as a mediating variable between recreational screen time activities and depressive symptomatology over time, independent of age and depressive symptomatology at T0, among adolescents. The present study's findings support cognitive behavioural theory demonstrating that cognitions, behaviours, and emotions work together to place adolescents at risk for mental health concerns. This knowledge can translate to

practice by adults encouraging adolescents to use recreational screen time responsibly. For example, parents can include adolescents in conversation regarding setting realistic time limits on their recreational screen time use and ensuring that they understand the rationale for these time limits. Parents to involve their children in the planning of “screen-free” activities to promote in-person interaction. Efforts can be made to inform parents about modeling of adaptive recreational screen time use, and informing them about warning signs regarding maladaptive use of these technologies. Media literacy programs for adolescents should consider incorporating discussions and activities focused on strategies to teach adolescents to view media content with a critical eye, to buffer against negative effects of recreational screen time on their mental health. Moreover, the current study’s findings have implications for school policy whereby teachers can place limits on students from using the cell phones, and develop curriculum that educates students on the risks and benefits of various forms of media to promote more adaptive and less extreme use.

Given that total daily recreational computer use and videogame engagement was related to increased restrained eating among females, prospective research may also wish to examine specific computer activities and videogames that females engage in online and how this may mediate the relationship between recreational computer use and depressive symptomatology. More recent literature has highlighted that it is the specific activities (e.g., appearance comparison and exposure) that females, albeit adults, are engaging in on SNSs that are contributing to body image and eating concerns (Hummel & Smith, 2015; Meier & Gray, 2014; Smith et al., 2013). Future research would also benefit from further examining the role of recreational computer use and videogame engagement in relation to mental health benefits for male adolescents.

Although directionality of variables in the model can be discussed, causal conclusions cannot be drawn without an experimental design. Prospective research will require manipulations of adolescents’ exposure to recreational screen time activities to establish causal relationships. To

complement the present study's findings, forthcoming research may also focus on advanced statistical modelling, such as latent change scores (Selig & Preacher, 2009), to examine how changes in recreational screen time are related to changes in body image, disordered eating behaviours, and depressive symptomatology in adolescents, over time. Such a design would provide useful information in which associations of trajectories can be drawn. Future studies should examine the bidirectionality of the relationship such that depressive symptomatology mediate the relationship between total daily recreational screen time and disordered eating behaviours, or whether depressive symptomatology predict duration and type of recreational screen time. It is plausible that depressed adolescents spend more time indoors and spend more time on screens, possibly as a coping mechanism, and the increased screen exposure may exacerbate depressive symptoms, creating a vicious cycle.

Finally, given the limitations of the recreational screen time activities measure used in the present study, it is important for future researchers to consider implementing measures that capture more accurate and comprehensive recreational screen time data. For example, using an application that tracks adolescents' recreational screen time use could provide a more objective estimate. Also, including a qualitative component (i.e., focus groups, interviews, open-ended survey questions) could complement quantitative data by providing a better understanding of adolescents' use of recreational screen time activities, such as functional and interpersonal needs these digital technologies may meet, as well as adaptive and maladaptive behaviours that may be associated with adolescents' recreational screen time use.

References

- Allen, K. L., Byrne, S. M., La Puma, M., McLean, N., & Davis, E. A. (2008). The onset and course of binge eating in 8- to 13-year-old healthy weight, overweight and obese children. *Eating Behaviors*, 9, 438-446. doi:10.1016/j.eatbeh.2008.07.008
- Altenburger, E. M., Tung, E. S., & Keuthen, N. J. (2014). Body esteem in adolescent hair pullers. *Journal of Behavioral Addictions*, 3, 124-127. doi:10.1556/JBA.3.2014.010
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: American Psychiatric Association.
- Anderson, C. A., Shibuya, A., Ihori, N., Swing, E. L., Bushman, B. J., Sakamoto, A., ... Muniba, S. (2010). Violent video game effects on aggression, empathy, and prosocial behavior in eastern and western countries: A meta-analytic review. *Psychological Bulletin*, 136, 151-173. doi:10.1037/a0018251
- Añez, E., Fornieles-Deu, A., Fauquet-Ars, J., López-Guimerà, G., Puntí-Vidal, J. & Sánchez-Carracedo, D. (2018). Body image dissatisfaction, physical activity and screen-time in Spanish adolescents. *Journal of Health Psychology*, 23, 36-47. doi: 10.1177/1359105316664134
- Anton, S. D., Newton, R. L., Sothorn, M., Martin, C. K., Stewart, T. M., & Williamson, D. A. (2006). Association of depression with body mass index, sedentary behavior, and maladaptive eating attitudes and behaviors in 11 to 13-year old children. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 11, e102-e108. doi:10.1007/BF03327566
- Arbuckle, J. L. (2016). Amos (Version 24.0) [Computer software]. Chicago, IL: IBM SPSS.
- Auerbach, J. D., Lonner, B. S., Crerand, C. E., Shah, S. A., Flynn, J. M., Bastrom, T., ... Newton, P. O. (2014). Body image in patients with adolescent idiopathic scoliosis: Validation of the body image disturbance questionnaire-scoliosis version. *Journal of Bone and Joint Surgery*, 96, e61. doi:10.2106/JBJS.L.00867

Babic, M. J., Smith, J. J., Morgan, P. J., Eather, N., Plotnikoff, R.C., & Lubans, D. R. (2017).

Longitudinal associations between changes in screen-time and mental health outcomes in adolescents. *Mental Health and Physical Activity*, 12, 124-131.

Banasiak, S. J., Wertheim, E. H., Koerner, J., & Voudouris, N. J. (2001). Test-retest reliability and internal consistency of a variety of measures of dietary restraint and body concerns in a sample of adolescent girls. *International Journal of Eating Disorders*, 29, 85-89. doi:10.1002/1098-108X(200101)29:1<85::AID-EAT14>3.0.CO;2-G

Benson, L. P., Williams, R. J., & Novick, M. B. (2013). Pediatric obesity and depression: A cross-sectional analysis of absolute BMI as it relates to children's depression index scores in obese 7- to 17-year-old children. *Clinical Pediatrics*, 52, 24-29. doi:10.1177/0009922812459949

Bertha, E. A., & Balázs, J. (2013). Subthreshold depression in adolescence: A systematic review. *European Child & Adolescent Psychiatry*, 22, 589-603. doi:10.1007/s00787-013-0411-0

Blashill, A. J., & Wilhelm, S. (2014). Body image distortions, weight, and depression in adolescent boys: Longitudinal trajectories into adulthood. *Psychology of Men & Masculinity*, 15, 445- 451. doi:10.1037/a0034618

Bucchianeri, M. M., Arikian, A. J., Hannan, P. J., Eisenberg, M. E., & Neumark-Sztainer, D. (2013). Body dissatisfaction from adolescence to young adulthood: Findings from a 10-year longitudinal study. *Body Image*, 10, 1-7. doi:10.1016/j.bodyim.2012.09.001

Cao, H., Qian, Q., Weng, T., Yuan, C., Sun, Y., Wang, H., & Tao, F. (2011). Screen time, physical activity and mental health among urban adolescents in China. *Preventive Medicine*, 53, 316-320. doi:10.1016/j.ypmed.2011.09.002

Cattarin, J. A., Thompson, J. K., Thomas, C., & Williams, R. (2000). Body image, mood, and televised images of attractiveness: The role of social comparison. *Journal of Social and Clinical Psychology*, 19, 220-239.

- Chapman, C. D., Nilsson, V. C., Thune, H. Å., Cedernaes, J., Le Grevès, M., Hogenkamp, P. S., ... Schiöth, H. B. (2014). Watching TV and food intake: The role of content. *PLoS One*, 9, e100602. doi:10.1371/journal.pone.0100602
- Chaput, J. P., Visby, T., Nyby, S., Klingenberg, L., Gregersen, N.T., Tremblay, A., Astrup, A., Sjodin, A. (2011). Video game playing increases food intake in adolescents: a randomized crossover study. *The American Journal of Clinical Nutrition*, 93, 1196–1203. doi: 10.3945/ajcn.110.008680
- Chen, J. L., & Kennedy, C. (2005). Cultural variations in children's coping behaviour, TV viewing time, and family functioning. *International Nursing Review*, 52, 186-195.
- Chen, W., & Swalm, R. L. (1998). Chinese and American college students' body-image: Perceived body shape and body affect. *Perceptual and Motor Skills*, 87, 395-403. doi:10.2466/pms.1998.87.2.395
- Crowe, M., Ward, N., Dunnachie, B., & Roberts, M. (2006). Characteristics of adolescent depression. *International Journal of Mental Health Nursing*, 15, 10-18. doi:10.1111/j.1447-0349.2006.00399.x
- de Vries, D. A., Peter, J., de Graaf, H., & Nikken, P. (2016). Adolescents' social network site use, peer appearance-related feedback, and body dissatisfaction: Testing a mediation model. *Journal of Youth and Adolescence*, 45, 211-224. doi:10.1007/s10964-015-0266-4
- Duchesne, S. & Ratelle, C. F. (2014). Attachment security to mothers and fathers and developmental trajectories of depressive symptoms in adolescence: Which parent for which trajectory? *Journal of Youth and Adolescence*, 43, 641-654. doi:10.1007/s10964-013-0029-z
- Eisenmann, J.C., Milburn, N., Jacobsen, L., & Moore, S. (2002). Reliability and convergent validity of the Godin Leisure-Time Exercise Questionnaire in rural 5th-grade schoolchildren. *Journal of Human Movement Studies*, 43, 135-149.

- Enders, C. K. (2010). *Applied Missing Data Analysis*. New York, NY: Guilford Press.
- Eyal, K., & Te'eni-Harari, T. (2013). Explaining the relationship between media exposure and early adolescents' body image perceptions. *Journal of Media Psychology, 25*, 129-141.
doi:10.1027/1864-1105/a000094
- Faul, F., Erdfelder, E., Buchner, A., & Lang, A. G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods, 41*, 1149-1160.
- Flament, M. F., Hill, E. M., Buchholz, A., Henderson, K., Tasca, G. A., & Goldfield, G. (2012). Internalization of the thin and muscular body ideal and disordered eating in adolescence: The mediation effects of body esteem, *Body Image, 9*, 68-75. doi:10.1016/j.bodyim.2011.07.007
- Godin, G., & Shephard, R. J. (1985). A simple method to assess exercise behavior in the community. *Canadian Journal of Applied Sport Science, 10*, 141-146.
- Goldfield, G. S., Henderson, K., Buchholz, A., Obeid, N., Nguyen, H., & Flament, M. F. (2011). Physical activity and psychological adjustment in adolescents. *Journal of Physical Activity and Health, 8*, 157-163.
- Goldfield, G. S., Moore, C., Henderson, K., Buchholz, A., Obeid, N., & Flament, M. F. (2010). Body dissatisfaction, dietary restraint, depression, and weight status in adolescents. *The Journal of School Health, 80*, 186-192. doi:10.1111/j.1746-1561.2009.00485.x
- Goldfield, G. S., Murray, M. A., Maras, D., Wilson, A., Phillips, P., Kenny, G. P., ... Sigal, R. J. (2016). Screen time is associated with depressive symptomatology among obese adolescents: A HEARTY study. *European Journal of Pediatrics, 175*, 909-919. doi:10.1007/s00431-016-2720-z
- Gonzales, A. L., & Hancock, J. T. (2011). Mirror, mirror on my Facebook wall: Effects of exposure to Facebook on self-esteem. *Cyberpsychology, Behavior, and Social Networking, 14*, 79-83.
doi:10.1089/cyber.2009.0411

- Goossens, L., Braet, C., Van Vlierberghe, L., & Mels, S. (2009). Loss of control over eating in overweight youngsters: The role of anxiety, depression and emotional eating. *European Eating Disorders Review*, 17, 68-78. doi:10.1002/erv.892
- Grøntved, A., Singhammer, J., Froberg, K., Møller, N. C., Pan, A., Pfeiffer, K. A., & Kristensen, P. L. (2015). A prospective study of screen time in adolescence and depression symptoms in young adulthood. *Preventive Medicine*, 81, 108-113. doi:10.1016/j.ypmed.2015.08.009
- Gunnell, K. E., Flament, M. F., Buchholz, A., Henderson, K. A., Obeid, N., Schubert, N., & Goldfield, G. S. (2016). Examining the bidirectional relationship between physical activity, screen time, and symptoms of anxiety and depression over time during adolescence. *Preventive Medicine*, 88, 147-152. doi:10.1016/j.ypmed.2016.04.002
- Haferkamp, N., Eimler, S. C., Papadakis, A.-M., & Kruck, J. V. (2012). Men are from Mars, women are from Venus? Examining gender differences in self-presentation on social networking sites. *Cyberpsychology, Behavior, and Social Networking*, 15, 91-98. doi:10.1089/cyber.2011.0151
- Haferkamp, N., & Krämer, N. C. (2011). Social comparison 2.0: Examining the effects of online profiles on social-networking sites. *Cyberpsychology, Behavior, and Social Networking*, 14, 309-314. doi:10.1089/cyber.2010.0120
- Harrison, K., & Hefner, V. (2006). Media exposure, current and future body ideals, and disordered eating among preadolescent girls: A longitudinal panel study. *Journal of Youth and Adolescence*, 35, 153-163. doi:10.1007/s10964-005-9008-3
- Healey, G. N., Wijndaele K., Dunstan, D. W., Shaw, J. E., Salmon, J., Zimmet, P. Z., & Owen, N. (2008). Objectively measured sedentary time, physical activity, and metabolic risk: the Australian Diabetes, Obesity and Lifestyle Study. *Diabetes Care*, 31, 369-371.
- Herman, C. P., & Mack, D. (1975). Restrained and unrestrained eating. *Journal of Personality*, 43, 647-660. doi:10.1111/j.1467-6494.1975.tb00727.x

- Herman, C. P., & Polivy, J. (1980). Restrained eating. In A. J. Stunkard (Ed.), *Obesity* (pp. 208-225). Philadelphia, PA: Saunders.
- Hummel, A. C., & Smith, A. R. (2015). Ask and you shall receive: Desire and receipt of feedback via Facebook predicts disordered eating concerns. *International Journal of Eating Disorders*, 48, 436-442. doi:10.1002/eat.22336
- Jansen, A., Nederkoorn, C., Roefs, A., Bongers, P., Teugels, T., & Havermans, R. (2011). The proof of the pudding is in the eating: Is the DEBQ - external eating scale a valid measure of external eating? *International Journal of Eating Disorders*, 44, 164-168. doi:10.1002/eat.20799
- Jones, J. M., Bennett, S., Olmsted, M. P., Lawson, M. L., & Rodin, G. (2001). Disordered eating attitudes and behaviours in teenaged girls: A school-based study. *Canadian Medical Association Journal*, 165, 547-552.
- Jonsson, U., Bohman, H., von Knorring, L., Olsson, G., Paaren, A., & von Knorring, A.-L. (2011). Mental health outcome of long-term and episodic adolescent depression: 15-year follow-up of a community sample. *Journal of Affective Disorders*, 130, 395-404. doi:10.1016/j.jad.2010.10.046
- Katon, W., Richardson, L., Russo, J., McCarty, C. A., Rockhill, C., McCauley, E., ... Grossman, D. C. (2010). Depressive symptoms in adolescence: The association with multiple health risk behaviors. *General Hospital Psychiatry*, 32, 233-239. doi:10.1016/j.genhosppsy.2010.01.008
- Khouja, J., Munafò, M., Tilling, K., Wiles, N., Joinson, C., Etchells, P., ... Cornish, R. (2017). Is increased screen time associated with the development of anxiety or depression in young people? *European Psychiatry*, 41, S530-S531. doi:10.1016/j.eurpsy.2017.01.719
- Kiefl, B. (2011). *Trends in TV and Internet use: The impact of Internet TV on Canadian programming*. Retrieved from http://www.omdc.on.ca/Assets/Research/Research+Reports/Trends+in+TV+and+Internet+Use/Trends+in+TV+and+Internet+Use_en.pdf

- Kim, J.-H., & Lennon, S. J. (2007). Mass media and self-esteem, body image, and eating disorder tendencies. *Clothing and Textiles Research Journal*, 25, 3-23. doi:10.1177/0887302X06296873
- Klein, D. N., Shankman, S. A., Lewinsohn, P. M., & Seeley, J. R. (2009). Subthreshold depressive disorder in adolescents: Predictors of escalation to full-syndrome depressive disorders. *Journal of the American Academy of Child & Adolescent Psychiatry*, 48, 703-710. doi:10.1097/CHI.0b013e3181a56606
- Kovacs, M. (1985). The Child Depression Inventory (CDI). *Psychopharmacology Bulletin*, 21, 995-998.
- Kovacs, M. (1992). *The Children's Depression Inventory (CDI) Manual*. New York, NY: Multi-Health Systems.
- Kovess-Masfety, V., Keyes, K., Hamilton, A., Hanson, G., Bitfoi, A., Golitz, D., ... Pez, O. (2016). Is time spent playing video games associated with mental health, cognitive and social skills in young children? *Social Psychiatry and Psychiatric Epidemiology*, 51, 349-357. doi:10.1007/s00127-016-1179-6
- Kowert, R., & Oldmeadow, J. A. (2015). Playing for social comfort: Online video game play as a social accommodator for the insecurely attached. *Computers in Human Behavior*, 53, 556-566. doi:10.1016/j.chb.2014.05.004
- Kraut, R., Patterson, M., Lundmark, V., Kiesler, S., Mukopadhyay, T., & Scherlis, W. (1998). Internet paradox: A social media that reduces social involvement and psychological well-being? *American Psychologist*, 53, 1017-1031. doi:10.1037/0003-066X.53.9.1017
- Lazarevich, I., Irigoyen Camacho, M. E., Velázquez-Alva, M. D. C., & Zepeda Zepeda, M. (2016). Relationship among obesity, depression, and emotional eating in young adults. *Appetite*, 107, 639-644. doi:10.1016/j.appet.2016.09.011

- Leatherdale, S. T., & Ahmed, R. (2011). Screen-based sedentary behaviours among a nationally representative sample of youth: Are Canadian kids couch potatoes? *Chronic Diseases and Injuries in Canada*, 31, 141-146.
- Leatherdale, S. T., & Harvey, A. (2015). Examining communication- and media-based recreational sedentary behaviors among Canadian youth: Results from the COMPASS study. *Preventive Medicine*, 74, 74-80. doi:10.1016/j.ypmed.2015.02.005
- Lenhart, A. (2015, April 9). Teens, Social Media & Technology Overview 2015. *Pew Research Center*. Retrieved from <http://www.pewinternet.org/2015/04/09/teens-social-media-technology-2015/>
- Maras, D., Flament, M. F., Murray, M., Buchholz, A., Henderson, K. A., Obeid, N., & Goldfield, G. S. (2015). Screen time is associated with depression and anxiety in Canadian youth. *Preventive Medicine*, 73, 133-138. doi:10.1016/j.ypmed.2015.01.029
- Matthey, S., & Petrovski, P. (2002). The Children's Depression Inventory: Error in cutoff scores for screening purposes. *Psychological Assessment*, 14, 146-149. doi:10.1037/1040-3590.14.2.146
- McCarthy, M. (1990). The thin ideal, depression and eating disorders in women. *Behaviour Research and Therapy*, 28, 205-215. doi:10.1016/0005-7967(90)90003-2
- McVey, G., Tweed, S., & Blackmore, E. (2005). Correlates of weight loss and muscle-gaining behavior in 10- to 14-year-old males and females. *Preventive Medicine*, 40, 1-9. doi:10.1016/j.ypmed.2004.04.043
- Meier, E. P., & Gray, J. (2014). Facebook photo activity associated with body image disturbance in adolescent girls. *Cyberpsychology, Behavior, and Social Networking*, 17, 199-206. doi:10.1089/cyber.2013.0305
- Mendelson, B. K., Mendelson, M. J., & White, D. R. (2001). Body-esteem scale for adolescents and adults. *Journal of Personality Assessment*, 76, 90-106. doi:10.1207/S15327752JPA7601_6

- Messias, E., Castro, J., Saini, A., Usman, M., & Peeples, D. (2011). Sadness, suicide, and their association with video game and Internet overuse among teens: Results from the Youth Risk Behavior Survey 2007 and 2009. *Suicide and Life-Threatening Behavior*, *41*, 307-315. doi:10.1111/j.1943-278X.2011.00030.x
- Mojtabai, R., Olfson, M., & Han, B. (2016). National trends in the prevalence and treatment of depression in adolescents and young adults. *Pediatrics*, *138*, 1-10. doi:10.1542/peds.2016-1878
- Moriarty, C. M., & Harrison, K. (2008). Television exposure and disordered eating among children: A longitudinal panel study. *Journal of Communication*, *58*, 361-381. doi:10.1111/j.1460-2466.2008.00389.x
- Mostafavi-Darani, F., Daniali, S. S., & Azadbakht, L. (2013). Relationship of Body Satisfaction, with Nutrition and Weight Control Behaviors in Women. *International Journal of Preventive Medicine*, *4*, 467-474.
- Murray, M., Maras, D., & Goldfield, G. S. (2016). Excessive time on social networking sites and disordered eating behaviors among undergraduate students: Appearance and weight esteem as mediating pathways. *Cyberpsychology, Behavior, and Social Networking*, *19*, 709-715. doi:10.1089/cyber.2016.0384
- Nakamura, H., Ohara, K., Kouda, K., Fujita, Y., Mase, T., Miyawaki, C., ... Ishikawa, T. (2012). Combined influence of media use on subjective health in elementary school children in Japan: A population-based study. *BMC Public Health*, *12*, 432. doi:10.1186/1471-2458-12-432
- National Eating Disorders Association. (2011). General eating disorders information. Retrieved from <http://www.nationaleatingdisorders.org>
- Neira, C. J. B., & Barber, B. L. (2014). Social networking site use: Linked to adolescents' social self-concept, self-esteem, and depressed mood. *Australian Journal of Psychology*, *66*, 56-64. doi:10.1111/ajpy.12034

- Neumark-Sztainer, D., Goeden, C., Story, M., & Wall, M. (2004). Associations between body satisfaction and physical activity in adolescents: Implications for programs aimed at preventing a broad spectrum of weight-related disorders. *Eating Disorders, 12*, 125-137.
doi:10.1080/10640260490444989
- Nguyen-Michel, S. T., Unger, J. B., & Spruijt-Metz, D. (2007). Dietary correlates of emotional eating in adolescence. *Appetite, 49*, 494-499. doi:10.1016/j.appet.2007.03.005
- Nguyen-Rodriguez, S. T., Unger, J. B., & Spruijt-Metz, D. (2009). Psychological determinants of emotional eating in adolescence. *Eating Disorders, 17*, 211-224.
doi:10.1080/10640260902848543
- Norwood, S. J., Bowker, A., Buchholz, A., Henderson, K. A., Goldfield, G., & Flament, M. F. (2011). Self-silencing and anger regulation as predictors of disordered eating among adolescent females. *Eating Behaviors, 12*, 112-118. doi:10.1016/j.eatbeh.2011.01.009
- Norwood, S. J., Murray, M., Nolan, A., & Bowker, A. (2011). Beautiful from the inside out: A school-based programme designed to increase self-esteem and positive body image among preadolescents. *Canadian Journal of School Psychology, 26*, 263-282.
doi:10.1177/0829573511423632
- O'Keeffe, G. S., & Clarke-Pearson, K. (2011). The impact of social media on children, adolescents, and families. *Pediatrics, 127*, 800-804. doi:0.1542/peds.2011-0054
- Ouwens, M. A., van Strien, T., & van Leeuwe, J. F. J. (2009). Possible pathways between depression, emotional and external eating. A structural equation model. *Appetite, 53*, 245-248.
doi:10.1016/j.appet.2009.06.001
- Pantic, I., Damjanovic, A., Todorovic, J., Topalovic, D., Bojovic-Jovic, D., Ristic, S., & Pantic, S. (2012). Association between online social networking and depression in high school students: Behavioral physiology viewpoint. *Psychiatria Danubina, 24*, 90-93.

- Patton, G. C., Johnson-Sabine, E., Wood, K., Mann, A. H., & Wakeling, A. (1990). Abnormal eating attitudes in London schoolgirls – a prospective epidemiological study: Outcome at twelve month follow-up. *Psychological Medicine*, 20, 383-394. doi:10.1017/S0033291700017700
- Polivy, J., & Herman, C. P. (1985). Dieting and bingeing: A causal analysis. *American Psychologist*, 40, 193-201. doi:10.1037/0003-066X.40.2.193
- Pollice, C., Kaye, W. H., Greeno, C. G., & Weltzin, T. E. (1997). Relationship of depression, anxiety, and obsessionality to state of illness in anorexia nervosa. *International Journal of Eating Disorders*, 21, 367-376. doi:10.1002/(SICI)1098-108X(1997)21:4<367::AID-EAT10>3.0.CO;2-W
- Primack, B. A., Swanier, B., Georgiopoulos, A. M., Land, S. R., & Fine, M. J. (2009). Association between media use in adolescence and depression in young adulthood: A longitudinal study. *Archives of General Psychiatry*, 66, 181-188. doi:10.1001/archgenpsychiatry.2008.532
- Rideout, V. J., Foehr, U. G., & Roberts, D. F. (2010, January 1). Generation M2: Media in the lives of 8- to 18-year-olds. *Kaiser Family Foundation*. Retrieved from <http://www.kff.org/entmedia/upload/8010.pdf>
- Roberts, K. C., Yao, X., Carson, V., Chaput, J. P., Janssen, I., & Tremblay, M. S. (2017). Meeting the Canadian 24-hour movement guidelines for children and youth. *Health Reports*, 18, 3-7.
- Rubin, D. B. (1987). *Multiple imputation for nonresponse in surveys*. New York, NY: John Wiley & Sons. doi:10.1002/9780470316696
- Russoniello, C. V., O'Brien, K., & Parks, J. M. (2009). The effectiveness of casual video games in improving mood and decreasing stress. *Journal of Cyber Therapy and Rehabilitation*, 2, 53-66.
- Sagioglou, C., & Greitemeyer, T. (2014). Facebook's emotional consequences: Why Facebook causes a decrease in mood and why people still use it. *Computers in Human Behavior*, 35, 359-363. doi:10.1016/j.chb.2014.03.003

- Sampasa-Kanyinga, H., & Lewis, R. F. (2015). Frequent use of social networking sites is associated with poor psychological functioning among children and adolescents. *Cyberpsychology, Behavior, and Social Networking*, 18, 380-385. doi:10.1089/cyber.2015.0055
- Selig, J. P., & Preacher, K. J. (2009). Mediation models for longitudinal data in developmental research. *Research in Human Development*, 6, 144-164. doi:10.1080/15427600902911247
- Smith, A. R., Hames, J. L., & Joiner, T. E., Jr. (2013). Status update: Maladaptive Facebook usage predicts increases in body dissatisfaction and bulimic symptoms. *Journal of Affective Disorders*, 149, 235-240. doi:10.1016/j.jad.2013.01.032
- Steeves, V. (2014). Young Canadians in a wired world, phase III: Life online. *MediaSmarts*. Retrieved from <http://mediasmarts.ca/ycww/life-online>
- Stice, E., Hayward, C., Cameron, R. P., Killen, J. D., & Taylor, C. B. (2000). Body-image and eating disturbances predict onset of depression among female adolescents: A longitudinal study. *Journal of Abnormal Psychology*, 109, 438-444. doi:10.1037/0021-843X.109.3.438
- Striegel-Moore, R. H., & Bulik, C. M. (2007). Risk factors for eating disorders. *American Psychologist*, 62, 181-198. doi:10.1037/0003-066X.62.3.181
- Suchert, V., Hanewinkel, R., & Isensee, B. (2015). Sedentary behavior and indicators of mental health in school-aged children and adolescents: A systematic review. *Preventive Medicine*, 76, 48-57. doi:10.1016/j.ypmed.2015.03.026
- Sylvia, Z., King, T. K., & Morse, B. J. (2014). Virtual ideals: The effect of video game play on male body image. *Computers in Human Behavior*, 37, 183-188. doi:10.1016/j.chb.2014.04.029
- Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics* (6th ed.). Boston, MA: Pearson.
- Thompson, J. K., Heinberg, L. J., Altabe, M., & Tantleff-Dunn, S. (1999). *Exacting beauty: Theory, assessment, and treatment of body image disturbance*. Washington, DC: American Psychological Association.

- Tiggemann, M., & Miller, J. (2010). The Internet and adolescent girls' weight satisfaction and drive for thinness. *Sex Roles*, 63, 79-90. doi:10.1007/s11199-010-9789-z
- Timbremont, B., Braet, C., & Dreessen, L. (2004). Assessing depression in youth: Relation between the Children's Depression Inventory and a structured interview. *Journal of Clinical Child and Adolescent Psychology*, 33, 149-157. doi:10.1207/S15374424JCCP3301_14
- Tomlin, D., McKay, H. A., Forster, M., Rhodes, R. E., Rose, H., Higgins, J. W., & Naylor, P.-J. (2014). Exploring the relationship between diet and TV, computer and video game use in a group of Canadian children. *International Journal of Child Health and Nutrition*, 3, 195-203. doi:10.6000/1929-4247.2014.03.04.6
- Torstveit, M. K., Agedal-Mortensen, K., & Stea, T. H. (2015). More than half of high school students report disordered eating: A cross sectional study among Norwegian boys and girls. *PLoS One*, 10, e0122681. doi:10.1371/journal.pone.0122681
- U.S. National Library of Medicine. (2015). Screen Time and Children. Retrieved from <https://medlineplus.gov/ency/patientinstructions/000355.htm>
- van Strien, T., Frijters, J. E. R., Bergers, G. P. A., & Defares, P. B. (1986). The Dutch eating Behavior Questionnaire (DEBQ) for assessment of restrained, emotional, and external eating behavior. *International Journal of Eating Disorders*, 5, 295-315. doi:10.1002/1098-108X(198602)5:2<295::AID-EAT2260050209>3.0.CO;2-T
- Wardle, J. (1987). Eating style: A validation study of the Dutch Eating Behaviour Questionnaire in normal subjects and women with eating disorders. *Journal of Psychosomatic Research*, 31, 161-169. doi:10.1016/0022-3999(87)90072-9
- Westenhoefer, J., Engel, D., Holst, C., Lorenz, J., Peacock, M., Stubbs, J.,...Raats, M. (2013). Cognitive and weight-related correlates of flexible and rigid restrained eating behaviour. *Eating Behaviors*, 14, 69-72.

You, S., Shin, K., & Kim, A. Y. (2017). Body image, self-esteem, and depression in Korean adolescents. *Child Indicators Research*, 10, 231-245. doi:10.1007/s12187-016-9385-z

Study 2

A Longitudinal Investigation in the Relationship Between Total Daily Recreational Screen Time and Depressive Symptomatology Among Adolescents: The Moderating Role of Interpersonal Factors and

Gender

Marisa A. Murray¹, Nicole Obeid², Katherine Henderson³, Annick Buchholz⁴, Martine
Flament⁵, & Gary S. Goldfield^{1,6}

¹School of Psychology, University of Ottawa

²Eating Disorder Program, Children's Hospital of Eastern Ontario

³Anchor Psychological Services

⁴Centre for Healthy Active Living, Children's Hospital of Eastern Ontario

⁵University of Ottawa Institute of Mental Health Research

⁶Healthy Active Living & Obesity Research Group, Children's Hospital of Eastern Ontario
Research Institute

Keywords: screen time; depression; adolescents; attachment style; coping style; social support

Abstract

The purpose of the study was to examine the moderating role of interpersonal factors (i.e., attachment style, coping style, and perceived social support) in the relationship between total daily recreational screen time and depressive symptomatology among adolescents over time. The final sample included 170 adolescents (106 females) from a larger research study, the Research on Eating and Adolescent Lifestyle (REAL) Study. The mean age was 13.01 years ($SD = 0.96$) for females and 12.67 years ($SD = 0.64$) for males. We analyzed data from questionnaires related to total daily recreational screen time (*Leisure-Time Sedentary Activities Scale*), depressive symptomatology (*Children's Depression Inventory*), attachment style (*Adolescent Relationship Questionnaire*), coping style (*Coping Inventory for Stressful Situation*), perceived social support (*McKnight Risk Factor Survey-IV*), physical activity level (*Godin Leisure Time Exercise Questionnaire*), and sociodemographic information. Results from a regression analysis indicated that total daily recreational screen time at T0 predicted depressive symptomatology at T4. Contrary to our expectations, results from hierarchical linear multiple regressions indicated that attachment style, coping style, and perceived social support at baseline (T0) did not moderate the relationship between total daily recreational screen time at T0 and depressive symptomatology at Time 4 (T4). A significant three-way interaction emerged between total daily recreational screen time, perceived social support, and gender ($B = 2.29, p = .04$) to predict depressive symptomatology at T4. When participants reported receiving high levels of perceived social support, higher total daily recreational screen time at T0 was associated with higher levels of depressive symptomatology at T4, and this relationship was stronger for males. A significant two-way interaction also emerged between gender and attachment style. Insecure attachment style at T0 was a risk factor for depressive symptomatology at T4 for males. All results were independent of depressive symptomatology at T0. The interactions that emerged highlight the importance of considering gender differences for program development and implementation.

Introduction

Adolescent depression is an increasingly prevalent issue (Mojtabai, Olfson, & Han, 2016; Thapar, Collishaw, Pine, & Thapar, 2012). There has been an upward trend in the number of adolescents who meet criteria for clinical depression (Mojtabai et al., 2016) and adolescents who exhibit moderate to high subthreshold symptomatology (more than 30%; Kremer et al., 2014). From 2005 to 2014, adolescent clinical depression rates increased from 8.7% to 11.3% (Mojtabai et al., 2016). Trajectories of depressive symptomatology typically increase during adolescence (Duchesne & Ratelle, 2014), and females are two times likely than males to experience depression (Taylor, 2011). Adolescent depression often manifests in the form of decreased school performance (Fröjd et al., 2008), substance use (Clark, Ringwalt, & Shamblen, 2011), and interpersonal difficulties (Prinstein, Borelli, Cheah, Simon, & Aikins, 2005). Adolescent depression also increases the risk of developing depression in the adulthood (Jonsson et al., 2011).

Canadian children and adolescents spend up to an average of 8 hours per day in front of electronic screen devices (Leatherdale & Ahmed, 2011; Leatherdale & Harvey, 2015), which well exceeds the less than 2-hour daily screen time recommendation (Roberts et al., 2017). Recent longitudinal Australian research has identified a negative relationship between increases in recreational screen time and has stressed the need for future longitudinal research to identify causal relationships between recreational screen time and mental health (Babic et al., 2017). A growing body of cross-sectional (Benson, Williams, & Novick, 2013; Maras et al., 2015; Messias, Castro, Saini, Usman, & Peeples, 2011) and longitudinal (Babic et al., 2017; Grøntved et al., 2015; Primack, Swanier, Georgiopoulos, Land, & Fine, 2009) research has identified a link between higher levels of total daily screen time (e.g., recreational computer use, television viewing, and videogame engagement) and depression among adolescents. However, underlying variables that may influence this relationship remain unstudied.

Attachment Style & Depression

General attachment style refers to the nature of parent-infant bonds, which are highly influential in the development of an attachment style adopted in future relationships (Ainsworth & Bowlby, 1991). A secure attachment develops when the main caregiver attends to the child's needs in a timely and consistent manner (Bowlby, 1988). If the primary caregiver provides inconsistent responses or rejects the child's needs, this will foster insecure attachment styles (Hazan & Shaver, 1987). Early attachment styles are found to be quite stable during adolescence (Cook, Heinze, Miller, & Zimmerman, 2016) and the life course and play a pivotal role in initiating, forming, and maintaining social relations with others (Fraley & Shaver, 2000). Attachment style has consistently been implicated in the depression literature. According to cross-sectional research, lower levels of attachment were related to increased levels of emotional and behavioural problems (Keskin & Çam, 2010) and depression among adolescents (Brumariu & Kerns, 2010). Longitudinal studies have also identified insecure attachment style as a risk factor for clinical depression (Eberhart & Hammen, 2006) and subclinical depression (Sund & Wichstrøm, 2002). Conversely, a secure attachment style during adolescence has been associated with decreased risk of developing future internalizing disorders (Jakobsen, Horwood, & Fergusson, 2012). Gender differences have also been elucidated. That is, females have shown stronger attachment bonds with their peers compared to males (Gullone & Robinson, 2005; Raja, McGee, & Stanton, 1992), and female adolescents who perceived their parents to be low in warmth reported more internalizing issues and depressive symptomatology as they aged (Scaramella, Conger, & Simons, 1999). Insecure attachment style may work with other factors to predict depression, highlighting the importance of examining interdependent risk factors that could lead to mental health issues (see Brumariu & Kerns, 2010, for a review).

Recreational Screen Time & Attachment

Relationships between recreational screen time activities and attachment have been identified in adolescent samples. Attachment style has been found to manifest similarly in offline and online behaviour. For example, Yaakobi and Goldenberg (2014) found that securely attached individuals reported using social networking sites (SNSs) as social hubs, whereas avoidantly attached individuals were least likely to use SNSs as social hubs. Anxiously attached individuals used SNSs to develop their relationships. Richards, McGee, Williams, Welch, and Hancox's (2010) cross-sectional study found that each additional hour that adolescents spent watching television demonstrated a 13% and 24% inflation in risk for low parental and peer attachment, respectively. Moreover, increased time spent engaged in recreational computer use was negatively related to parental attachment, and increased time engrossed in videogame engagement was related to decreased attachment with peers. Furthermore, recreational computer use demonstrated a 5% inflation in risk for low parental attachment (Richards et al., 2010).

Coping Style, Depression, & Recreational Screen Time

Adolescence is a particularly stressful developmental stage due to the many biological and social changes that occur (e.g., parental conflict, mood dysregulation, and risky behaviour; Arnett, 1999), with more than 70% of adolescents reporting that they have felt stressed during the previous month (Debnam, Milam, Furr-Holden, & Bradshaw, 2016). Accordingly, adolescence is also considered a period that involves the development of coping styles, which can be adaptive or maladaptive in nature (Debnam et al., 2016). Coping is defined as the ability to apply cognitive and behavioural strategies to manage stress (Folkman, Lazarus, Gruen, & DeLongis, 1986). Problem-oriented coping, which is used interchangeably with task-oriented coping, is considered an adaptive means of coping, whereby individuals explore options to solve a problem, consider the risks and benefits of the options, and carry out appropriate steps to solve the problem. Conversely, maladaptive

coping styles include emotion-oriented (e.g., attempts to manage emotional distress caused by the situation or stressor, which can include venting (Lazarus & Folkman, 1984), and avoidance-oriented coping (e.g., efforts to dismiss thoughts related to the problem/engage in distractive behaviours; Endler & Parker, 1990a).

Problem-oriented and emotion-oriented coping have been positively and negatively related to physical and psychological health, respectively (Penley, Tomaka, & Wiebe, 2002). Longitudinal research has found that children and adolescents who used avoidance-oriented coping report the greatest depressive symptomatology, whereas those who used an adaptive coping style (e.g., approach-oriented coping) report the least depressive symptomatology. Similarly, those who modified their coping style from approach-oriented to avoidance-oriented over a one-year period experienced significantly more depressive symptomatology, whereas those who modified their coping style from avoidance-oriented to approach-oriented over one-year experienced significantly less depressive symptomatology (Herman-Stahl, Stemmler, & Petersen, 1995). It is important to examine how adolescents cope with perceived stressors given that psychological stress during adolescence is a pivotal risk factor for internalizing and externalizing problems (Anyan, & Hjemdal, 2016).

With respect to gender, there is longstanding evidence that females are more likely to use emotion-oriented coping and avoidance-oriented coping (Billings & Moos, 1984; Matud, 2004; Piko, 2001; Ptacek, Smith, & Dodge, 1994). Conversely, males have been found to use problem-oriented coping more frequently than females (Billings & Moos, 1984; Ptacek et al., 1992). However, some research has found that male adolescents use distraction techniques to a greater extent than females (Camara et al., 2017). Compas, Orosan, and Grant (1993) explain that males use techniques to distract their emotions, which could buffer against interpersonal stress. Also inconsistent with the findings above, Ongen (2006) found that among adolescents, although females and males used more task-oriented and avoidance-oriented coping, respectively, females reported higher levels of depressive

symptomatology compared to their male counterparts.

Though limited, there is an identified link between excessive Internet use and avoidance-oriented coping style (Beutel et al., 2011). Undergraduate students who were classified as having an Internet addiction reported using more avoidance-oriented coping, which suggests that these individuals showed a preference to escape real-life problems instead of actively confronting them (Cheng, Sun, & Mak, 2015). Maladaptive coping during adolescence has also been associated with depression (Rafnsson, Jonsson, & Windle, 2006; Seiffge-Krenke & Klessinger, 2000).

Perceived Social Support, Depression, & Recreational Screen Time

Perceived social support (e.g., a sense that one can rely on others for help; Albrecht & Goldsmith, 2003) becomes progressively important as children move from childhood to adolescence (Furman & Buhrmester, 1992; Pendley et al., 2002). Social support contributes positively to an individual's mental health by decreasing feelings of loneliness (Eldeleklioglu, 2008), depression (Jensen et al., 2014; Weber, Puskar, & Ren, 2010), as well as increasing the prognosis of depressive recovery (Parker, Holmes, & Manicavasagar, 1986). A lack of social support is considered a major stressor (Paykel, 2003), and although peers are highly influential during adolescence, low levels of perceived social support from parents has been related to higher depressive symptomatology among adolescents (Stice, Ragan, & Randall, 2004). Declines in peer and parental support from eighth to ninth grade have been associated with increased depressive symptomatology (Newman, Newman, Griffen, O'Connor, & Spas, 2007).

Female adolescents report higher levels of perceived social support, compared to males (Baldwin, Brown, Wayment, Nez, & Brelsford, 2011), especially emotional support from friends (Desjardins & Leadbeater, 2011). Findings have also revealed that female adolescents develop more close-knit social ties compared to their male peers (Bank & Hansford, 2000; Zarbatany, Conley, & Pepper, 2004). Accordingly, females are more inclined to rely on others for comfort. By contrast,

adolescent males have been found to use distraction techniques, Camara et al., 2017). However, Piko (2001) found that when male adolescents do reach out for social support, they benefit from this support to a greater extent than females (Piko, 2001).

Research in relation to perceived social support and recreational screen time appears to be mixed. There is research that suggests that the Internet can significantly increase perceived social support (Frison & Eggermont, 2015; Shaw & Gant, 2002). However, the displacement hypothesis (Kraut et al., 1998), which postulates that sedentary screen time activities limit or prevent engagement in more active or meaningful tasks, lends support to recreational screen time hindering the quality of relationships. Given that sedentary behaviours are associated with social isolation (O’Keeffe & Clarke-Pearson, 2011; Primack et al., 2017), and accompanied negative thoughts and feelings (e.g., loneliness) are potential consequences of increased recreational screen time, over time, these potential consequences could manifest in depressive symptomatology, given the strong relationship between social isolation and depression (Hawthorne, 2008; Matthews et al., 2016).

The Present Study

In sum, despite the pivotal role that interpersonal factors play during adolescence, it appears that researchers have not elucidated their function in the relationship between total daily recreational screen time activities and depressive symptomatology among adolescents. However, given the increasingly high depression rates in adolescent populations (Kremer et al., 2014; Mojtabai et al., 2016), it is important to identify factors that increase adolescents’ risk for depression. Accordingly, daily recreational screen time was chosen as the independent variable in the present study due to its popularity among adolescents and its known relationship with depressive symptomatology. Attachment style, coping style, and perceived social support were chosen as moderating variables because, depending on the type or level, they can act as risk or protective factors for psychopathology. The purpose of the present study was to examine whether total daily recreational screen time interacts

with attachment style, coping style, and perceived social support to increase or buffer an adolescent's risk for depressive symptomatology over time.

First, we expected that insecure attachment at baseline (T0) would strengthen, while secure attachment at T0 would weaken, the relationship between total daily recreational screen time at T0 and depressive symptomatology at Time 4 (T4; see Figure 1). Second, we expected that the maladaptive coping styles (i.e., emotion-oriented and avoidance-oriented coping) at T0 would strengthen, while adaptive coping (e.g., task-oriented coping) at T0 would weaken, the relationship between total daily recreational screen time at T0 and depressive symptomatology at T4 (see Figure 2). Third, we expected that lower levels of perceived social support at T0 would strengthen, while higher levels of perceived social support at T0 would weaken, the relationship between total daily recreational screen time at T0 and depressive symptomatology at T4 (see Figure 3). In each model (i.e., attachment model, coping models, and perceived social support model), we controlled for depression at T0 and examined gender differences. We expected that females would report higher levels of perceived social support compared to males, which may influence (i.e., weaken) the relationship between total daily recreational screen time at T0 and depressive symptomatology at T4. Given the differences in findings in the attachment and coping literature, gender differences in attachment style, coping style, total daily recreational screen time, and depressive symptomatology were exploratory in nature.

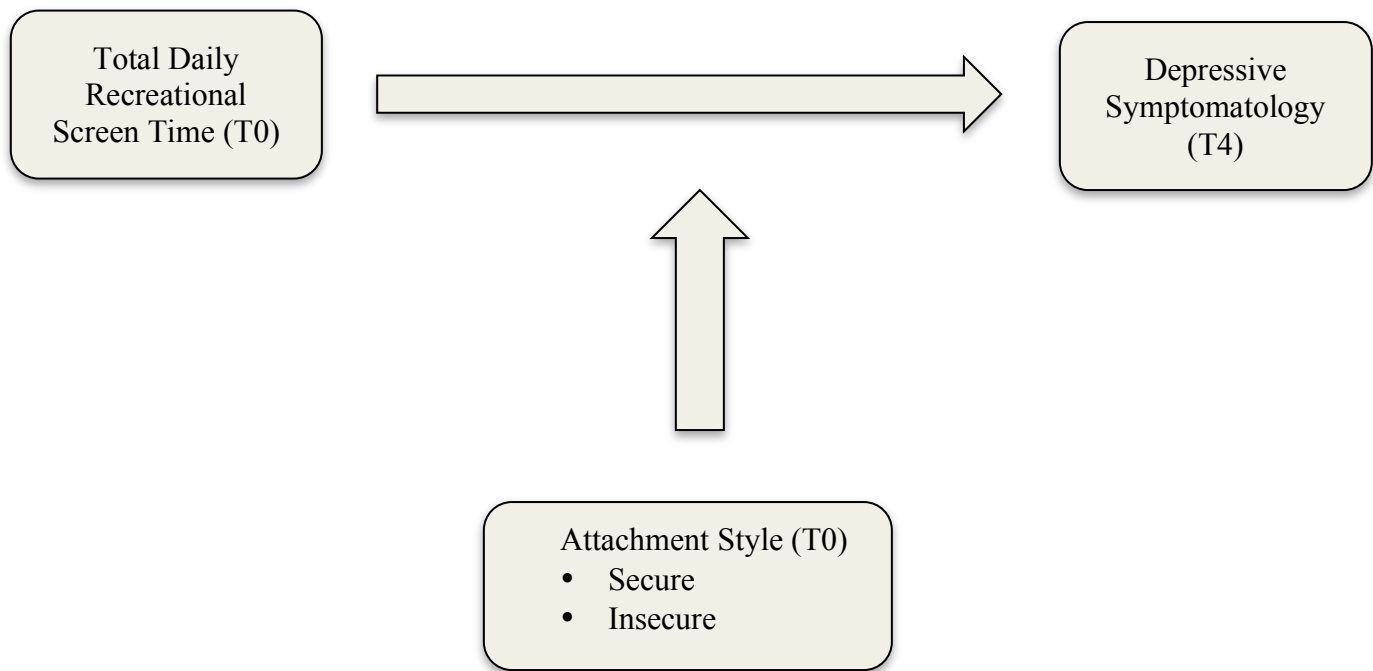


Figure 1. The relationship between total daily recreational screen time at T0 and depressive symptomatology at T4, moderated by attachment style at T0.

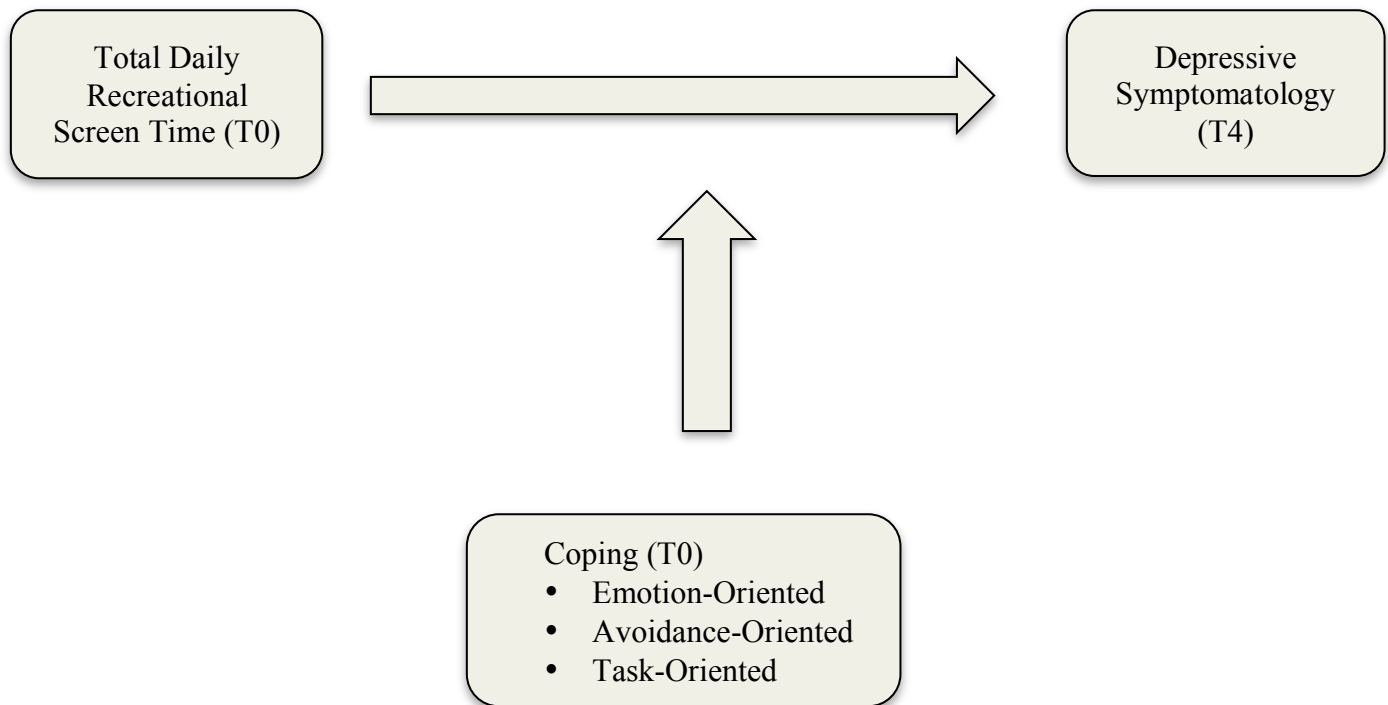


Figure 2. The relationship between total daily recreational screen time at T0 and depressive symptomatology at T4, moderated by coping style at T0.

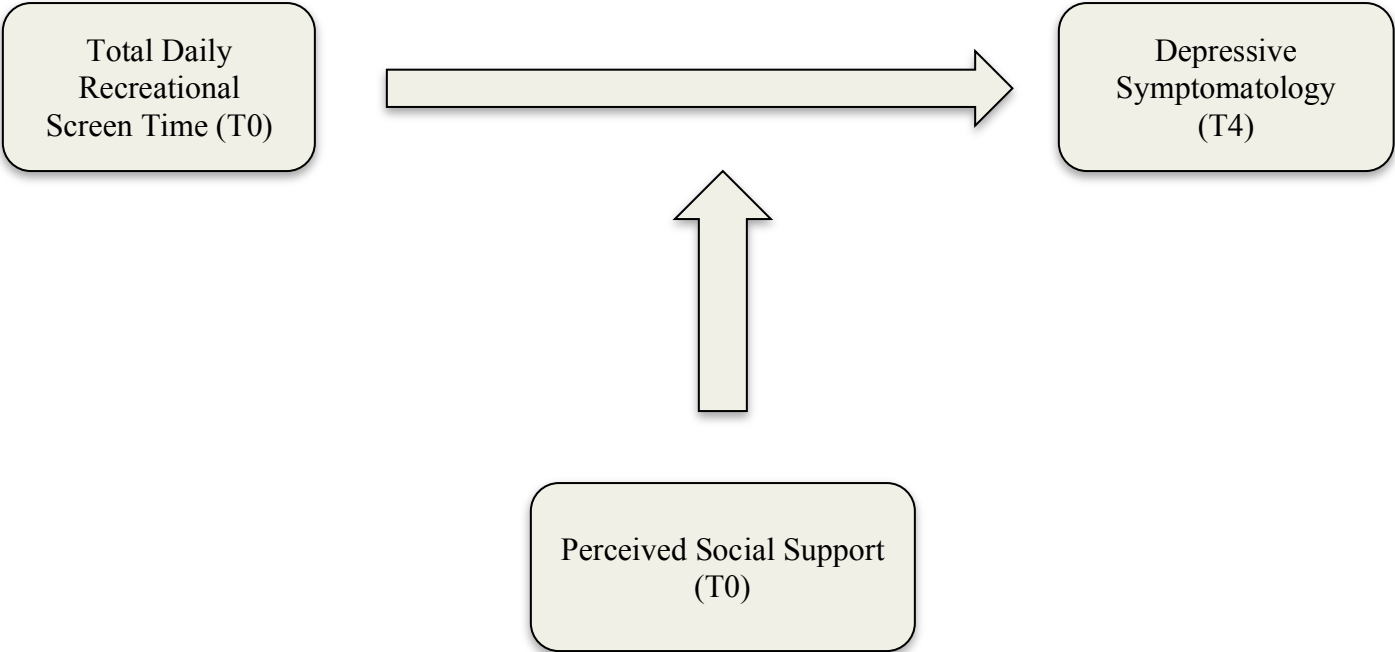


Figure 3. The relationship between total daily recreational screen time at T0 and depressive symptomatology at T4, moderated by perceived social support at T0.

Method

The present study included data from a large community-based study, the Research on Eating and Adolescent Lifestyles (REAL) Study. The REAL Study's main objective was to examine shared risk and protective factors associated with eating disorders and obesity among adolescents from the National Capital Region of Canada. To be included in the longitudinal component of the study, students had to either have been in Grade 7 or 9 at the initial time of data collection.

Sample Size Calculation

A power analysis was conducted by G*Power version 3.1 (Faul, Erdfelder, Buchner, & Lang, 2009) to determine the number of participants needed to detect an effect size of $f^2 = .25$ with $\alpha = .05$ and power of .90 in a multiple regression analysis. Results indicated that a sample of 160 participants was needed.

Participants

Individuals who participated the present study were taken from the longitudinal component of the REAL Study's database. Participation in the present study involved repeated assessment (i.e., interval of 1-2 years) for up to seven years (i.e., from 2006-2013). Data exceeding T4 were not included in the present study because of the high attrition rate (Gunnell et al., 2016). The final sample was comprised of 170 participants (106 females). The mean age was 13.01 years ($SD = 0.96$) for females and 12.67 years ($SD = 0.64$) for males with a mean age of 13.01 years and a SD of 0.96 at T0. The majority of participants in the final sample (49.4%) self-identified as North American, while 27.6% self-identified as European, 11.2% self-identified as Asian, 4.1% self-identified as Arabic, 2.9% self-identified as Hispanic, 2.4% self-identified as Aboriginal, 1.2% self-identified as Black, and 1.2% self-identified as other. This sample had an objectively measured BMI in the "normal range" ($M = 20.05$, $SD = 3.50$) and reported that their parents had a postsecondary education level (81%). This sample is considered representative of adolescents from the National Capital Region of Canada based

on previous research which has examined how sociodemographics from the REAL Study compare to adolescents in the Ottawa and surrounding area (Flament et al., 2012).

Procedure and Design

Thirty-one schools from three local school boards and two private schools from the National Capital Region of Canada agreed to take part in the REAL Study. Research staff presented students with an overview of the study during the initial visit. Interested participants were required to provide signed assent and parent/guardian consent before participating. Participants were also informed that they were permitted to withdraw from the study at any point. Participants completed a package of questionnaires, and had their height and weight taken confidentially by research staff, during regularly scheduled class time. Questionnaires were scored within 24 hours, and any participant who indicated a high level of depressive symptomatology, including suicidal ideation or maladaptive eating behaviours, received follow-up from a mental health professional on the research team. Given that this was a community-based sample, most students did not require clinical follow-up. Participating students from classes with a 70% consent rate were compensated with a pizza lunch or a gift certificate draw. Students who were in Grade 7 or 9 when the REAL Study began received an invitation to take part in the longitudinal component of the REAL Study. This involved completing the study measures on an annual or biannual basis (within three months of their initial study date) over seven years. Students who were not present on the day that the questionnaires were administered were invited to the Youth Psychiatry Research Unit at the Royal Ottawa Mental Health Care Centre to complete the measures. Participants received reimbursement for their parking fee and were compensated for their time with CA\$20. See Goldfield et al. (2011) for a more detailed description of the REAL Study procedure.

Measures

We selected measures from the full questionnaire battery to assess interpersonal factors (i.e., attachment style, coping style, and perceived social support), which may influence the relationship

between total daily recreational screen time and depressive symptomatology over time. We controlled for all sociodemographic factors (i.e., age, gender, BMI, parental level of education as a proxy of SES, and ethnicity) and anthropometric variables (i.e., level of physical activity) that were known to be significantly related to the outcome measure (i.e., depressive symptomatology).

Demographics. Participants provided information about self-identified gender, school/grade, date of birth to calculate age, parents' highest level of education, and ethnicity (see Appendix D).

BMI. Weight was measured in kilograms to the nearest 0.1 kg and weight was measured in centimetres to the nearest 0.1 cm. Height was converted to metres and used to calculate participants' BMI. $BMI = \text{weight (kg)} / \text{height (m)}^2$. Participants who were sensitive about being weighed by the research staff were exempted from this component of the study; though, this was a rare occurrence.

Physical Activity. The *Godin Leisure-Time Exercise Questionnaire* (GODIN; Godin & Shephard, 1985) was used to measure physical activity (see Appendix E). Participants answered questions regarding how often they engage in specific levels (i.e., strenuous, moderate, and mild) of exercise for more than 15 minutes at a time. Total leisure activity score is calculated as follows: (frequency of mild exercise $\times$ 3 METS [metabolic equivalent of task]) + (frequency of moderate exercise $\times$ 5 METS) + (frequency of strenuous exercise $\times$ 9 METS). Higher total scores indicate increased intensity of exercise. The GODIN has been demonstrated to be a reliable and valid measure, with test-retest reliability coefficients of $r = .94$. Given that sedentary behaviors are both conceptually and empirically different from absence of physical activity (Healey et al., 2008), physical activity was considered as a covariate in the present study.

Recreational Screen Time. The *Leisure-Time Sedentary Activities Scale* is a 6-item self-report questionnaire that was created by the REAL Study team to measure daily recreational sedentary screen time based on three screen time activities: recreational computer use, television viewing, and videogame engagement (see Appendix F). Respondents were required to indicate the number of

hours they typically spend per day watching television, using a computer for recreational purposes, or engaging in videogames. Response options were as follows: 0 (*not at all*), 1 (*less than 1 h*), 2 (*1 to 2.9 h*), 3 (*3 to 4.9 h*), 4 (*5 to 8 h*), and 5 (*more than 8 h*). The questionnaire includes items to differentiate weekday and weekend recreational screen time. Total daily recreational screen time and time spent engaged in a specific recreational screen time activity were weighted as according to the following equation: $[(\text{week day} \times 5) + (\text{weekend} \times 2)]/7$. A higher score indicates more time spent engaged in recreational screen time activities. It should be noted that raw total scale and subscale scores do not represent total recreational screen time hours, but instead places participants in one of the six aforementioned categories, which correspond to the response choices (i.e., 0 to 5). This measure was used in a recent cross-sectional study (i.e., Maras et al., 2015), which demonstrated that recreational screen time scores were positively associated with BMI and negatively associated with mental health outcomes, such as depression and anxiety. In the present study, this measure revealed an adequate internal consistency ($\alpha = .64$).

Depressive Symptomatology. The *Children's Depression Inventory* (CDI; Kovacs, 1985) is a 27-item self-report questionnaire used to assess behavioural, cognitive, and emotional symptomatology of depression to identify depressive disorders in adolescents and children (Timbremont, Braet, & Dreessen, 2004). See Appendix G. The CDI is comprised of five subscales: negative mood (e.g., item 11, "Things bother me all the time", "Things bother me many times", "Things bother me once in a while"), ineffectiveness (e.g., item 23, "My school work is all right", "My schoolwork is not as good as before", "I do very badly in subjects I used to be good in"), anhedonia (e.g., item 17, "I am tired once in a while", "I am tired many days", "I am tired all the time"), negative self-esteem (e.g., item 7, "I hate myself", "I do not like myself", "I like myself"), and interpersonal problems (e.g., item 5, "I am bad all the time", "I am bad many times", "I am bad once in a while"). Participants answered items based on a 3-point scale, which ranged from 0 to 2;

higher scores represent increased markers of depression. Summing the values that corresponds to each chosen response results in a total score, which can range from 0 to 54. In addition, researchers have used the CDI extensively, reporting adequate to good internal consistency ($\alpha = .71-.89$) and test-retest reliability ($r = .50-.83$), and have established evidence of concurrent validity (Kovacs, 1992). In the present study, the total depression score demonstrated excellent internal consistency with a Cronbach's alpha coefficient of .90 at T0 (covariate) and .88 at T4 (dependent variable).

Although Kovacs (1992) originally suggested a research cutoff score of 19 to differentiate between depressed and nondepressed children and adolescents, Matthey and Petrovski (2002) proposed that the CDI be used as a continuous measure to ensure that the inventory captures symptomatology appropriately. Given that we used the CDI as a continuous measure, participants were not categorized as depressed or nondepressed.

Attachment Style. The *Adolescent Relationship Questionnaire* (A-RSQ; Bartholomew & Horowitz, 1991), used interchangeably with the RQ, is a 4-item self-report measure that assesses global attachment (see Appendix K). The A-RSQ is an adaptation of the original *Relationship Questionnaire* (RSQ) for adults and is a well-known measure used to evaluate global attachment (Karavasilis, Doyle, & Markiewicz, 2003). The attachment styles include secure, fearful, preoccupied, and dismissing. Each item is rated on a 7-point scale, ranging from 1 (*not at all like me*) to 7 (*very much like me*). In addition, the questionnaire includes a forced-choice component that requires respondents to select one of four attachment style descriptions that best reflects them. As such, a continuous score is derived for the various attachment styles, resulting in an "attachment profile." The A-RSQ has been used successfully in adolescent and young adult attachment studies (Matsuoka et al., 2006; Tanaka et al., 2008). The A-RSQ can be scored both categorically or continuously. Using a categorical approach, participants are classified as either securely or insecurely (i.e., fearful, preoccupied, or dismissing) attached. Scoring the measure continuously involves obtaining a total

attachment score, where higher scores are more reflective of a secure attachment and lower scores are more reflective of an insecure attachment (Matsuoka et al., 2006). The A-RSQ has indicated test-retest reliability that is considered comparable to interview methods, with correlations ranging from .39 to .58 between two time points (Scharfe & Bartholomew, 1994). It has also demonstrated good validity and strong psychometric properties (Griffin & Bartholomew, 1994). In the present study, attachment was separated by secure attachment versus insecure attachment (i.e., fearful, preoccupied, or dismissing) using the attachment prototype that participants indicated described them best.

Coping Style. The *Coping Inventory for Stressful Situations-24* (CISS; Buchholz, 1998) is an abridged version of the original 48-item CISS (Endler & Parker, 1990b). See Appendix L. Akin to the original CISS, the CISS-24 is a 24-item self-report measure that is used to assess three coping styles: emotion-oriented coping, avoidance-oriented coping, and task-oriented coping. These three coping styles have demonstrated good internal consistency ($\alpha = .76-.91$; Endler & Parker, 1990a). McWilliams, Cox, and Enns (2003) found that the original CISS demonstrated good validity and reliability among individuals diagnosed with major depressive disorder. The CISS-24 includes 24 items that loaded highest on the original factor structure. Using a 5-point scale that measures one's coping style (i.e., emotion-oriented coping, avoidance-oriented coping, and task-oriented coping), participants rated the extent to which they would use the specific coping strategy from 1 (*not at all*) to 5 (*very much*). For example, the general statement reads, "When I enter a difficult, upsetting, or stressful situation," and the possible responses are "I become very upset" (item 6; emotion-oriented), "I go to a party" (item 11; avoidance-oriented), and "I come up with several different solutions to the problem" (item 22; task-oriented). Higher scores indicate greater use of specific coping style. The emotion-oriented coping subscale includes seven items, the avoidance-oriented coping subscale includes 10 items, and the task-oriented coping subscale includes seven items. The abridged measure has been validated with an adolescent sample and has revealed good internal consistency (e.g.,

Cronbach's α = .74 to .86; Buchholz, 1998). Task-oriented coping was associated with lower psychopathology, whereas emotion-oriented coping and avoidance-oriented coping was associated with higher levels of psychopathology. The CISS does not assess a global score; each subscale has its own total score. In the present study, the emotion-oriented coping, avoidance-oriented coping, and task-oriented coping subscales were examined as moderating variables, and each subscale displayed good internal consistency (i.e., Cronbach's α = .82 to .86), which are consistent with those demonstrated by Endler and Parker (1990a) and Buchhloz (1998).

Perceived Social Support. The *McKnight Risk Factor Survey-IV-Grades 6-12 version* (MRFS-IV; McKnight Investigators, 2003) is a 103-item self-report questionnaire used to assess potential risk and protective factors for disordered eating in both preadolescents and adolescents (see Appendix M). Items are categorized into various domains according to theory. Of interest to the present study is the perceived support/sharing subscale, which includes three statements that are answered using a 5-point Likert scale, ranging from 1 (*never*) to 5 (*always*). Higher total scores indicate a higher level of perceived social support. The three items comprising the support/sharing subscale were as follows: "In the past year, how often have you had someone you can count on to listen to you when you need to talk?" (item 12), "In the past year, how often have you had someone to share your most private worries and fears with?" (item 16), and "In the past year, how often have you had someone to help you understand a problem when you needed it?" (item 39). The MRFS-IV has demonstrated adequate test-retest reliability, and it has shown evidence suggesting that it is a valid measure in two cohorts of American youth (i.e., Arizona Site and California Site; McKnight Investigators, 2003). The perceived social support subscale displayed good internal consistency in the present study (α = .80) and was examined as a moderating variable. Although the present study did not measure received social support due to the nature of the self-report measure, perceptions of social support are related to psychological health (Barrera & Garrison-Jones, 1992).

Data Analytic Plan

We used the Statistical Package for the Social Sciences version 24 to perform data analyses in the present study. We screened the minimum and maximum scores to ensure that data were scored properly and within the correct scoring range. We inspected both subscale scores and total scores to verify that all items were correctly entered before they were summed to generate the variables of interest. We also screened for missing data.

The independent variables were grand-mean centered in order to obtain unbiased estimates of the relationships of interest (Kenny, Kashy, & Cook, 2006). We performed analyses with a two-tailed alpha at the 0.05 level. Separate hierarchical regression analyses were conducted to examine whether attachment style, coping style, and perceived social support were moderators in the relationship between total daily recreational screen time at T0 and depressive symptomatology at T4. In the following sections, we report our findings for the attachment model, coping models, and perceived social support model. In the coping models, each coping style variable was included separately for two reasons. First, given that this is novel research, it is important to examine variables separately to examine how they influence one other before grouping them together. Second, the simultaneous inclusion of each coping variable and their respective interaction terms in a single regression model would have resulted in a great loss of statistical power.

Missing Data

We took a missing data inventory for the variables of interest. We set selection criteria to ensure that imputation for missing data was reasonable. Specifically, to be included in further statistical analyses, participants had to have responded to at least 75% of the items across the variables of interest (i.e., 71 or more of the 94 scale items). In total, 170 of the 1201 participants were included in the final sample. Among the 170 participants, there was 1.12% missing data. A Little's Missing Completely at Random (MCAR) test was conducted to further examine the missing data. Results, χ^2

(6168) = 6466.45, $p = .004$, indicated that the data were not missing completely at random, which will be addressed as a study limitation. We used Expectation Maximization (EM) algorithm to impute missing values (Dempster, Laird, & Rubin, 1977), which is a reliable means of dealing with missing data (Enders & Bandalos, 2001).

We performed t tests to further examine data that were not missing completely at random, and t -test results revealed that participants' age and BMI were responsible for the data that were not missing completely at random. We also performed t tests to examine whether participants whom we removed from the original database due to missing data differed from those who were included in the final sample on sociodemographic variables of interest. Results indicated a significant age difference between those who were removed from the study ($M = 13.54$, $SD = 1.11$) and those who were retained in the study ($M = 13.01$, $SD = 0.96$), $t(250) = 6.62$, $p < .001$, $d = 0.50$. Results also indicated that BMI for those who were removed from the study ($M = 20.72$, $SD = 3.66$) was significantly higher than those who were retained in the study ($M = 20.05$, $SD = 3.50$), but the effect size was small, $t(1190) = 2.23$, $p = .01$, $d = 0.19$.

Testing of Assumptions

Prior to conducting the main analyses, we examined the data to verify that multiple regression assumptions were met (Tabachnick & Fidell, 2013). First, we screened each variable for univariate outliers. We identified three outliers from the total daily recreational screen time at T0 variable, which we winsorized to reduce them to $z = 3.29$. Next, we checked the assumption of normality. We verified that the residuals of the multiple regression were normally distributed by plotting histograms and normal P-P plots. The histogram for the total daily recreational screen time at T0 variable appeared to be positively skewed. However, given that the skewness and kurtosis measures did not exceed the cutoff values and the skewness did not influence the analysis in the model, we did not transform the

variable.¹ The histogram for the perceived social support at T0 and depressive symptomatology at T0 variable appeared to be quite negatively skewed, and thus no transformation was effective. As such, the variables were dichotomized (i.e., participant scores above the mean and participant scores below the mean) in attempt to meet the normality assumption. For the other variables of interest, the distribution did not appear to be discordant from what is considered normal. After transforming the social support variable, the residuals in the regression models reported below were normally distributed. We verified that the linearity and homoscedasticity assumptions were met via visual inspection of scatterplots that included comparisons between regression residuals and their predicted values. The scatterplots did not reveal any systematic patterns and Cook's Distance did not include any value over 1.00, which suggested that the model assumptions had been met. We examined the Variance Inflation Factor (VIF) values to verify that the multicollinearity assumption was met. Results indicated that VIF scores fell within acceptable limits (i.e., did not exceed 2.5) and the Condition Index did not exceed 30.

Potential Control Variables

Prior to testing the hypotheses, we calculated the correlation matrix between the dependent variable (i.e., depressive symptomatology at T4), sociodemographic variables (i.e., gender, parental education, age, BMI, and ethnicity), and anthropometric variable (i.e., physical activity), which are theoretically related to depressive symptomatology at T4, and thus could influence the present study's results. Findings suggested that only depressive symptomatology at T0 ($p < .001$) was significantly correlated to depressive symptomatology at T4; thus, we controlled for this variable in the present study.

¹ The transformed total daily screen time variable produced results consistent with the non-transformed total daily screen time variable in the model. As such, the non-transformed variable was used in the analyses to simplify the interpretation of the results.

Results

Descriptive Statistics

Table 1 presents descriptive statistics for the variables of interest. Independent t-tests revealed that females scored significantly higher on emotion-oriented coping, $t(168) = -3.20, p = .002$, avoidance-oriented coping, $t(168) = -2.28, p = .02$, perceived social support, $t(168) = -2.35, p = .02$, depressive symptomatology at T0, $t(163) = -2.02, p = .05$, and total daily recreational computer use, $t(168) = -2.69, p = .008$. Males scored significantly higher on total daily videogame engagement, $t(168) = -4.47, p < .001$. Depressive scores for both females (T0: $M = 7.83, SD = 7.81$; T4: $M = 8.08, SD = 6.33$) and males (T0: $M = 5.73, SD = 5.62$; T4: $M = 8.09, SD = 6.82$) increased from T0 to T4. However, while the increase from T0 to T4 was not statistically significant for females, $t(105) = -.341, p = .73$, the increase was significant for males, $t(63) = -3.39, p = .001$.

Table 2 reveals that more than half of the adolescents in the present study (52%) reported spending between 3-4.9 hours engaged in recreational screen time activities per day. On weekends, 52% of adolescents engaged in recreational screen time activities for 5-8 hours per day. On weekdays, 48% of adolescents reported engaged in recreational screen time activities for 3-5 hours per day. Participants reported television viewing on both weekdays (1-2.9 hours) and weekends (1-2.9 hours) as the most frequently used recreational screen time activity. Compared to males, females reported using recreational screen time for longer periods of time on weekdays (see Table 3 for a detailed description).

Table 3 presents a correlation matrix of all variables included in the model. All variables were correlated in the expected direction. Maladaptive forms of coping (i.e., avoidance-oriented coping and emotion-oriented coping) were not significantly related to depressive symptomatology at T4. Avoidance-oriented coping and emotion-oriented coping were significantly and positive related to both total daily recreational screen time and total daily recreational computer use. Task-oriented coping was

significantly and positively related to both total daily recreational screen time and total daily videogame engagement. Attachment and perceived social support were not significantly related to any recreational screen time activity, but were significantly and negatively related to depressive symptomatology at T4.

Table 1

Descriptive Statistics for Coping Style, Attachment Style, and Perceived Social Support Among Males (n = 64) and Females (n = 106)

	Females	Males	Females		Males	
	<i>M (SD)</i>	<i>M (SD)</i>	Min	Max	Min	Max
Task-Oriented Coping	22.47(5.48)	22.24(5.67)	10.00	35.00	8.00	35.00
Emotion-Oriented Coping	17.88(5.51)	15.22(4.78)	7.00	29.00	6.35	25.00
Avoidance-Oriented Coping	29.47(7.11)	26.79(7.91)	12.00	50.00	13.00	44.00
Depressive Symptoms (T0)	7.83(7.81)	5.73(5.62)	0.00	31.00	0.00	26.00
Depressive Symptoms (T4)	8.08(6.33)	8.09(6.82)	0.00	29.00	0.00	30.00
Total Daily Screen Time	4.36(1.75)	4.56(1.59)	0.57	10.22	1.57	8.57
Recreational Computer Use	1.83(1.03)	1.43(0.75)	0.00	5.00	0.00	3.29
Videogame Engagement	0.81(0.89)	1.45(0.90)	0.00	5.00	0.00	5.00
Television Viewing	1.75(0.71)	1.69(0.67)	0.57	5.00	0.00	3.29
	N(%)	N(%)				
Secure Attachment Style	77(72.6)	52(81.3)				
Insecure Attachment Style	29(27.4)	12(18.7)				
High Perceived Social Support	63(59.4)	29(45.3)				
Low Perceived Social Support	43(40.6)	35(54.7)				

Note. Total Daily Recreational Screen Time = Measured at T0; Recreational Computer Use = Total Daily Recreational Computer Use; Videogame Engagement = Total Daily Videogame Engagement; Television Viewing = Total Daily Television Viewing. The standard deviation is shown in parentheses. The Attachment and Perceived Social Support variables were dummy coded and are presented as frequencies N(%). Insecure Attachment Style = fearful, preoccupied and dismissing. High Perceived Social Support = 1 standard deviation above the mean and Low Perceived Social Support = 1 standard deviation below the mean. The mean score (SD) for Perceived Social Support was 4.17 (0.79) for females and 3.86 (0.94) for males.

Table 2

Recreational Screen Time Activities by Gender

Recreational Screen Activities	Male n(%)	Female n(%)	Total N(%)
TV on Weekdays			
0 = not at all	6(9.38)	9(8.49)	15(8.82)
1 = less than an hour	24(37.50)	36(33.96)	60(35.29)
2 = 1-2.9 hours	29(45.31)	48(45.28)	77(45.29)
3 = 3-4.9 hours	5(7.81)	12(11.32)	17(10.00)
4 = 5-8 hours	0(0.00)	0(0.00)	0(0.00)
5 = more than 8 hours	1(1.56)	0(0.00)	1(0.59)
TV on Weekends			
0 = not at all	4(6.25)	7(6.60)	11(6.47)
1 = less than an hour	12(18.75)	19(17.93)	31(28.97)
2 = 1-2.9 hours	27(42.19)	50(47.17)	77(45.29)
3 = 3-4.9 hours	16(25.00)	26(24.53)	42(24.71)
4 = 5-8 hours	4(6.25)	1(0.94)	5(2.94)
5 = more than 8 hours	1(1.56)	3(2.83)	4(2.35)
Videogames on Weekdays			
0 = not at all	15(23.44)	49(46.23)	64(37.65)
1 = less than an hour	27(42.19)	45(42.45)	72(42.35)
2 = 1-2.9 hours	19(29.69)	9(8.49)	28(16.47)
3 = 3-4.9 hours	1(1.56)	0(0.00)	1(0.59)
4 = 5-8 hours	1(1.56)	2(1.89)	3(1.77)
5 = more than 8 hours	1(1.56)	1(0.94)	2(1.18)
Videogames on Weekends			
0 = not at all	2(3.13)	36(33.96)	38(22.35)
1 = less than an hour	20(31.25)	42(39.62)	62(36.47)
2 = 1-2.9 hours	24(37.50)	19(17.93)	43(25.29)
3 = 3-4.9 hours	11(17.19)	6(5.66)	17(10.00)
4 = 5-8 hours	4(6.25)	1(0.94)	5(2.94)
5 = more than 8 hours	3(4.69)	2(1.89)	5(2.94)
Computer on Weekdays			
0 = not at all	6(9.38)	6(5.66)	12(7.06)
1 = less than an hour	36(56.25)	39(36.79)	75(44.12)
2 = 1-2.9 hours	16(25.00)	43(40.57)	59(34.71)
3 = 3-4.9 hours	6(9.38)	11(10.38)	17(10.00)
4 = 5-8 hours	0(0.00)	4(3.77)	4(2.35)
5 = more than 8 hours	0(0.00)	3(2.83)	3(1.77)
Computer on Weekends			
0 = not at all	9(14.06)	10(9.43)	19(11.18)
1 = less than an hour	19(29.69)	31(29.25)	50(29.41)
2 = 1-2.9 hours	25(39.06)	37(34.91)	62(36.47)
3 = 3-4.9 hours	8(12.50)	16(15.09)	24(14.12)
4 = 5-8 hours	3(4.69)	8(7.55)	11(6.47)
5 = more than 8 hours	0(0.00)	4(3.77)	4(2.35)

Total Screen Time During Week			
0 = not at all	0(0.00)	1(0.94)	1(0.59)
1 = less than an hour	0(0.00)	0(0.00)	0(0.00)
2 = 1-2.9 hours	14(21.88)	13(12.26)	27(15.88)
3 = 3-4.9 hours	25(39.06)	57(53.77)	82(48.24)
4 = 5-8 hours	25(39.06)	31(29.25)	56(32.94)
5 = more than 8 hours	0(0.00)	4(3.77)	4(2.35)
Total Screen Time During Weekend			
0 = not at all	0(0.00)	1(0.94)	1(0.59)
1 = less than an hour	0(0.00)	0(0.00)	0(0.00)
2 = 1-2.9 hours	0(0.00)	11(10.38)	11(6.47)
3 = 3-4.9 hours	20(31.25)	32(30.19)	52(30.59)
4 = 5-8 hours	35(54.69)	54(50.94)	89(52.35)
5 = more than 8 hours	9(14.06)	8(7.55)	17(10.00)
Total Screen Time Activities^a			
0 = not at all	0(0.00)	0(0.00)	0(0.00)
1 = less than an hour	0(0.00)	1(0.94)	1(0.59)
2 = 1-2.9 hours	10(15.63)	16(15.09)	26(15.29)
3 = 3-4.9 hours	31(48.44)	58(54.72)	89(52.35)
4 = 5-8 hours	21(32.81)	27(25.47)	48(28.24)
5 = more than 8 hours	2(3.13)	4(3.77)	6(3.53)
^a Weighted Mean			

Table 3

Correlations Between Variables of Interest

	1	2	3	4	5	6	7	8	9	10	11	12
GEN	-											
SCRN	0.06	-										
COMP	-0.20**	0.76**	-									
TV	-0.04	0.57**	0.27**	-								
VGAM	0.33**	0.66**	0.23**	0.03	-							
DEP0	-0.14	0.27**	0.28**	0.01	0.22**	-						
DEP4	0.00	0.28**	0.23**	0.05	0.26**	0.49**	-					
TASK	-0.02	-0.16*	-0.13	0.00	-0.16*	-0.37**	-0.24**	-				
EMOT	-0.24**	0.17*	0.24**	0.06	0.05	0.41**	0.14	-0.05	-			
AVOI	-0.17*	0.22**	0.22**	0.14	0.10	-0.13	0.00	0.37**	0.08	-		
ATT	0.11	-0.13	-0.12	-0.01	-0.12	-0.62**	-0.31**	0.33**	-0.33**	0.17*	-	
SUPP	-0.18*	-0.03	-0.03	-0.01	-0.02	-0.35**	-0.16*	0.24**	-0.12	0.32**	0.39**	-

Note. GEN = Gender; SCRN = Total Daily Recreational Screen Time at T0; COMP = Total Daily Recreational Computer Use; TV = Total Daily Television Viewing; VGAM = Total Daily Videogame Engagement; DEP0 = Depressive Symptomatology at T0 (continuous); DEP4 = Depressive Symptomatology at T4; TASK = Task-Oriented Coping; EMOT = Emotion-Oriented Coping; AVOI = Avoidance-Oriented Coping; ATT = Total Attachment Score; SUPP = Perceived Social Support (continuous). * $p < .05$, two-tailed. ** $p < .01$, two-tailed.

Principal Analyses

Attachment Style Model. Results indicated that 66.5% reported consistent attachment style over time, whereby those with insecure attachment at baseline remained insecure at T4 and those with secure attachment remained as such at T4. However, there were some observed shifts in attachment style from T0 to T4. For example, 21.8% reported a decline (e.g., from secure to insecure) in attachment, 10% reported an improvement (from insecure to secure), and 1.8% data were missing at T4.

In the first model, we examined attachment style as a moderating variable in the relationship between total daily recreational screen time at T0 and depressive symptomatology at T4. Secure attachment style at T0 was dummy coded as 1 and insecure attachment style was dummy coded as 0. On step 1, depressive symptomatology at T0 significantly predicted depressive symptomatology at T4, $B = 8.44, p < .001$. On step 2, total daily recreational screen time at T0 significantly predicted depressive symptomatology at T4, $B = 0.74, p = .01$, and explained 8% of the unique proportion of variance in depressive symptomatology ($sr^2 = .08$). On step 3, the interaction term between attachment style at T0 and gender was significant, $B = -4.98, p = .03$, indicating that the relationship between total daily recreational screen time at T0 and depressive symptomatology at T4 is influenced by gender and attachment style. On step 4, the three-way interaction between total daily recreational screen time at T0, gender, and attachment style at T0 was nonsignificant (see Table 4).

Figure 4 illustrates that when total daily recreational screen time was grand-mean centered, insecurely attached males at T0 reported higher levels of depressive symptomatology at T4, compared to securely attached males. A follow-up simple effect analysis confirmed this. Insecurely attached males at T0 ($M = 13.67, SD = 9.75$) reported significantly higher levels of depressive symptomatology, compared to securely attached males ($M = 6.81, SD = 5.28$), $t(12.53) = 2.36, p = .01$. For females, the line appears to be quite flat, indicating that there may not exist significant differences between

insecurely and securely attached females in association with depressive symptomatology at T4. A follow-up simple effect analysis confirmed this. There were no significant differences between insecurely ($M = 9.69$, $SD = 7.56$) and securely attached females ($M = 7.47$, $SD = 5.75$), $t(104) = 1.62$, $p > .05$.

Table 4

Hierarchical Regression Analysis of Total Daily Recreational Screen Time at T0 and Depressive Symptomatology at T4 and Potential Moderating Effects of Attachment Style and Gender

Predictor Variable	R^2	F	ΔR^2	ΔF	B
Step 1	0.18	37.75***			
DEP0					8.44***
Step 2	0.23	11.98***	0.04	2.95*	
SCRN					0.74**
ATTAC					0.78
Gender					2.08
Step 3	0.25	7.63***	0.02	1.63	
SCRN*Gender					-0.21
SCRN*ATTAC					0.13
ATT*Gender					-4.98*
Step 4	0.26	6.92***	0.01	1.76	
ATT*Gender*SCRN					2.01

Note. DEP0 = Depressive Symptomatology at T0; SCRN = Total Daily Recreational Screen Time at T0; ATTAC = Dichotomous Attachment (i.e., Insecure vs. Secure). All steps in the model controlled for variables included in the previous steps. * $p < .05$. ** $p < .01$. *** $p < .001$.

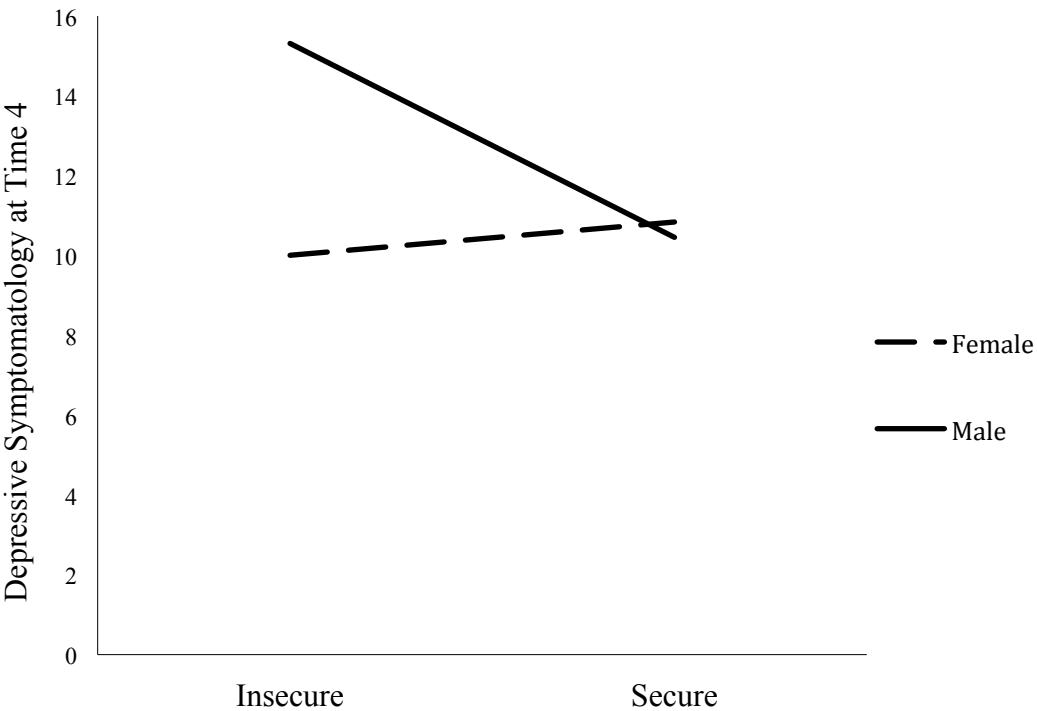


Figure 4. Unstandardized slopes for a significant two-way interaction between Attachment Style × Gender when total daily recreational screen time is at the mean.

Avoidance-Oriented Coping Style Model. On step 1, depressive symptomatology at T0 significantly predicted depressive symptomatology at T4, $B = 8.44, p < .001$. On step 2, total daily recreational screen time at T0 significantly predicted depressive symptomatology at T4, $B = 0.74, p = .01$. On step 3, there was a significant two-way interaction between avoidance-oriented coping at T0 and gender, $B = -0.26, p = .047$, indicating that the relationship between avoidance-oriented coping at T0 and depressive symptomatology at T4 may be influenced by gender. On step 4, the three-way interaction between total daily recreational screen time at T0, gender, and avoidance-oriented coping at T0 was nonsignificant (see Table 5).

Figure 5 illustrates that at average levels of recreational screen time, for females, higher levels of avoidance-oriented coping at T0 were associated with higher levels of depressive symptomatology at T4, and lower levels of avoidance-oriented coping at T0 were associated with lower levels of depressive symptomatology at T4. Conversely, for males, higher levels of avoidance-oriented coping at T0 were associated with lower levels of depression at T4, and lower levels of avoidance-oriented coping at T0 were associated with higher levels of depressive symptomatology at T4. Follow-up simple slope analyses indicated that, despite the aforementioned trends, the relationship between avoidance-oriented coping at T0 and depressive symptomatology at T4 was not significant for males, $B = -.50, p = .13$, or females, $B = 0.16, p = .39$. This could be related to the interaction only being marginally significant ($p = .047$). That is, the effect size of the differences was not strong, thus the interaction effect was marginal.

Table 5

Hierarchical Regression Analysis of Total Daily Recreational Screen Time at T0 and Depressive Symptomatology at T4 and Potential Moderating Effects of Avoidance-Oriented Coping and Gender

Predictor Variable	R^2	F	ΔR^2	ΔF	B
Step 1	0.18	37.75***			
DEP0					8.44***
Step 2	0.22	11.84***	0.04	2.80*	
SCRN					0.74*
AVOI					0.01
Gender					0.65
Step 3	0.24	7.38***	0.02	1.34	
SCRN*Gender					0.34
SCRN*AVOI					0.003
AVOI*Gender					-0.26*
Step 4	0.25	6.57***	0.004	0.93	
AVOI*Gender*SCRN					0.07

Note. DEP0 = Depressive Symptomatology at T0; SCRN = Total Daily Recreational Screen Time at T0; AVOI = Avoidance-Oriented Coping. All steps in the model controlled for variables included in the previous steps. * $p < .05$. ** $p < .01$. *** $p < .001$.

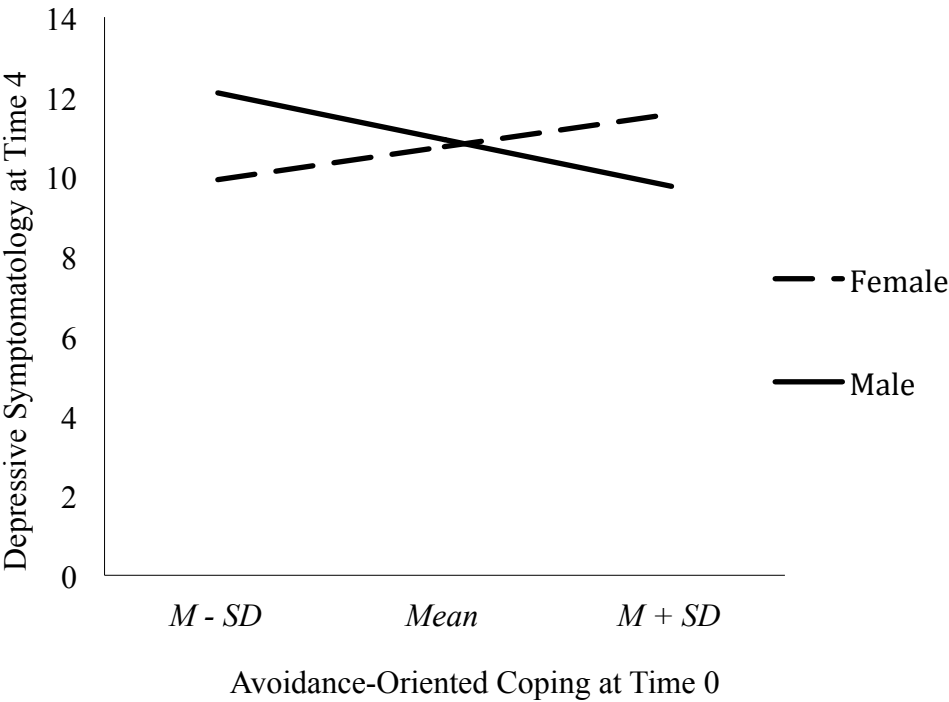


Figure 5. Unstandardized slopes for a significant two-way interaction between Avoidance-Oriented Coping $\times$ Gender when total daily recreational screen time is at the mean.

Emotion-Oriented Coping Style Model. On step 1, depressive symptomatology at T0 significantly predicted depressive symptomatology at T4, $B = 8.44$, $p < .001$. On step 2, total daily recreational screen time at T0 significantly predicted depressive symptomatology at T4, $B = 0.75$, $p = .01$. On step 3, there were no significant two-way interactions. On step 4, the three-way interaction between total daily recreational screen time at T0, gender, and emotion-oriented coping was nonsignificant (see Table 6).

Table 6

Hierarchical Regression Analysis of Total Daily Recreational Screen Time at T0 and Depressive Symptomatology at T4 and Potential Moderating Effects of Emotion-Oriented Coping and Gender

Predictor Variable	R^2	F	ΔR^2	ΔF	B
Step 1	0.18	37.75***			
DEP0					8.44***
Step 2	0.22	11.84***	0.04	2.80*	
SCRN					0.75**
EMOT					-0.02
Gender					0.59
Step 3	0.23	6.88***	0.006	0.43	
SCRN*Gender					0.35
SCRN*EMOT					0.06
EMOT*Gender					-0.06
Step 4	0.24	6.50***	0.02	3.19	
EMOT*Gender*SCRN					-0.21

Note. DEP0 = Depressive Symptomatology at T0; SCRN = Total Daily Recreational Screen Time at T0; EMOT = Emotion-Oriented Coping. All steps in the model controlled for variables included in the previous steps. * $p < .05$. ** $p < .01$. *** $p < .001$.

Task-Oriented Coping Style Model. On step 1, depressive symptomatology at T0 significantly predicted depressive symptomatology at T4, $B = 8.44, p < .001$. On step 2, total daily recreational screen time at T0 significantly predicted depressive symptomatology at T4, $B = 0.76, p = .01$. On step 3, there were no significant two-way interactions. On step 4, the three-way interaction between total daily recreational screen time at T0, gender, and task-oriented coping was nonsignificant (see Table 7).

Table 7

Hierarchical Regression Analysis of Total Daily Recreational Screen Time at T0 and Depressive Symptomatology at T4 and Potential Moderating Effects of Task-Oriented Coping and Gender

Predictor Variable	R^2	F	ΔR^2	ΔF	B
Step 1	0.18	37.75***			
DEP0					8.44***
Step 2	0.22	11.88***	0.04	2.85*	
SCRN					0.76**
TASK					0.02
Gender					0.62
Step 3	0.23	8.21***	0.008	0.09	
SCRN*Gender					-0.14
SCRN*TASK					0.02
TASK*Gender					-0.18
Step 4	0.24	7.13***	0.003	0.69	
TASK*Gender*SCRN					0.08

Note. DEP0 = Depressive Symptomatology at T0; SCRN = Total Daily Recreational Screen Time at T0; TASK = Task-Oriented Coping. All steps in the model controlled for variables included in the previous steps. * $p < .05$. ** $p < .01$. *** $p < .001$.

Perceived Social Support Model. We examined perceived social support as a moderating variable in the relationship between total daily recreational screen time activities at T0 and depressive symptomatology at T4. On step 1, depressive symptomatology at T0 significantly predicted depressive symptomatology at T4, $B = 8.44, p < .001$. On step 2, total daily recreational screen time activities at T0 significantly predicted depressive symptomatology at T4, $B = 0.74, p = .01$. On step 3, there were no significant two-way interactions. On step 4, the three-way interaction between total daily recreational screen time, gender, and perceived social support was a significant predictor, $B = 2.29, p = .044$ of depressive symptomatology at T4 (see Table 8). Figures 6 and 7 illustrate these interactions when perceived social support is low (one *SD* below the mean) and high (one *SD* above the mean), respectively.

For the following analyses, we separated participants into two groups: a low perceived social support group and a high perceived social support group. Figure 6 illustrates that in the low perceived social support group, for females, the relationship between total daily recreational screen time at T0 and depressive symptomatology at T4 was not significant, $B = 0.91, p = 0.13$. The relationship between total daily recreational screen time at T0 and depressive symptomatology at T4 for males was also not significant, $B = -0.43, p = 0.52$.

However, Figure 7 demonstrates that in the high perceived social support group, for both males and females, higher daily recreational screen time at T0 was associated with higher depressive symptomatology at T4. For females, there was a marginally significant and positive relationship between total daily recreational screen time at T0 and depressive symptomatology at T4, $B = 0.75, p = 0.055$. The relationship was stronger and significant for males, $B = 1.76, p = 0.009$.

Table 8

Hierarchical Regression Analysis of Total Daily Recreational Screen Time at T0 and Depressive Symptomatology at T4 and Potential Moderating Effects of Perceived Social Support and Gender

Predictor Variable	R^2	F	ΔR^2	ΔF	B
Step 1	0.18	37.75***			
DEP0					8.44***
Step 2	0.23	11.97***	0.04	2.94*	
SCRN					0.74**
SUPP					-0.59
Gender					0.53
Step 3	0.24	7.15***	0.01	0.78	
SCRN*Gender					0.08
SCRN*SUPP					0.76
SUPP*Gender					0.96
Step 4	0.26	6.89***	0.02	4.12*	
SUPP*Gender*SCRN					2.29*

Note. DEP0 = Depressive Symptomatology at T0; SCRN = Total Daily Recreational Screen Time Activities at T0; SUPP = Perceived Social Support (dichotomous mean split). All steps in the model controlled for variables included in the previous steps. * $p < .05$. ** $p < .01$. *** $p < .001$.

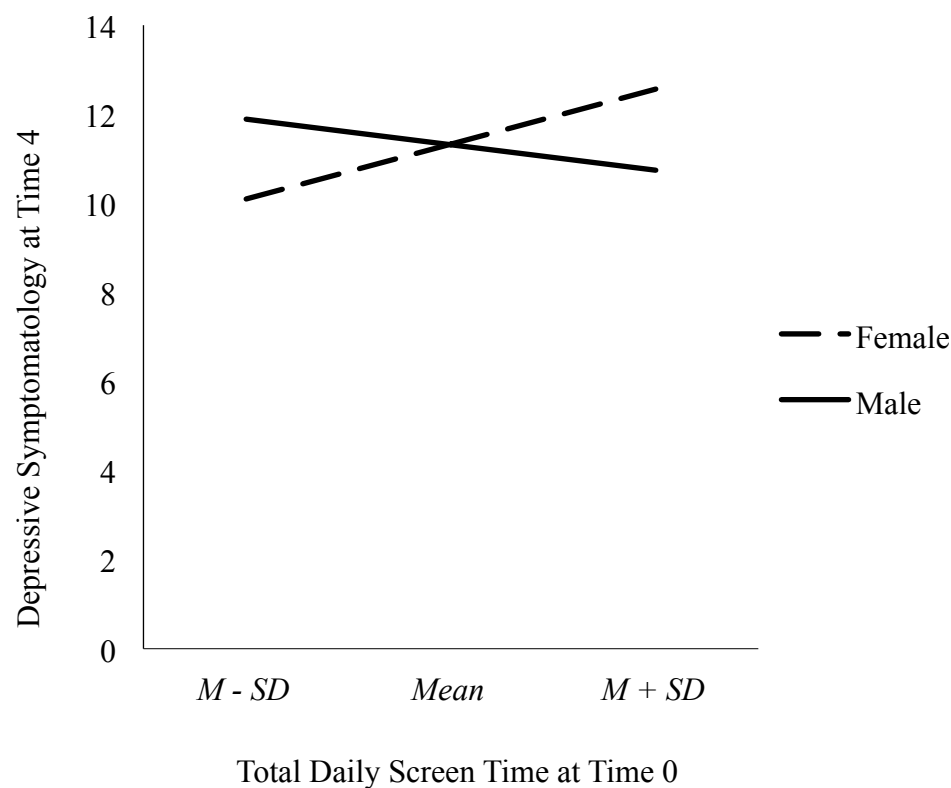


Figure 6. Unstandardized slopes for a significant three-way interaction between Perceived Social Support $\times$ Total Daily Recreational Screen Time at T0 $\times$ Gender when perceived social support is low.

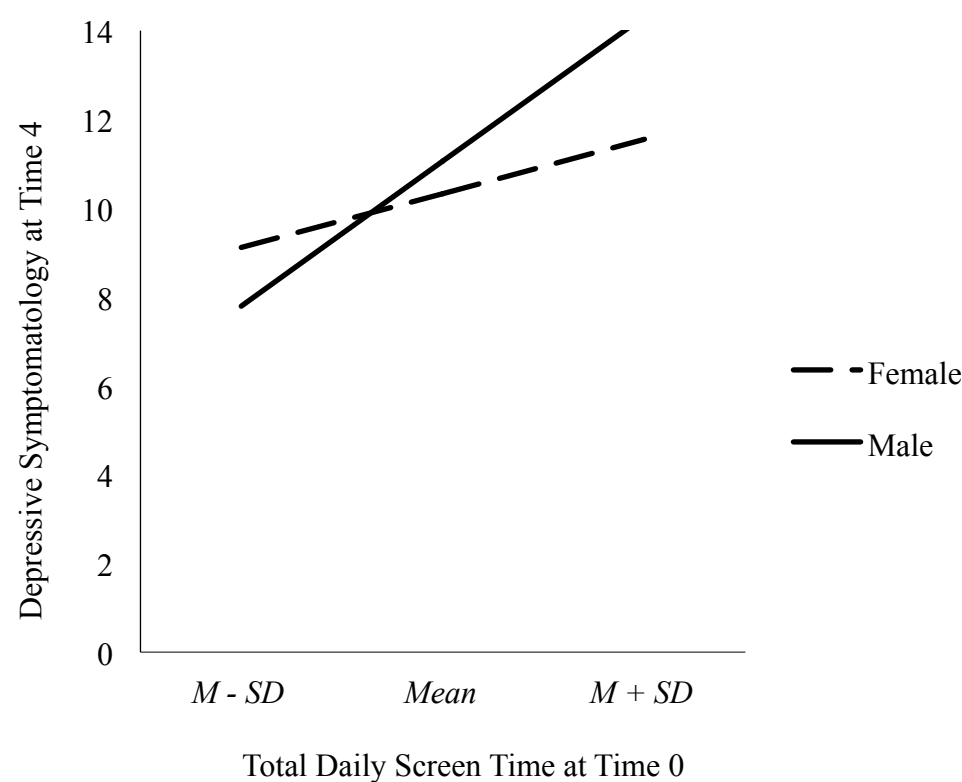


Figure 7. Unstandardized slopes for a significant three-way interaction between Perceived Social Support $\times$ Total Daily Recreational Screen Time at T0 $\times$ Gender when perceived social support is high.

Discussion

The purpose of the study was to examine a novel model, including relevant interpersonal variables (i.e., attachment style, coping style, and perceived social support) as moderating variables in the relationship between total daily recreational screen time activities and depressive symptomatology among adolescents over time. The present study's findings are discussed in the paragraphs that follow.

Summary of Findings

Results of preliminary analyses revealed gender differences that are consistent with findings from previous research. For example, females have been found to report significantly higher levels of maladaptive coping styles (e.g., emotion-oriented coping and avoidance-oriented coping; Billings & Moos, 1984; Matud, 2004; Ptacek et al., 1994; Ptacek et al., 1992), perceived social support (Baldwin et al., 2011; Desjardins & Leadbeater, 2011), and depressive symptomatology (Taylor, 2011), compared to males. Females also reported significantly higher levels of total daily recreational computer use and were older than their male counterparts. Conversely, consistent with findings from previous studies, males scored significantly higher than females on total daily videogame engagement (Brown, 2017). The increase in depressive symptomatology over time was significant for males in the present study. This finding highlights the importance of examining risk factors for adolescent depression.

In the present study, more than half of the adolescents reported spending between 3-4.9 hours engaged in recreational screen time activities per day. On weekends, more than half of the adolescents engaged in recreational screen time activities for 5-8 hours per day, which is comparable to published data (Leatherdale & Ahmed, 2011; Leatherdale & Harvey, 2015). On weekdays, nearly half of adolescents engaged in recreational screen time activities for 3-4.9 hours per day. The recreational screen time activity that participants spent the most time frequently engaged in was television viewing

(1-2.9 hours). Females reported using recreational screen time activities for longer periods of time on weekdays compared to males.

This section is focused on the study's hypotheses and main findings. Screen time activities at T0 was significantly predictive of depressive symptomatology at T4, independent of depressive symptomatology at T0. First, we expected that attachment style would moderate the relationship between total daily recreational screen time at T0 and depressive symptomatology at T4. Specifically, we expected that secure attachment style would weaken the relationship between total daily recreational screen time and depressive symptomatology over time, while an insecure attachment style would strengthen the relationship between total daily recreational screen time and depressive symptomatology over time. Contrary to our expectations, attachment style did not moderate the relationship between total daily recreational screen time at T0 and depressive symptomatology at T4. Similar to previous research (Keskin & Çam, 2010), the majority of participants reported a secure attachment style (76%). Inconsistent with past research, which has identified a negative relationship between recreational screen time and attachment style during adolescence (Richards et al., 2010), our findings did not reveal a significant relationship between total daily recreational screen time at T0 and attachment style at T0. However, our findings revealed a significant and negative association between total attachment score at T0 (i.e., better attachment) and depressive symptomatology at T4, which is consistent with previous research (Eberhart & Hammen, 2006; Jakobsen et al., 2012; Sund & Wichstrøm, 2002). Given that we did not examine recreational screen time content, we do not have information about content that our participants were exposed to, and thus we can only propose possible reasons as to why attachment style did not moderate the relationship between total daily recreational screen time at T0 and depressive symptomatology at T4. First, it is plausible that attachment style may act as a risk or protective factor between total daily recreational screen time and depressive symptomatology over time when recreational screen time content is taken into consideration (e.g.,

viewing photos online, engaging in online conversations, playing specific types of videogames, or watching certain television shows). Second, it is also possible that results may have been more pronounced if we had implemented a more comprehensive measure of attachment or had obtained parental ratings of adolescent attachment as well. It is also important to consider that there can be shifts in attachment style during adolescent development (Allen, McElhaney, Kuperminc, & Jodl, 2004). Although our data confirm that the majority of participants (67%) reported consistent attachment at T0 and T4, the one-third who shifted in this construct may have nevertheless impacted the null association.

Although attachment style did not moderate the relationship between total daily recreational screen time at T0 and depressive symptomatology at T4, a significant two-way interaction between gender and attachment style emerged, independent of depressive symptomatology at T0. That is, for males, insecure attachment style at T0 was identified as a risk factor for depressive symptomatology at T4. Given that this is novel research, our explanations for these findings are speculative in nature. Relationships with peers are highly influential during adolescence (Larson, Richards, Moneta, Holmbeck, & Duckett, 1996), and females are more likely to report secure relationships with peers during this developmental period (Gullone & Robinson, 2005; Raja et al., 1992). Accordingly, although our study does not differentiate between parental and peer attachment, a plausible speculation for our finding is that the insecure attachment males report may be more strongly related to peer relationships. Characteristics associated with insecure attachment, such as concerns about abandonment and reservations about others becoming too close (Fraley & Shaver, 2000) could be related to the higher levels of depressive symptomatology that males reported. Research has identified gender differences in peer relations among insecurely attached children. Specifically, insecurely attached boys were found to be more disruptive and display more aggression and attention-seeking behaviours, whereas insecure girls were considered more dependent, affiliative, and compliant (Turner,

1991). Though these findings are from a child sample, another plausible speculation for our findings is that the manifestation of insecure attachment among males may be considered more maladaptive in nature, and thus more strongly related to negative psychological outcomes, such as depressive symptomatology, over time. Given that females are socialized more to have and value close friendships, they may have inflated secure attachment, which dampens the association with depression.

Second, we expected that coping style would moderate the relationship between total daily recreational screen time at T0 and depressive symptomatology at T4. Specifically, we expected that adaptive coping (i.e., task-oriented coping) would weaken the relationship between total daily recreational screen time and depressive symptomatology over time. Conversely, we expected that maladaptive coping (i.e., avoidance-oriented coping and emotion-oriented coping) would strengthen the relationship between total daily recreational screen time and depressive symptomatology over time. Contrary to our expectations, coping style did not emerge as a significant moderator, indicating that the relationship between total daily recreational screen time at T0 and depressive symptomatology at T4 was not dependent on adolescents' coping style. As expected, task-oriented coping was significantly and negatively related to both total daily recreational screen time and total daily videogame engagement. Maladaptive coping styles (i.e., emotion-oriented and avoidance-oriented) were significantly and positively related to total daily recreational screen time and total daily recreational computer use, which is consistent with previous work linking avoidance-oriented coping to Internet addiction (Cheng et al., 2015). However, they were not significantly related to depressive symptomatology at T4. Regarding depressive symptomatology, task-oriented coping was significantly and negatively associated with depressive symptomatology at T4, whereas emotion-oriented and avoidance-oriented coping were not significantly related to depressive symptomatology at T4.

In addition to the coping styles assessed in our study, it is possible that there are alternative means of coping that adolescents use, which could have moderated the relationship between total daily

recreational screen time at T0 and depressive symptomatology at T4. Adolescent substance abuse is considered a pressing public health concern (Kann et al., 2014), given that students and adolescents collectively use illicit drugs and consume alcohol more frequently than all other age groups (Canadian Centre on Substance Use and Addiction, 2017). Substance use and abuse, which are considered avoidant means of coping, may have a moderating effect on total daily recreational screen time and depressive symptomatology over time. Leonard et al. (2015) found that adolescents cited substance use as a main coping strategy to reduce stress and some identified their substance use as an emotion-oriented coping strategy, which gives them sense of control of their overly demanding lives.

We identified a significant two-way interaction between gender and avoidance-oriented coping at T0 on depressive symptomatology at T4, at average levels of total daily recreational screen time. Specifically, when females used higher levels of avoidance-oriented coping at T0, they reported higher levels of depressive symptomatology at T4. Conversely, when males used lower levels of avoidance-oriented coping, they reported higher levels of depressive symptomatology at T4. It appears that avoidance-oriented coping may act as a risk factor for depressive symptomatology among females and a protective factor for depressive symptomatology among males. Follow-up simple slope analyses confirmed trends. The trend for females is in line with previous longitudinal research, which has identified avoidance-oriented coping as a risk factor for depression for both males and females (Herman-Stahl et al., 1995; Holahan, Moos, Holahan, Brennan, & Schutte, 2005), in that by avoiding a stressor, it often becomes exacerbated over time, resulting in heightened distress. We found it unusual that males reported less depressive symptomatology when using increased avoidance-oriented coping, especially because we used a longitudinal design and expected that even if avoidance-oriented coping offered short-term benefits to males, this coping style would become detrimental over time. This finding however is in line with previous research, which found that males use avoidance-oriented coping to a greater extent than females and although considered a maladaptive coping strategy, still

experience less depressive symptomatology than females (Ongen, 2006). Perhaps, for males in our sample, the social component (e.g., going out to eat or socializing at a party) associated with avoidance-orientated coping provides them with a means of communicating and connecting with others, buffering against depressive symptomatology. It is also possible that males in our study sought social or emotional coping as part of their avoidance-oriented coping and although male adolescents do not seek social support as readily as female adolescents, they have been found to benefit from social support to a greater extent than their female counterparts (Piko, 2001).

Third, we expected that perceived social support would moderate the relationship between total daily recreational screen time at T0 and depressive symptomatology at T4. We also expected that results would be more pronounced among females. Contrary to our expectations, perceived social support did not moderate the relationship between total daily recreational screen time at T0 and depressive symptomatology at T4. However, perceived social support at T0 was significantly and negatively related to depressive symptomatology at T4. The three items included on the social support subscale assessed general perceived social support, and thus we do not know if participants answered the questions based on online experiences, real-life experiences, or a combination of the two. One speculation as to why perceived social support did not moderate the relationship between total daily recreational screen time at T0 and depressive symptomatology at T4 is that the social isolation (O’Keeffe & Clarke-Pearson, 2011; Primack et al., 2017) of high recreational screen time may be offset by gaining a sense of perceived social support from online interactions with peers, essentially washing out the effects of perceived social support.

We found it interesting that there was a significant three-way interaction between total daily recreational screen time at T0, gender, and perceived social support at T0, independent of depressive symptomatology at T0. When adolescents reported receiving low levels of social support, the relationship between total daily recreational screen time at T0 and depressive symptomatology at T4

was nonsignificant. However, when adolescents reported receiving high levels of perceived social support, higher total daily recreational screen time at T0 was associated with higher levels of depressive symptomatology at T4, and this relationship was stronger for males. One speculation that could explain these findings is that both male and female adolescents may perceive that they obtain most of their social support through technology-based platforms (e.g., online chats, interactive multiplayer videogames). Accordingly, although they receive support through technological means, they may also engage in simultaneous activities that are considered more maladaptive to their mental health (e.g., social comparison on SNSs and interaction in highly competitive videogames; Meier & Gray; Shafer, 2012), which could minimize the positive benefits of perceived social support and contribute to higher levels of depressive symptomatology, over time. A possible explanation as to why this relationship was stronger for males may be driven by males engaging in significantly higher levels of competitive videogames than females in the present study, which again may override the perceived social support they experience and contribute to higher levels of depressive symptomatology, over time. Adolescents also use screen time activities to escape reality, which has been linked to addictive tendencies (Kwon, Chung, & Lee, 2011) and to address mental health difficulties of daily life (e.g., social anxiety; Pierce, 2009). It is possible that adolescents find it easier to communicate with others via non-face-to-face communication methods, especially with perceived online anonymity. Though, given online anonymity, it is possible to lose contact with online friends without notice. Another possibility is that when our participants responded to the questionnaires, they were reminded of their lack of in-person social support, even though they have online friends.

Limitations & Strengths

Findings from the present study contribute novel information to the psychological literature. Though, study limitations must be acknowledged. First, the study included a convenience sample (i.e., adolescents in the National Capital Region of Canada), with a heavy attrition rate, and thus findings

cannot be generalized to the entire Canadian adolescent population. Next, the use of self-report measures may be related to memory recall and social desirability. It is important to note that participants reported engaging in recreational screen time activities for an average of 3-4.9 hours per day, which is less than the figures reported in the literature (e.g., average approximately 8 hours; Leatherdale & Ahmed, 2011; Leatherdale & Harvey, 2015). It is important to consider the possibility that participants in the present study underreported their total daily recreational screen time. Also, recreational screen time activities were limited to recreational computer use, television viewing, and videogame engagement. Therefore, it is possible that participants used other forms of recreational screen time activities (e.g., text message and smartphone applications) that were not captured by the measures used in the current study. However, it is important to note that participants' reported total daily recreational screen at T0 in 2006, is consistent with 2006 screen time data (Kiefl, 2011). Data are also limited to duration of recreational screen time use. It could have been beneficial to assess recreational screen time content in relation to interpersonal factors and depressive symptomatology.

Another limitation of the present study is that the perceived social support measure did not ask participants about the source of their received social support. For example, it would have been beneficial to know whether participants received their social support during face-to-face interactions, online, or from a combination of the two. On a related note, the attachment measure was dichotomized as secure and insecure, and thus it is unknown whether a particular type (i.e., preoccupied, dismissing, or fearful) was driving the insecure attachment style. It was also a brief attachment questionnaire and although validated, a more detailed evaluation of attachment may have yielded different results. In addition, there were almost 50% less males in our sample than females. As such, it is possible that we did not have enough male participants to detect certain effect in our male sample. It is also important to note that when the total daily recreational screen time $\times$ Gender interaction was included in the model, results were not significant. As such, models in Study 2 were run without this interaction term.

Finally, data were not missing at random. Participants who were removed from the study had a higher BMI and were older than those retained in the study. Perhaps older participants who had a higher BMI may have been more self-conscious of their depressive symptomatology and were reluctant to report about their psychosocial well-being, and thus they did not fill out many of the questionnaires. As such, results should be interpreted with some caution because our sample may not represent the whole population that we set out to investigate.

Despite the limitations, the present study has many strengths, including its implementation of a longitudinal sample and its use of well-validated questionnaires to assess interpersonal functioning and mental health. In addition, the present study offers a wealth of new knowledge, as we examined novel risk-protective mental health models in the adolescent domain, which is a timely contribution given the high prevalence rates of clinical and subclinical depression in this population (Kremer et al., 2014; Mojtabai et al., 2016). Accordingly, the limitations of the current study are balanced with the methodological strengths and theoretical and practical contributions.

Conclusion, Implications, & Future Direction

The significant and positive relationship between total daily recreational screen time at T0 and depressive symptomatology at T4 highlights that duration of recreational screen time in early adolescence is a risk factor for depressive symptomatology in late adolescence. This is particularly important given that our findings also showed that depressive symptomatology increased over time, similar to other research (e.g., Mojtabai et al., 2016), and the peak onset of clinical depression is during adolescence (Andersen & Teicher, 2008). Such findings, combined with the expectation that child and adolescent mental health will be one of the primary causes of morbidity, mortality, and disability (World Health Organization, 2001), speaks to the importance of focusing interventions on teaching adolescents adaptive ways to use recreational screen time with the goal of reducing the risk of experiencing future depressive symptomatology. Although attachment style, coping style, and

perceived social support did not emerge as significant moderators in the relationship between total daily recreational screen time at T0 and depressive symptomatology at T4, nonsignificant findings provide valuable information to researchers in terms of variables to consider or omit when designing intervention and prevention programs. However, given the novelty of this research, replication is advised before ruling out these variables as intervention targets. The two-and three-way interactions that emerged in the present study highlight the importance of considering gender differences in future program development and implementation. We aimed to keep the models simple in this preliminary study; however, future research may wish to examine changes in study variables over time, which would provide important information related to specific time points during the adolescent developmental period that moderating effects potentially emerge. For example, recreational screen time and attachment style have been found to shift during adolescence (i.e., secure to insecure and vice versa), and thus examining both recreational screen time and attachment at different time points over the course of several years would be beneficial. More accurate results of interpersonal functioning may also be captured using parental measures in addition to adolescent measures. Specific to the limitations of the recreational screen time measure used in the present study, future researchers should consider implementing measures that assess more accurate and comprehensive recreational screen time activities. That is, subsequent studies could consider including an application to track recreational screen time, which would result in a more objective estimate. As well, including qualitative research such as: adolescent focus groups, interviews, and open-ended survey questions, in addition to quantitative data would provide a better understanding of recreational screen time activities among adolescents; for example, functional and interpersonal needs these activities may meet and adaptive and maladaptive recreational screen time behaviours that could be related to adolescents' use of these technologies.

Future research could examine additional prevalent maladaptive coping mechanisms (e.g., substance use) among adolescents as moderating variables in the relationship between total daily recreational screen time and depressive symptomatology. Given that depressive symptomatology has been found to predict lower attachment over time (Allen et al., 2004), future studies could also focus on the bidirectionality of the relationship such that depressive symptomatology predicts recreational screen time with cognitive, affective, behavioural, and interpersonal moderating variables.

References

- Ainsworth, M. D. S., & Bowlby, J. (1991). An ethological approach to personality development. *American Psychologist*, 46, 333-341. doi:10.1037/0003-066X.46.4.333
- Albrecht, T. L., & Goldsmith, D. J. (2003). Social support, social networks, and health. In T. L. Thompson, A. M. Dorsey, K. I. Miller, & R. Parrott (Eds.), *Handbook of health communication* (pp. 263-284). Mahwah, NJ: Lawrence Erlbaum Associates.
- Allen, J. P., McElhaney, K. B., Kuperminc, G. P., & Jodl, K. M. (2004). Stability and change in attachment security across adolescence. *Child Development*, 75, 1792-1805. doi:10.1111/j.1467-8624.2004.00817.x
- Añez, E., Fornieles-Deu, A., Fauquet-Ars, J., López-Guimerà, G., Puntí-Vidal, J. & Sánchez-Carracedo, D. (2018). Body image dissatisfaction, physical activity and screen-time in Spanish adolescents. *Journal of Health Psychology*, 23, 36-47. doi: 10.1177/1359105316664134
- Anyan, F. & Hjemdal, O. (2016). Research paper Adolescent stress and symptoms of anxiety and depression: Resilience explains and differentiates the relationships. *Journal of Affective Disorders*, 203, 213-220.
- Arnett, J. J. (1999). Adolescent storm and stress, reconsidered. *American Psychologist*, 54, 317-326. doi:10.1037/0003-066X.54.5.317
- Babic, M. J., Smith, J. J., Morgan, P. J., Eather, N., Plotnikoff, R.C., & Lubans, D. R. (2017). Longitudinal associations between changes in screen-time and mental health outcomes in adolescents. *Mental Health and Physical Activity*, 12, 124-131.
- Baldwin, J. A., Brown, B. G., Wayment, H. A., Nez, R. A., & Brelsford, K. M. (2011). Culture and context: Buffering the relationship between stressful life events and risky behaviors in American Indian youth. *Substance Use and Misuse*, 46, 1380-1394. doi:10.3109/10826084.2011.592432

- Bank, B. J., & Hansford, S. L. (2000). Gender and friendship: Why are men's best same sex friendships less intimate and supportive? *Journal of the International Association for Relationship Research*, 7, 63-78.
- Barrera, M., & Garrison-Jones, C. (1992). Family and peer social support as specific correlates of adolescent depressive symptoms. *Journal of Abnormal Child Psychology*, 20, 1-16.
doi:10.1007/BF00927113
- Bartholomew, K., & Horowitz, L. M. (1991). Attachment styles among young adults: A test of four-category model. *Journal of Personality and Social Psychology*, 61, 226-244.
- Beck, A. T. (1976). *Cognitive therapy and the emotional disorders*. New York: International Universities Press.
- Beck, A. T. (1973). *The diagnosis and management of depression*. Philadelphia: University of Pennsylvania Press.
- Benson, L. P., Williams, R. J., & Novick, M. B. (2013). Pediatric obesity and depression: A cross-sectional analysis of absolute BMI as it relates to Children's Depression Index scores in obese 7- to 17-year-old children. *Clinical Pediatrics*, 52, 24-29. doi:10.1177/0009922812459949
- Beutel, M. E., Brähler, E., Glaesmer, H., Kuss, D. J., Wölfling, K., & Müller, K. W. (2011). Regular and problematic leisure-time Internet use in the community: Results from a German population-based survey. *Cyberpsychology, Behavior, and Social Networking*, 14, 291-296.
doi:10.1089/cyber.2010.0199
- Billings, A. G., & Moos, R. H. (1984). Coping, stress, and social resources among adults with unipolar depression. *Journal of Personality and Social Psychology*, 46, 877-891. doi:10.1037/0022-3514.46.4.877
- Bowlby, J. (1988). *A secure base: Parent-child attachment and healthy human development*. New York, NY: Basic Books.

- Brown, A. (2017, September 11). Young men play videogames, but so do a diverse group of other Americans. Retrieved from <http://www.pewresearch.org/fact-tank/2017/09/11/younger-men-play-video-games-but-so-do-a-diverse-group-of-other-americans/>
- Brumariu, L. E., & Kerns, K. A. (2010). Parent–child attachment and internalizing symptoms in childhood and adolescence: A review of empirical findings and future directions. *Development and Psychopathology*, 22, 177-203. doi:10.1017/S0954579409990344
- Buchholz, A. (1998). The role of female emotional development in relation to disordered eating and binge eating in adolescent girls (Unpublished doctoral dissertation). Concordia University, Montreal, Quebec, Canada.
- Canadian Centre on Substance Use and Addiction. (2017). *Student Drug Use*. Retrieved from <http://www.ccdus.ca/Eng/topics/Monitoring-Trends/Student-Drug-Use/Pages/default.aspx>
- Camara, M., Bacigalupe, G. & Padilla, P. (2017). The role of social support in adolescents: are you helping me or stressing me out? *International Journal of Adolescence and Youth*, 22, 123-136. doi: 10.1080/02673843.2013.875480
- Cao, H., Qian, Q., Weng, T., Yuan, C., Sun, Y., Wang, H., & Tao, F. (2011). Screen time, physical activity and mental health among urban adolescents in China. *Preventive Medicine*, 53, 316-320. doi:10.1016/j.ypmed.2011.09.002
- Cheng, C., Sun, P., & Mak, K. K. (2015). Internet addiction and psychosocial maladjustment: Avoidant coping and coping inflexibility as psychological mechanisms. *Cyberpsychology, Behavior, and Social Networking*, 18, 539-546. doi:10.1089/cyber.2015.0121
- Clark, H. K., Ringwalt, C. L., & Shamblen, S. R. (2011). Predicting adolescent substance use: The effects of depressed mood and positive expectancies. *Addictive Behaviors*, 36, 488-493. doi:10.1016/j.addbeh.2011.01.018

- Compas, B. E., Orosan, P. G., & Grant, K. E. (1993). Adolescent stress and coping: Implications for psychopathology during adolescence. *Journal of Adolescence*, *16*, 331-349.
doi:10.1006/jado.1993.1028
- Cook, S. H., Heinze, J. E., Miller, A. L., & Zimmerman, M. A. (2016). Transitions in friendship attachment during adolescence are associated with developmental trajectories of depression though adulthood. *Journal of Adolescent Health*, *58*, 260-266.
doi:10.1016/j.jadohealth.2015.10.252
- Debnam, K., Milam, A. J., Furr-Holden, C. D., & Bradshaw, C. (2016). The role of stress and spirituality in adolescent substance use. *Substance Use & Misuse*, *51*, 733-741.
doi:10.3109/10826084.2016.1155224
- Dempster, A. P., Laird, N. M., & Rubin, D. B. (1977). Maximum likelihood from incomplete data via the EM algorithm. *Journal of the Royal Statistical Society. Series B (Methodological)*, *39*, 1-38.
- Desjardins, T. L., & Leadbeater, B. J. (2011). Relational victimization and depressive symptoms in adolescence: Moderating effects of mother, father, and peer emotional support. *Journal of Youth and Adolescence*, *40*, 531-544. doi:10.1007/s10964-010-9562-1
- Duchesne, S., & Ratelle, C. F. (2014). Attachment security to mothers and fathers and the developmental trajectories of depressive symptoms in adolescence: Which parent for which trajectory? *Journal of Youth and Adolescence*, *43*, 641-654. doi:10.1007/s10964-013-0029-z
- Eberhart, N. K., & Hammen, C. L. (2006). Interpersonal predictors of onset of depression during the transition to adulthood. *Personal Relationships*, *13*, 195-206. doi:10.1111/j.1475-6811.2006.00113.x
- Eldeleklioğlu, J. (2008). Gender, romantic relationships, Internet use, perceived social support and social skills as the predictors of loneliness. *Egitim Arastirmalari - Eurasian Journal of Educational Research*, *33*, 127-140.

- Enders, C. K., & Bandalos, D. L. (2001). The relative performance of full information maximum likelihood estimation for missing data in structural equation models. *Structural Equation Modeling*, 8, 430-457. doi:10.1207/S15328007SEM0803_5
- Endler, N. S., & Parker, J. D. A. (1990a). Multidimensional assessment of coping: A critical evaluation. *Journal of Personality and Social Psychology*, 58, 844-854. doi:10.1037/0022-3514.58.5.844
- Endler, N. S., & Parker, J. D. A. (1990b). *Coping Inventory for Stressful Situations (CISS)*. Toronto: Multi-Health Systems.
- Faul, F., Erdfelder, E., Buchner, A., & Lang, A. G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, 41, 1149-1160.
- Flament, M. F., Hill, E. M., Buchholz, A., Henderson, K., Tasca, G. A., & Goldfield, G. (2012). Internalization of the thin and muscular body ideal and disordered eating in adolescence: The mediation effects of body esteem, *Body Image*, 9, 68-75. doi:10.1016/j.bodyim.2011.07.007
- Folkman, S., Lazarus, R. S., Gruen, R. J., & DeLongis, A. (1986). Appraisal, coping, health status, and psychological symptoms. *Journal of Personality and Social Psychology*, 50, 571-579.
- Fraley, R. C., & Shaver, P. R. (2000). Adult romantic attachment: Theoretical developments, emerging controversies, and unanswered questions. *Review of General Psychology*, 4, 132-154. doi:10.1037/1089-2680.4.2.132
- Frison, E., & Eggermont, S. (2015). The impact of daily stress on adolescents' depressed mood: The role of social support seeking through Facebook. *Computers in Human Behavior*, 44, 315-325. doi:10.1016/j.chb.2014.11.070
- Fröjd, S. A., Nissinen, E. S., Pelkonen, M. U. I., Marttunen, M. J., Koivisto, A.-M., & Kaltiala-Heino, R. (2008). Depression and school performance in middle adolescent boys and girls. *Journal of Adolescence*, 31, 485-498. doi:10.1016/j.adolescence.2007.08.006

- Furman, W., & Buhrmester, D. (1992). Age and sex differences in perceptions of networks of personal relationships. *Child Development*, 63, 103-115. doi:10.2307/1130905
- Godin, G., & Shephard, R. J. (1985). A simple method to assess exercise behavior in the community. *Canadian Journal of Applied Sports Science*, 10, 141-146.
- Goldfield, G. S., Henderson, K., Buchholz, A., Obeid, N., Nguyen, H., & Flament, M. F. (2011). Physical activity and psychological adjustment in adolescents. *Journal of Physical Activity and Health*, 8, 157-163.
- Goldfield, G. S., Murray, M. A., Maras, D., Wilson, A. L., Phillips, P., Kenny, G. P., ... Sigal, R. J. (2016). Screen time is associated with depressive symptomatology among obese adolescents: A HEARTY study. *European Journal of Pediatrics*, 175, 909-919. doi:10.1007/s00431-016-2720-z
- Griffin, D., & Bartholomew, K. (1994). Models of the self and other: Fundamental dimensions underlying measures of adult attachment. *Journal of Personality and Social Psychology*, 67, 430-445. doi:10.1037/0022-3514.67.3.430
- Grøntved, A., Singhammer, J., Froberg, K., Møller, N. C., Pan, A., Pfeiffer, K. A., & Kristensen, P. L. (2015). A prospective study of screen time in adolescence and depression symptoms in young adulthood. *Preventive Medicine*, 81, 108-113. doi:10.1016/j.ypmed.2015.08.009
- Gullone, E., & Robinson, K. (2005). The inventory of parent and peer attachment—Revised (IPPA-R) for children: A psychometric investigation. *Clinical Psychology & Psychotherapy*, 12, 67-79. doi:10.1002/cpp.433
- Gunnell, K. E., Flament, M. F., Buchholz, A., Henderson, K. A., Obeid, N., Schubert, N., & Goldfield, G. S. (2016). Examining the bidirectional relationship between physical activity, screen time, and symptoms of anxiety and depression over time during adolescence. *Preventive Medicine*, 88, 147-152. doi:10.1016/j.ypmed.2016.04.002

- Hawthorne, G. (2008). Perceived social isolation in a community sample: Its prevalence and correlates with aspects of peoples' lives. *Social Psychiatry and Psychiatric Epidemiology*, 43, 140-150. doi:10.1007/s00127-007-0279-8
- Hazan, C., & Shaver, P. (1987). Romantic love conceptualized as an attachment process. *Journal of Personality and Social Psychology*, 52, 511-524. doi:10.1037/0022-3514.52.3.511
- Healey, G. N., Wijndaele, K., Dunstan, D. W., Shaw, J. E., Salmon, J., Zimmet, P. Z., & Owen, N. (2008). Objectively measured sedentary time, physical activity, and metabolic risk: The Australian Diabetes, Obesity and Lifestyle Study. *Diabetes Care*, 31, 369-371. doi:10.2337/dc07-1795
- Herman-Stahl, M. A., Stemmler, M., & Petersen, A. C. (1995). Approach and avoidant coping: Implications for adolescent mental health. *Journal of Youth and Adolescence*, 24, 649-665. doi:10.1007/BF01536949
- Holahan, C. J., Moos, R. H., Holahan, C. K., Brennan, P. L., & Schutte, K. K. (2005). Stress generation, avoidance coping, and depressive symptoms: A 10-year model. *Journal of Consulting and Clinical Psychology*, 73, 658-666. doi:10.1037/0022-006X.73.4.658
- Jakobsen, I. S., Horwood, L. J., & Fergusson, D. M. (2012). Childhood anxiety/withdrawal, adolescent parent-child attachment and later risk of depression and anxiety disorder. *Journal of Child and Family Studies*, 21, 303-310. doi:10.1007/s10826-011-9476-x
- Jensen, M. P., Smith, A. E., Bombardier, C. H., Yorkston, K. M., Miró, J., & Molton, I. R. (2014). Social support, depression, and physical disability: Age and diagnostic group effects. *Disability & Health Journal*, 7, 164-172. doi:10.1016/j.dhjo.2013.11.001
- Jonsson, U., Bohman, H., von Knorring, L., Olsson, G., Paaren, A., & von Knorring, A.-L. (2011). Mental health outcome of long-term and episodic adolescent depression: 15-year follow-up of a community sample. *Journal of Affective Disorders*, 130, 395-404. doi:10.1016/j.jad.2010.10.046

Kann, L., Kinchen, S., Shanklin, S. L., Flint, K. H., Hawkins, J., Harris, W. A., ... Zaza, S. (2014).

Youth Risk Behavior Surveillance — United States, 2013. *MMWR Surveillance Summaries*, 63, 1-168. Retrieved from <http://www.jstor.org/stable/24806229>

Karavasilis, L., Doyle, A. B., & Markiewicz, D. (2003). Associations between parenting style and attachment to mother in middle childhood and adolescence. *International Journal of Behavioral Development*, 27, 153-164. doi:10.1080/0165025024400015

Katon, W., Richardson, L., Russo, J., McCarty, C. A., Rockhill, C., McCauley, E., ...

Grossman, D. C. (2010). Depressive symptoms in adolescence: The association with multiple health risk behaviors. *General Hospital Psychiatry*, 32, 233-239.

doi:10.1016/j.genhosppsych.2010.01.008

Kenny, D. A., Kashy, D. A., & Cook, W. L. (2006). *Dyadic Data Analysis*. New York, NY: The Guilford Press.

Keskin, G., & Çam, O. (2010). Adolescents' strengths and difficulties: Approach to attachment styles.

Journal of Psychiatric and Mental Health Nursing, 17, 433-441. doi:10.1111/j.1365-2850.2009.01540.x

Kiefl, B. (2011). *Trends in TV and Internet use: The impact of Internet TV on Canadian programming*.

Retrieved from

http://www.omdc.on.ca/Assets/Research/Research+Reports/Trends+in+TV+and+Internet+Use/Trends+in+TV+and+Internet+Use_en.pdf

Kovacs, M. (1985). The Child Depression Inventory (CDI). *Psychopharmacology Bulletin*, 21, 995-998.

Kovacs, M. (1992). *Children's Depression Inventory (CDI) Manual*. New York, NY: Multi-Health Systems.

- Kraut, R., Patterson, M., Lundmark, V., Kiesler, S., Mukopadhyay, T., & Scherlis, W. (1998). Internet paradox: A social media that reduces social involvement and psychological well-being? *American Psychologist*, 53, 1017-1031. doi:10.1037/0003-066X.53.9.1017
- Kremer, P., Elshaug, C., Leslie, E., Toumbourou, J. W., Patton, G. C., & Williams, J. (2014). Physical activity, leisure-time screen use and depression among children and young adolescents. *Journal of Science and Medicine in Sport*, 17, 183-187. doi:10.1016/j.jsams.2013.03.012
- Kwon, J.-H., Chung, C.-S., & Lee, J. (2011). The effects of escape from self and interpersonal relationship on the pathological use of Internet games. *Community Mental Health Journal*, 47, 113-121. doi:10.1007/s10597-009-9236-1
- Larson, R. W., Richards, M. H., Moneta, G., Holmbeck, G., & Duckett, E. (1996). Changes in adolescents' daily interactions with their families from ages 10 to 18: Disengagement and transformation. *Developmental Psychology*, 32, 744-754. doi:10.1037/0012-1649.32.4.744
- Lazarus, R. S., & Folkman, S. (1984). Stress, appraisal, and coping. New York, NY: Springer.
- Leatherdale, S. T., & Ahmed, R. (2011). Screen-based sedentary behaviours among a nationally representative sample of youth: Are Canadian kids couch potatoes? *Chronic Diseases and Injuries in Canada*, 31, 141-146.
- Leatherdale, S. T., & Harvey, A. (2015). Examining communication- and media-based recreational sedentary behaviors among Canadian youth: Results from the COMPASS study. *Preventive Medicine*, 74, 74-80. doi:10.1016/j.ypmed.2015.02.005
- Leonard, N. R., Gwadz, M. V., Ritchie, A., Linick, J. L., Cleland, C. M., Elliott, L., & Grethel, M. (2015). A multi-method exploratory study of stress, coping, and substance use among high school youth in private schools. *Frontiers in Psychology*, 6, 1028, doi:10.3389/fpsyg.2015.01028

- Maras, D., Flament, M. F., Murray, M., Buchholz, A., Henderson, K. A., Obeid, N., & Goldfield, G. S. (2015). Screen time is associated with depression and anxiety in Canadian youth. *Preventive Medicine*, 73, 133-138. doi:10.1016/j.ypmed.2015.01.029
- Matsuoka, N., Uji, M., Hiramura, H., Chen, Z., Shikai, N., Kishida, Y., & Kitamura, T. (2006). Adolescents' attachment style and early experiences: A gender difference. *Archives of Women's Mental Health*, 9, 23-29. doi:10.1007/s00737-005-0105-9
- Matthews, T., Danese, A., Wertz, J., Odgers, C. L., Ambler, A., Moffitt, T. E., & Arseneault, L. (2016). Social isolation, loneliness and depression in young adulthood: A behavioural genetic analysis. *Social Psychiatry and Psychiatric Epidemiology*, 51, 339-348. doi:10.1007/s00127-016-1178-7
- Matthey, S., & Petrovski, P. (2002). The Children's Depression Inventory: Error in cutoff scores for screening purposes. *Psychological Assessment*, 14, 146-149. doi:10.1037/1040-3590.14.2.146
- Matud, M. P. (2004). Gender differences in stress and coping styles. *Personality and Individual Differences*, 37, 1401-1415. doi:10.1016/j.paid.2004.01.010
- McKnight Investigators. (2003). Risk factors for the onset of eating disorders in adolescent girls: Results of the McKnight longitudinal risk factor study. *American Journal of Psychiatry*, 160, 248-254. doi:10.1176/ajp.160.2.248
- McWilliams, L. A., Cox, B. J., & Enns, M. W. (2003). Use of the Coping Inventory for Stressful Situations in a clinically depressed sample: Factor structure, personality correlates, and prediction of distress. *Journal of Clinical Psychology*, 59, 423-437. doi:10.1002/jclp.10080
- Meier, E. P., & Gray, J. (2014). Facebook photo activity associated with body image disturbance in adolescent girls. *Cyberpsychology, Behavior, and Social Networking*, 17, 199-206. doi:10.1089/cyber.2013.0305

- Messias, E., Castro, J., Saini, A., Usman, M., & Peeples, D. (2011). Sadness, suicide, and their association with video game and Internet overuse among teens: Results from the Youth Risk Behavior Survey 2007 and 2009. *Suicide and Life-Threatening Behavior*, 41, 307-315. doi:10.1111/j.1943-278X.2011.00030.x
- Mojtabai, R., Olfson, M., & Han, B. (2016). National trends in the prevalence and treatment of depression in adolescents and young adults. *Pediatrics*, 138, 1-10. doi:10.1542/peds.2016-1878
- Nakamura, H., Ohara, K., Kouda, K., Fujita, Y., Mase, T., Miyawaki, C., ... Ishikawa, T. (2012). Combined influence of media use on subjective health in elementary school children in Japan: A population-based study. *BMC Public Health*, 12, 432. doi:10.1186/1471-2458-12-432
- Newman, B. M., Newman, P. R., Griffen, S., O'Connor, K., & Spas, J. (2007). The relationship of social support to depressive symptoms during the transition to high school. *Adolescence*, 42, 441-459.
- Ongen, D. (2006). The relationships between coping strategies and depression among Turkish adolescents. *Social Behavior and Personality*, 34, 181-196.
- O'Keeffe, G. S., & Clarke-Pearson, K. (2011). The impact of social media on children, adolescents, and families. *Pediatrics*, 127, 800-804. doi:0.1542/peds.2011-0054
- Parker, G., Holmes, S., & Manicavasagar, V. (1986). Depression in general practice attenders: "Caseness", natural history and predictors of outcome. *Journal of Affective Disorders*, 10, 27-35. doi:10.1016/0165-0327(86)90046-7
- Paykel, E. S. (2003). Life events and affective disorders. *Acta Psychiatrica Scandinavica*, 108, 61-66. doi:10.1034/j.1600-0447.108.s418.13.x
- Pendley, J. S., Kasmien, L. J., Miller, D. L., Donze, J., Swenson, C., & Reeves, G. (2002). Peer and family support in children and adolescents with type 1 diabetes. *Journal of Pediatric Psychology*, 27, 429-438.

- Pierce, T. (2009). Social anxiety and technology: Face-to-face communication versus technological communication among teens. *Computers in Human Behavior*, 25, 1367-1372, doi:10.1016/j.chb.2009.06.003
- Piko, B. (2001). Gender differences and similarities on adolescents' ways of coping. *The Psychological Record*, 51, 223-235. doi:10.1007/BF03395396
- Primack, B. A., Swanier, B., Georgiopoulos, A. M., Land, S. R., & Fine, M. J. (2009). Association between media use in adolescence and depression in young adulthood: A longitudinal study. *Archives of General Psychiatry*, 66, 181-188. doi:10.1001/archgenpsychiatry.2008.532
- Ptacek, J. T., Smith, R. E., & Dodge, K. L. (1994). Gender differences in coping with stress: When stressor and appraisals do not differ. *Personality and Social Psychology Bulletin*, 20, 421-430. doi:10.1177/0146167294204009
- Ptacek, J. T., Smith, R. E., & Zanas, J. (1992). Gender, appraisal, and coping: A longitudinal analysis. *Journal of Personality*, 60, 747-770. doi:10.1111/j.1467-6494.1992.tb00272.x
- Prinstein, M. J., Borelli, J. L., Cheah, C. S. L., Simon, V. A., & Aikins, J. W. (2005). Adolescent girls' interpersonal vulnerability to depressive symptoms: A longitudinal examination of reassurance-seeking and peer relationships. *Journal of Abnormal Psychology*, 114, 676-688. doi:10.1037/0021-843X.114.4.676
- Rafnsson, F. D., Jonsson, F. H., & Windle, M. (2006). Coping strategies, stressful life events, problem behaviors, and depressed affect. *Anxiety, Stress & Coping*, 19, 241-257. doi:10.1080/10615800600679111
- Raja, S. N., McGee, R., & Stanton, W. R. (1992). Perceived attachments to parents and peers and psychological well-being in adolescence. *Journal of Youth and Adolescence*, 21, 471-485. doi:10.1007/BF01537898

- Richards, R., McGee, R., Williams, S. M., Welch, D., & Hancox, R. J. (2010). Adolescent screen time and attachment to parents and peers. *Archives of Pediatrics & Adolescent Medicine*, 164, 258-262. doi:10.1001/archpediatrics.2009.280
- Roberts, K. C., Yao, X., Carson, V., Chaput, J. P., Janssen, I. & Tremblay, M. S. (2017). Meeting the Canadian 24-hour movement guidelines for children and youth. *Health Reports*, 18, 3-7.
- Scaramella, L. V., Conger, R. D., & Simons, R. L. (1999). Parental protective influences and gender-specific increases in adolescent internalizing and externalizing problems. *Journal of Research on Adolescence*, 9, 111-141. doi:10.1207/s15327795jra0902_1
- Scharfe, E., & Bartholomew, K. (1994). Reliability and stability of adult attachment patterns. *Personal Relationships*, 1, 23-43. doi:10.1111/j.1475-6811.1994.tb00053.x
- Seiffge-Krenke, I., & Klessinger, N. (2000). Long-term effects of avoidant coping on adolescents' depressive symptoms. *Journal of Youth and Adolescence*, 29(6), 617-630.
- Shafer, D. M. (2012). Causes of state hostility and enjoyment in player versus player and player versus environment video games. *Journal of Communication*, 62, 719-737.
<http://dx.doi.org/10.1111/j.1460-2466.2012.01654.x>
- Shaw, L. H., & Gant, L. M. (2002). In defense of the Internet: The relationship between Internet communication and depression, loneliness, self-esteem, and perceived social support. *CyberPsychology & Behavior*, 5, 157-171. doi:10.1089/109493102753770552
- Stice, E., Ragan, J., & Randall, P. (2004). Prospective relations between social support and depression: Differential direction of effects for parent and peer support? *Journal of Abnormal Psychology*, 113, 155-159. doi:10.1037/0021-843X.113.1.155
- Sund, A. M., & Wichstrøm, L. (2002). Insecure attachment as a risk factor for future depressive symptoms in early adolescence. *Journal of the American Academy of Child & Adolescent Psychiatry*, 41, 1478-1485. doi:10.1097/01.CHI.0000024870.60748.3D

- Tabachnick, B. G., & Fidell, L. S. (2013). Using multivariate statistics (6th ed.). Boston, MA: Pearson.
- Tanaka, N., Hasui, C., Uji, M., Hiramura, H., Chen, Z., Shikai, N., & Kitamura, T. (2008). Correlates of the categories of adolescent attachment styles: Perceived rearing, family function, early life events, and personality. *Psychiatry and Clinical Neurosciences*, 62, 65-74. doi:10.1111/j.1440-1819.2007.01777.x
- Taylor, O. D. (2011). Adolescent depression as a contributing factor to the development of substance use disorders. *Journal of Human Behavior in the Social Environment*, 21, 696-710. doi:10.1080/10911359.2011.583519
- Thapar, A., Collishaw, S., Pine, D. S., & Thapar, A. K. (2012). Depression in adolescence. *The Lancet*, 379, 1056-1067. doi:10.1016/S0140-6736(11)60871-4
- Timbremont, B., Braet, C., & Dreessen, L. (2004). Assessing depression in youth: Relation between the Children's Depression Inventory and a structured interview. *Journal of Clinical Child and Adolescent Psychology*, 33, 149-157. doi:10.1207/S15374424JCCP3301_14
- Turner, P. J. (1991). Relations between attachment, gender, and behavior with peers in preschool. *Child Development*, 62, 1475-1488. doi:10.1111/j.1467-8624.1991.tb01619.x
- Wade, T. J., Cairney, J., & Pevalin, D. J. (2002). Emergence of gender differences in depression during adolescence: National panel results from three countries. *Journal of the American Academy of Child and Adolescent Psychiatry*, 41, 190-198. doi:10.1097/00004583-200202000-00013
- Weber, S., Puskar, K. R., & Ren, D. (2010). Relationships between depressive symptoms and perceived social support, self-esteem, & optimism in a sample of rural adolescents. *Issues in Mental Health Nursing*, 31, 584-588. doi:10.3109/01612841003775061
- World Health Organization. (2001). *Mental Health: A Call for Action by World Health Ministers*. Geneva, Switzerland, 1-21.

- Yaakobi, E., & Goldenberg, J. (2014). Social relationships and information dissemination in virtual social network systems: An attachment theory perspective. *Computers in Human Behavior*, 38, 127-135. doi:10.1016/j.chb.2014.05.025
- Zarbatany, L., Conley, R., & Pepper, S. (2004). Personality and gender differences in friendship needs and experiences in preadolescence and young adulthood. *International Journal of Behavioral Development*, 28, 229-310.

General Discussion

General Summary of Main Findings

The present dissertation had two main objectives: (a) to extend current research, which has identified a link between recreational screen time and depressive symptomatology among adolescents, by examining potential underlying cognitive, behavioural, and affective mechanisms that may explain this relationship over time, and (b) to examine the role of potential moderating interpersonal variables that may strengthen or weaken the relationship between total daily recreational screen time and depressive symptomatology among adolescents over time. Understanding the role that mediating and moderating variables play in the relationship between adolescents' daily recreational screen time and depressive symptomatology over time can inform effective integrative mental health prevention and treatment programs that target important adolescent issues. This dissertation was informed by the CBT framework in that adolescents' behaviour can influence maladaptive cognitions, affect, and maladaptive behaviours in a cyclical manner. Across both studies, most adolescents exceeded the less than 2-hour daily screen time recommendation (Roberts et al., 2017) by 1-3 hours on weekdays and up to 6 hours on weekends.

The two studies confirm previous cross-sectional (Benson et al., 2013; Goldfield et al., 2016; Maras et al., 2015; Messias et al., 2011) and longitudinal (Grøntved et al., 2015; Khouja et al., 2017; Primack et al., 2009) research, which has found that recreational screen time activities are associated with increased depressive symptomatology. General findings also demonstrated an upward trajectory of depressive symptomatology, especially for males, from T0 to T4, highlighting the importance of examining risk factors for adolescent depression. Males and females reported significantly higher levels of total daily videogame engagement and total daily recreational computer use (Brown, 2017; Kovess-Masfety et al., 2016), respectively. Though total daily recreational computer use between genders is quite comparable in the literature, Lenhart (2015) found that females reported using SNSs

more often than males. It is also important to note that, in both studies, separate recreational screen time activities at T0 were not significantly predictive of depressive symptomatology at T4, suggesting that dose or duration of total daily recreational screen time activities likely work in combination to predict depressive symptomatology among adolescents more robustly than individual recreational screen time activities alone.

Although many of the proposed mediating and moderating variables did not play a meaningful role in the relationship between total daily recreational screen time and depressive symptomatology, some hypotheses were confirmed and several unexpected and indirect relationships emerged. In Study 1, appearance (dis)satisfaction at T2 mediated the relationship between total daily recreational screen time activities at T0 and depressive symptomatology at T4, independent of age and depressive symptomatology at T0. Weight satisfaction and disordered eating behaviours (i.e., restrained and emotional eating) did not emerge as significant mediators. In Study 2, attachment style, coping style, and perceived social support at T0 did not moderate the relationship between total daily recreational screen time at T0 and depressive symptomatology at T4. However, a significant two-way interaction between gender and attachment style predicting depressive symptomatology over time emerged. I also found a significant three-way interaction between total daily recreational screen time at T0, perceived social support at T0, and gender, predicting depressive symptomatology over time. The General Discussion will discuss the (a) specific relationships between the main variables of interest in Study 1 and Study 2, (b) general limitations and strengths of the present studies, and (c) implications of the findings and possible future directions.

Study 1: Summary of Findings

The focus of Study 1 was to examine the mediating role of body image (i.e., appearance satisfaction and weight satisfaction) and disordered eating behaviours (i.e., restrained eating and emotional eating) in the relationship between total daily recreational screen time at T0 and depressive

symptomatology at T4, independent of age and depressive symptomatology at T0. Results partially supported the longitudinal path analysis model. First, total daily recreational screen time at T0 was negatively associated with weight satisfaction and appearance satisfaction at T2. The most notable and novel finding was that appearance (dis)satisfaction at T2 emerged as an underlying mechanism in the relationship between total daily recreational screen time activities at T0 and higher depressive symptomatology at T4.

Although disordered eating behaviours did not mediate the relationship between total daily recreational screen time and depressive symptomatology, over time, two indirect effects emerged. First, total daily recreational screen time at T0 was significantly and positively related to emotional eating at T2, as expected. Second, and unexpectedly, restrained eating at T2 was significantly and negatively related to depressive symptomatology at T4. A plausible explanation is that individuals who engage in higher levels of restrained eating may be better at regulating their emotions (e.g., very controlled). Restrained eating could also result in short term feelings of empowerment, which would explain reduced depressive symptomatology. Nevertheless, given that female adolescents who restrict their food intake are more susceptible to future diagnosable eating disorders (Patton, Johnson-Sabine, Wood, Mann, & Wakeling, 1990), this is an important topic to address in replication studies and prevention and treatment programs.

When recreational screen time activities were examined separately, total daily recreational computer use at T0 significantly predicted emotional eating at T2, suggesting that adolescents may in part, use food to cope with the negative affect that they experienced during daily recreational computer use. As well, increased total daily recreational computer use at T0 emerged as a risk factor for females and a protective factor for males for restrained eating at T2. For both males and females, increased total daily videogame engagement was related to decreased restrained eating; however, this effect was more pronounced among males. These findings suggest that when videogames are played in

moderation, they may offer adolescents a means of coping that is associated with reduced restrained eating. The majority of adolescents in the present sample reported less than 1 hour of daily videogame engagement per day, which lends support to the notion that engaging in videogames in moderation could allow one to experience positive mental health effects. Alternatively, individuals with good mental health may use videogames in moderation, because they are well balanced. To summarize, Study 1 revealed an association between total daily recreational screen time activities and increased risk for body image concerns and emotional eating, and depressive symptomatology over time. This is the first known study to identify that appearance (dis)satisfaction helps to explain the relationship between recreational screen time activities and depressive symptomatology over time.

It remains unclear in Study 1 why appearance (dis)satisfaction mediated the relationship between total daily recreational screen time and depressive symptomatology while weight (dis)satisfaction did not. Perhaps the countless images that recreational screen time activities expose adolescents to and the feedback they receive while engaging in recreational screen time activities could contribute to a more global negative perception of body image, instead of only one facet, such as weight. It is also possible that many adolescents perceive having the means to modify weight concerns through diet and exercise, whereas modifying facial features are typically less viable during adolescence, which over time, through repeated comparison, becomes associated with depressive symptomatology. Future research should examine the specific recreational computer activities and videogames that female adolescents engage in and how content-specific activities contributes to increased restrained eating. With respect to the negative relationship between restrained eating at T2 and depressive symptomatology at T4, it is important to consider that most weight-control behaviours, even those considered adaptive in nature can include a restrained eating component (Westenhoefer et al., 2013). This may provide adolescents with a sense of empowerment and more positive feelings about their bodies and result in less depressive symptomatology over time. In Study 1, although

directionality of variables in the model can be discussed, causal conclusions cannot be drawn without an experimental design. Future research will require manipulations of adolescents' exposure to recreational screen time activities to establish more definitive causal relationships.

Study 2: Summary of Findings

The focus of Study 2 was to use hierarchical multiple linear regression models to examine whether total daily recreational screen time interacted with interpersonal factors (i.e., attachment style, coping style, and perceived social support) to increase or buffer an adolescent's risk for experiencing depressive symptomatology at T4, independent of depressive symptomatology at T0.

Contrary to expectation, attachment style at T0 did not moderate the relationship between total daily recreational screen time at T0 and depressive symptomatology at T4; however, a significant two-way interaction between gender and attachment style emerged. For males, insecure attachment style at T0 was identified as a risk factor for depressive symptomatology at T4. Based on past literature (e.g., Turner, 1991), manifestation of insecure attachment among males may be considered more maladaptive in nature (e.g., aggression and attention-seeking behaviours), and thus more strongly related to negative psychological outcomes, such as depressive symptomatology, over time.

Another finding that was contrary to my expectation was that coping style at T0 did not moderate the relationship between total daily recreational screen time at T0 and depressive symptomatology at T4; however, a significant two-way interaction was identified between gender and avoidance-oriented coping at T0 on depressive symptomatology at T4. A trend emerged in that avoidance-orientated coping emerged as a risk factor for depressive symptomatology over time for females and a protective factor for males. The trend for females is in line with previous longitudinal research, which has identified avoidance-oriented coping as a risk factor for depression for both males and females (Herman-Stahl, Stemmler, & Petersen, 1995; Holahan, Moos, Holahan, Brennan, & Schutte, 2005). To be specific, if a stressor is avoided, it often exacerbates over time, resulting in

heightened distress. Holahan et al. (2005) found that avoidance-oriented coping at baseline predicted increased life stressors at four-year follow-up, which in turn, predicted increased depressive symptomatology at 10-year follow-up. For males, the social component (e.g., going to a party, going out for a snack or a meal) associated with avoidance-orientated coping may act as a means of communicating and connecting with others.

Although perceived social support at T0 did not moderate the relationship between total daily recreational screen time at T0 and depressive symptomatology at T4, a significant three-way interaction emerged between total daily recreational screen time, perceived social support, and gender. When individuals reported receiving higher levels of perceived social support, more daily recreational screen time at T0 was associated with increased depressive symptomatology at T4, and this relationship was stronger for males. It may be that adolescents obtain much of their perceived social support through technology and the deferential effects of recreational screen time may override the positive benefits adolescents received (i.e., perceived social support), which could contribute to the development of depressive symptomatology over time. An explanation as to why the relationship was stronger for males could be driven by males engaging in significantly higher levels of competitive videogames than females (Shafer, 2012), which may override the perceived social support they experience and contribute to increased depressive symptomatology over time.

General Limitations & Strengths

Findings from the two studies contribute important information to a growing body of literature, but there are limitations that should be addressed. First, the sample of adolescents was from the National Capital Region of Canada and included a high attrition rate, which limits the generalizability of the findings. Therefore, the results of these two studies are not considered representative of the broader Canadian adolescent population. Second, the REAL Study assessed the main variables examined in these two studies using self-report measures, which are susceptible to issues of memory

recall and social desirability. As such, it is important to consider that adolescents may have underreported their amount of total daily recreational screen time due to social desirability bias or have given an inaccurate report due to the difficulty of gauging the amount of time spent engaged in these activities on an average day. However, our recreational screen time data indicate that participants' self-reported daily television viewing and Internet use are highly consistent with Canadian screen time data from 2006 (Kiefl, 2011), when the longitudinal component of the REAL Study began. Third, the variables that define recreational screen time activities in the present studies were limited to recreational computer use, videogame engagement, and television viewing because the study began in 2006, predating smartphone and tablet usage. It is quite possible that more contemporary forms of recreational screen time activities, such as text messaging and smartphone applications, are related to the variables of interest. As well, the data do not provide information on the content that adolescents viewed on screens, as the measure only inquired about the amount of time spent engaged in daily recreational screen time activities. The inclusion of a social comparison, perceived stress, and loneliness measure could have confirmed the negative effects associated with total daily recreational screen time that have been identified in past research and provided more concrete evidence regarding why adolescents engage in maladaptive coping strategies after using recreational screen time. Including these measures in future research could shed light on why interpersonal factors (i.e., attachment style, coping style, and perceived social support) were not significant moderators in the relationship between total daily recreational screen time and depressive symptomatology. It is also important to note that the sample comprised almost twice as many females than males. As such, it is possible that I did not have enough participants to detect certain effects in males. With the exception of appearance satisfaction and recreational screen time at baseline, it is important to acknowledge the small amount of variance that the other potential mediating and moderating variables accounted for in

depressive symptomatology at T4. This highlights the need for researchers to continue to examine psychosocial variables that place adolescents at risk for depression.

Specific to Study 2, when the total daily recreational screen time $\times$ Gender interaction was included in the model, results were not significant. As such, models in Study 2 were run without this interaction term. The attachment measure was dichotomized as secure and insecure, and thus it is unknown whether a particular type (e.g., preoccupied, dismissing, or fearful) was driving the insecure attachment style. It was also a brief attachment questionnaire and although validated, a more detailed evaluation of attachment may have yielded different results. The perceived social support was also a brief measure and although participants were asked to base their answers on experiences over the past year, more recent positive (e.g., connecting with a new group of friends) or negative (e.g., break up with romantic partner) interpersonal interactions could have skewed their responses. As well, the measure did not assess the source of participants' received social support (e.g., online, in person, friends, family members). Having knowledge about the source of adolescents' perceived social support could have helped to explain its role in relation to recreational screen time activities and depressive symptomatology. For example, given that at higher perceived social support, more recreational screen time was related to increased depressive symptomatology over time, perhaps many adolescents use recreational screen time to obtain support from friends online, which may be lower in quality than face-to-face support. In a recent study for example, 17% of adolescents perceived that social media platforms result in less purposeful human interaction and can be damaging to relationships (Anderson & Jiang, 2018). Finally, in Study 2, data were not missing at random. In particular, participants who were removed from the study due to missing data had a higher BMI and were older than those retained in the study. Perhaps older participants who had a higher BMI may have been more self-conscious of their depressive symptomatology and were reluctant to report on their psychosocial well-being, and thus they did not fill out many of the questionnaires. As such, given the heavy attrition in conjunction

with missing data, results should be interpreted with some caution because the sample may not represent the entire population that I set out to investigate. However, it is important to note that the analyses attempted to compensate for this shortcoming.

Despite the considered caveats, both studies included well-validated questionnaires to assess mental health factors and employed a longitudinal design and advanced statistical analyses. This research is timely and addresses important areas of adolescent mental health. The majority of research in the area of adolescent recreational screen time and mental health has been overwhelmingly cross-sectional in nature and, to my knowledge, researchers have not examined underlying variables that may mediate or moderate the relationship between total daily recreational screen time and depressive symptomatology. As such, limitations of the present studies are balanced with the methodological strengths and theoretical and practical contributions. For example, having knowledge that appearance (dis)satisfaction helps to explain the relationship between recreational screen time and depressive symptomatology over time highlights the importance of teaching and encouraging adolescents to view and interpret screen based media with a critical eye. Having knowledge of factors that increase adolescents' risk for depressive symptomatology is crucial. For example, male gender combined with insecure (i.e., low) attachment style increases risk of depressive symptomatology over time, which is important knowledge for clinicians who work with male adolescents. Also noteworthy from the present dissertation is that adolescents may obtain social support via online platforms for various reasons such as convenience and anonymity. However, they also may use these platforms to simultaneously engage in maladaptive behaviours (e.g., social comparison, highly competitive videogames), which in turn could diminish the positive effects of social support and contribute to depressive symptomatology over time, especially among males. Clinicians could use this information for example to monitor the impact that competitive videogames have on adolescent males' depressive symptomatology, especially those who report excessive use and social isolation.

Contemporary Recreational Screen Time Data

Given that the REAL Study's data collection ended in 2013, it is important to examine how results compare with more contemporary data. Smartphones and social media applications are popular pastimes for adolescents of present day. According to Lenhart (2015), 73% of adolescents used smartphones. Recent Korean research has found that adolescents who researchers identified as highly addicted to their smartphones reported skipping meals more frequently, weight gain, and sleep problems (Kim, Lee, & Lim, 2017). Korean research has also identified gender differences in smartphone use, with male adolescents using them more frequently for gaming and female adolescents for SNSs (Kim, Nam, Oh, & Kang, 2016).

Research has also linked the use of digital technology to sleep disturbance. Lemola, Perkinson-Gloor, Brand, Dewald-Kaufmann, and Grob (2015) identified sleep disturbance as a mediating variable in the relationship between digital technology use and depressive symptomatology among adolescents. Recent longitudinal American research, which revealed that adolescents engaged in recreational screen time for 2.3 hours per day, also showed that increased use of digital technology in early adolescence predicted deficits in self-regulation and conduct problems a year and a half later (George, Russell, Piontak, & Odgers, 2018). Their study highlighted the positive impacts that smartphone use can have on at-risk children and adolescents. For example, George et al. (2018) found that on days that individuals reported engaging in more Internet use and sending a greater number of text messages, participants reported less anxiety symptomatology. They also found that on days that individuals reported sending more text messages, these individuals reported less anxiety and depressive symptomatology. George et al. (2018) offered speculations for their findings. They suggested that adolescents may use social networking platforms to connect with others in more positive ways, may use technology as a means of coping or distracting themselves from rumination and maladaptive thoughts, or may be more active when using recreational screen time activities on days when they

experience fewer mental health symptoms. It is also important to consider that adolescents in their sample reported daily recreational screen time rates similar to the recommended guidelines, and this balanced approach to screen time may explain why they did not identify a positive relationship between recreational screen time and depressive symptomatology.

Smartphone research in North America appears to be quite limited. Among American college students, females reported spending approximately 10 hours and males reported spending slightly more than 7.5 hours on their smartphones each day (Roberts, Yaya, & Manolis, 2014). Participants reported that texting, checking e-mail, and using SNSs were their three most common activities. Roberts et al. (2014) also found that females reported a significantly higher level of cell phone addiction compared to males. Although females also reported using Facebook more often than males, Facebook use significantly predicted smartphone addiction for males only, which suggests that females may use Facebook to strengthen friendships and expand their online social network. Similarly, although females invested more time in text messages compared to males, they did not send more text messages, suggesting that they may use text to maintain relationships. However, other SNSs, such as Instagram and Pinterest, were significantly predictive of smartphone addiction for females. Roberts et al. (2014) suggest that smartphone addiction can be viewed as a “secondary addiction” in that it is a means of escaping a more important issue (e.g., low self-worth, interpersonal difficulties, or boredom). Roberts et al. (2014) highlight the importance of further investigating why specific smartphone activities involve a more addictive component and identifying how these activities satisfy individual needs.

Conclusion, Implications, & Future Direction

Digital media developers introduced screen time activities with good intentions and these forms of technology can serve functional needs. They can assist with cognitive development and literacy and language skills from an early age (Paediatrics & Child Health, 2017). Videogame engagement specifically, has been related to benefits in areas of motivation, emotion, cognitive, and social

behaviour (see Granic, Lobel, & Engels, 2014). However, as recreational screen time activities become increasingly ingrained in adolescents' daily lives and given the many mental health concerns during this developmental period (World Health Organization, 2018), continued research in this area is warranted. Within the aforementioned limitations, the present studies provide support for the role that recreational screen time activities play in adolescent depressive symptomatology. In sum, the current body of research demonstrates an association between total daily recreational screen time and risk for body image concerns, emotional eating, and depressive symptomatology over time. To my knowledge, previous research has not investigated a model incorporating body image and disordered eating behaviours as mediating variables in the relationship between total daily recreational screen time activities and depressive symptomatology among adolescents over time, controlling for baseline depressive symptomatology and age. Also, to my knowledge, this is the first known study to identify appearance (dis)satisfaction as a mediating variable between total daily recreational screen time and depressive symptomatology, independent of age and depressive symptomatology at T0, among adolescents, longitudinally.

From a theoretical perspective, the present dissertation's findings support cognitive behavioural theory, demonstrating that cognitions, behaviours, and affect work together to place adolescents at risk for mental health concerns. The majority of adolescents in the present study reported spending between 3-4.9 or 5-8 hours in recreational screen time activities per day and more recent research suggests that over the years, recreational screen time use has increased among adolescents (Anderson & Jiang, 2018; Leatherdale & Harvey, 2015; Lenhart, 2015). Accordingly, it is important to consider the displacement hypothesis (Kraut et al., 1998), regarding the more adaptive activities that adolescents may not be participating in due to their increased time spent in recreational screen time activities. Although findings revealed that for adolescents in the present study, screen time activities contributed minimally to depressive symptomatology over time, these findings nevertheless support previous longitudinal

research (Babic et al., 2017; Grøntved et al., 2015; Primack, Swanier, Georgiopoulos, Land, & Fine, 2009) and extend current research by identifying appearance (dis)satisfaction as a factor that helps to explain the relationship between recreational screen time activities and depressive symptomatology among adolescents over time. Similarly, findings can act as a baseline of recreational screen time activities in relation to adolescent mental health (e.g., disordered eating behaviours, body image, and depressive symptomatology) against which more contemporary data can be compared.

Regarding clinical implications, findings from the present study offer important information for adults who can teach or guide adolescents to use recreational screen time responsibility. For example, parents can include adolescents in conversation regarding setting realistic time limits, customized to the family environment, on their recreational screen time use and ensuring that they understand the rationale for time limits (e.g., having time for homework completion and extracurricular activities, and sleep). It could also be advantageous for parents to involve children in the planning of “screen-free” activities to promote in-person interaction. Efforts can also be made to educate parents about modeling of adaptive recreational screen time use (i.e., balancing screen time with human interaction), and informing them about warning signs regarding maladaptive use of these technologies. As well, school-based media literacy programs for adolescents should consider incorporating discussions and activities regarding strategies to teach adolescents to view media content with a critical eye, to buffer against negative effects of recreational screen time on their mental health.

In terms of methodological implications, given the novelty of the research, findings highlight important directions for future research, including broadening measurement to include contemporary forms of recreational screen time (e.g., smartphones, tablets, and social media applications) and more objective measures of recreational screen time activities. However, with rapid changes in the popularity and introduction of new screen time activities (Anderson & Jiang, 2018), comes the challenge of studying recreational screen time longitudinally. As such, it is important for future

researchers to collect and use recreational screen time data in a timely fashion. It will be equally important for researchers to remain current about recreational screen time activities and strategize ways to study screen time activities accurately and effectively.

With respect to obtaining a more comprehensive picture of how recreational screen time impacts adolescents' mental health, both positively and negatively, future researchers could consider including an application that tracks adolescents' recreational screen time, which would render a more objective estimate of recreational screen time use. As well, including qualitative research (i.e., adolescent focus groups, interviews, and open-ended questions), in addition to quantitative measures would provide a better understanding of recreational screen time activities. Specifically, such an approach could provide researchers with information about functional and interpersonal needs that are being met by screen-based activities. Survey research has found that 45% of adolescents report being online "almost constantly" (Anderson & Jiang, 2018). It is necessary however, to tease out adaptive adolescent screen time activities, given that not all recreational screen time activities are equal (i.e., watching a documentary online versus engaging in social comparison behaviours on SNSs). An important avenue for future research is to collect more specific data, preferably qualitative, on content of recreational screen time activities to better understand how content-specific activities contribute to adolescent mental health. For example, recent recreational screen time research found that particular forms of media such as SNSs evoke psychological process (e.g., social comparison behaviours) that contribute to body image concerns among male and female young adults (Santarossa & Woodruff, 2017).

With respect to the interpersonal factors assessed in Study 2, first, future research may wish to obtain more comprehensive and objective perspectives of adolescent attachment, possibly using a more extensive attachment measure with parent reports. More accurate results may also be more optimally captured using parental measures of attachment style in addition to adolescent measures. Second,

future research studies could examine additional prevalent coping mechanisms (e.g., substance use) among adolescents, as moderating variables. Third, future studies may wish to include a more comprehensive social support measure to better understand quality, quantity, and source of the perceived social support.

To complement the present dissertation's findings, forthcoming research may also focus on advanced statistical modelling, such as latent change scores (Selig & Preacher, 2009), to examine how changes in recreational screen time are related to changes in body image, disordered eating behaviours, and interpersonal factors and depressive symptomatology among adolescents. Given the novelty of examining mediating and moderating variables in relation to total daily recreational screen time and depressive symptomatology over time, I kept models simple; however, examining changes in study variables at more time points could provide important information related to specific time points during the adolescent developmental period that mediating and moderating effects potentially emerge. Also, because depressive symptomatology scores were higher for females at baseline, but increased significantly over time for males only, future studies could control for gender differences in timing of puberty to help address this limitation.

Future studies may also wish to examine the bidirectionality of the relationships such that depressive symptomatology predicts total daily recreational screen time and examine whether this relationship is mediated or moderated by body image, disordered eating behaviours, and interpersonal factors. Given that recreational screen time activities are an integral part of adolescents' daily lives, it is important to acknowledge the benefits of balancing these activities with adolescents' human interaction and many other commitments. Encouraging adolescents to develop a healthy relationship with screen time activities will help to ensure that these technologies serve the leisure and functional purposes for which they were intended. From a protective-factor perspective, recreational screen time used in moderation may help buffer against adolescent depressive symptomatology. For example,

adolescents have described that SNSs such as Facebook are associated with stronger social connectedness (Anderson & Jiang, 2018), and researchers have linked increased “Facebook social connectedness” to better psychological health among adolescents and adults alike (Grieve, Indian, Witteveen, Tolan, & Marrington, 2013).

To conclude, with evidence pointing to the increased rates of daily recreational screen time and the link between recreational screen time and adolescent mental health, it is important to continue to assess factors that increase or decrease adolescents’ risk of developing future depressive symptomatology. Findings from the present dissertation make an important and unique, contribution to the growing psychological literature. This knowledge can be used as a foundation for researchers to further delineate longitudinal models of mediating and moderating variables in relation to popular digital technologies and adolescent mental health.

References

(as cited in the General Introduction and General Discussion)

- Active Healthy Kids Canada. (2013). *Are we driving our kids to unhealthy habits? The 2013 Active Healthy Kids Canada Report Card on physical activity for children and youth*. Retrieved from http://dvqdas9jty7g6.cloudfront.net/reportcard2013/Active-Healthy-Kids-2013-Report-Card_en.pdf
- Ainsworth, M. D. S., Blehar, M. C., Waters, E., & Wall, S. (2014). *Patterns of attachment: A psychological study of the strange situation*. New York, NY: Psychology Press. (Original work published 1978)
- Ainsworth, M. D. S., & Bowlby, J. (1991). An ethological approach to personality development. *American Psychologist*, 46, 333-341. doi:10.1037/0003-066X.46.4.333
- Albrecht, T. L., & Goldsmith, D. J. (2003). Social support, social networks, and health. In T. L. Thompson, A. M. Dorsey, K. I. Miller, & R. Parrott (Eds.), *Handbook of health communication* (pp. 263-284). Mahwah, NJ: Lawrence Erlbaum Associates.
- Allen, K. L., Byrne, S. M., La Puma, M., McLean, N., & Davis, E. A. (2008). The onset and course of binge eating in 8- to 13-year-old healthy weight, overweight and obese children. *Eating Behaviors*, 9, 438-446. doi:10.1016/j.eatbeh.2008.07.008
- Allen, K. L., Crosby, R. D., Oddy, W. H., & Byrne, S. M. (2013). Eating disorder symptom trajectories in adolescence: Effects of time, participant sex, and early adolescent depressive symptoms. *Journal of Eating Disorders*, 1, 1-14. doi:10.1186/2050-2974-1-32
- American Academy of Pediatrics (2016). *American Academy of Pediatrics Announces New Recommendations for Children's Media Use*. Retrieved from <https://www.aap.org/en-us/about-the-aap/aap-press-room/Pages/American-Academy-of-Pediatrics-Announces-New-Recommendations-for-Childrens-Media-Use.aspx>

- American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.). Washington, DC: American Psychiatric Association.
- American Psychological Association. (2010). *Depression: How Psychotherapy and other treatments can help people recover*. Retrieved from <http://www.apa.org/topics/depress/recover.aspx>
- Amirkhan, J. H. (1990). A factor analytically derived measure of coping: The Coping Strategy Indicator. *Journal of Personality and Social Psychology*, 59, 1066-1074. doi:10.1037/0022-3514.59.5.1066
- Andersen, S. L., & Teicher, M. H. (2008). Stress, sensitive periods and maturational events in adolescent depression. *Trends in Neurosciences*, 31, 183-191. doi:10.1016/j.tins.2008.01.004
- Anton, S. D., Newton, R. L., Sothorn, M., Martin, C. K., Stewart, T. M., & Williamson, D. A. (2006). Association of depression with body mass index, sedentary behavior, and maladaptive eating attitudes and behaviors in 11 to 13-year old children. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 11, e102-e108. doi:10.1007/BF03327566
- Arcelus, J., Mitchell, A. J., Wales, J., & Nielsen, S. (2011). Mortality rates in patients with anorexia nervosa and other eating disorders. *Archives of General Psychiatry*, 68, 724-731. doi:10.1001/archgenpsychiatry.2011.74
- Arnett, J. J. (1999). Adolescent storm and stress, reconsidered. *American Psychologist*, 54, 317-326. doi:10.1037/0003-066X.54.5.317
- Asarnow, J. R., Carlson, G. A., & Guthrie, D. (1987). Coping strategies, self-perceptions, hopelessness, and perceived family environments in depressed and suicidal children. *Journal of Consulting and Clinical Psychology*, 55, 361-366. doi:10.1037/0022-006X.55.3.361
- Anyan, F. & Hjemdal, O. (2016). Research paper Adolescent stress and symptoms of anxiety and depression: Resilience explains and differentiates the relationships. *Journal of Affective Disorders*, 203, 213-220.

- Babic, M. J., Smith, J. J., Morgan, P. J., Eather, N., Plotnikoff, R. C., & Lubans, D. R. (2017). Longitudinal associations between changes in screen-time and mental health outcomes in adolescents. *Mental Health and Physical Activity*, 12, 124-131. doi:10.1016/j.mhpa.2017.04.001
- Balázs, J., Miklósi, M., Keresztény, Á., Hoven, C. W., Carli, V., Wasserman, C., ... Wasserman, D. (2013). Adolescent subthreshold depression and anxiety: Psychopathology, functional impairment and increased suicide risk. *Journal of Child Psychology and Psychiatry*, 54, 670-677. doi:10.1111/jcpp.12016
- Baldwin, J. A., Brown, B. G., Wayment, H. A., Nez, R. A., & Brelsford, K. M. (2011). Culture and context: Buffering the relationship between stressful life events and risky behaviors in American Indian youth. *Substance Use and Misuse*, 46, 1380-1394. doi:10.3109/10826084.2011.592432
- Barry, C. T., Sidoti, C. L., Briggs, S. M., Reiter, S. R., & Lindsey, R. A. (2017). Adolescent social media use and mental health from adolescent and parent perspectives. *Journal of Adolescence*, 61, 1-11. doi:10.1016/j.adolescence.2017.08.005
- Beck, A. T. (1973). *The diagnosis and management of depression*. Philadelphia, PA: University of Pennsylvania Press.
- Beck, A. T. (1976). *Cognitive therapy and the emotional disorders*. New York, NY: International Universities Press.
- Becker, A. E., Burwell, R. A., Gilman, S. E., Herzog, D. B., & Hamburg, P. (2002). Eating behaviours and attitudes following prolonged exposure to television among ethnic Fijian adolescent girls. *British Journal of Psychiatry*, 180, 509-514.
- Benson, L. P., Williams, R. J., & Novick, M. B. (2013). Pediatric obesity and depression: A cross-sectional analysis of absolute BMI as it relates to Children's Depression Index scores in obese 7- to 17-year-old children. *Clinical Pediatrics*, 52, 24-29. doi:10.1177/0009922812459949
- Bessenoff, G. R. (2006). Can the media affect us? Social comparison, self-discrepancy, and the thin

- ideal. *Psychology of Women Quarterly*, 30, 239-251. doi:10.1111/j.1471-6402.2006.00292.x
- Beutel, M. E., Brähler, E., Glaesmer, H., Kuss, D. J., Wölfling, K., & Müller, K. W. (2011). Regular and problematic leisure-time Internet use in the community: Results from a German population-based survey. *Cyberpsychology, Behavior, and Social Networking*, 14, 291-296. doi:10.1089/cyber.2010.0199
- Billings, A. G., & Moos, R. H. (1984). Coping, stress, and social resources among adults with unipolar depression. *Journal of Personality and Social Psychology*, 46, 877-891. doi:10.1037/0022-3514.46.4.877
- Blashill, A. J., & Wilhelm, S. (2014). Body image distortions, weight, and depression in adolescent boys: Longitudinal trajectories into adulthood. *Psychology of Men & Masculinity*, 15, 445- 451. doi: 10.1037/a0034618
- Blond, A. (2008). Impacts of exposure to images of ideal bodies on male body dissatisfaction: A review. *Body Image*, 5, 244-250. doi:10.1016/j.bodyim.2008.02.003
- Boutelle, K. N., Hannan, P., Fulkerson, J. A., Crow, S. J., & Stice, E. (2010). Obesity as a prospective predictor of depression in adolescent females. *Health Psychology*, 29, 293-298. doi:10.1037/a0018645
- Bowlby, J. (1970). Disruption of affectional bonds and its effects on behaviour. *Journal of Contemporary Psychotherapy*, 2, 75-86. doi:10.1007/BF02118173
- Brown, A. (2017). Younger men play video games, but so do a diverse group of other Americans. *Pew Research Center*. Retrieved from <http://www.pewresearch.org/fact-tank/2017/09/11/younger-men-play-video-games-but-so-do-a-diverse-group-of-other-americans/>
- Bruch, H. (1964). Psychological aspects of overeating and obesity. *Psychosomatics*, 5, 269-274. doi:10.1016/S0033-3182(64)72385-7

- Brumariu, L. E., & Kerns, K. A. (2010). Parent–child attachment and internalizing symptoms in childhood and adolescence: A review of empirical findings and future directions. *Development and Psychopathology*, 22, 177-203. doi:10.1017/S0954579409990344
- Brunborg, G. S., Mentzoni, R. A., & Frøyland, L. R. (2014). Is video gaming, or video game addiction, associated with depression, academic achievement, heavy episodic drinking, or conduct problems? *Journal of Behavioral Addictions*, 3, 27-32. doi:10.1556/JBA.3.2014.002
- Bucchianeri, M. M., Arikian, A. J., Hannan, P. J., Eisenberg, M. E., & Neumark-Sztainer, D. (2013). Body dissatisfaction from adolescence to young adulthood: Findings from a 10-year longitudinal study. *Body Image*, 10, 1-7. doi: 10.1016/j.bodyim.2012.09.001
- Busch, V., Manders, L. A., & de Leeuw, J. R. J. (2013). Screen time associated with health behaviors and outcomes in adolescents. *American Journal of Health Behavior*, 37, 819-830. doi:10.5993/AJHB.37.6.11
- Byun, W., Dowda, M., & Pate, R. R. (2012). Associations between screen-based sedentary behavior and cardiovascular disease risk factors in Korean youth. *Journal of Korean Medical Science*, 27, 388-394. doi:10.3346/jkms.2012.27.4.388
- Calado, M., Lameiras, M., Sepulveda, A. R., Rodríguez, Y., & Carrera, M. V. (2010). The mass media exposure and disordered eating behaviours in Spanish secondary students. *European Eating Disorders Review*, 18, 417-427. doi:10.1002/erv.1024
- Camara, M., Bacigalupe, G. & Padilla, P. (2017). The role of social support in adolescents: are you helping me or stressing me out? *International Journal of Adolescence and Youth*, 22, 123-136. doi: 10.1080/02673843.2013.875480
- Canadian Mental Health Association. (2015). *Suicide statistics*. Retrieved August 5, 2015, from http://toronto.cmha.ca/mental_health/suicide-statistics/#.VgJACukk-fc

- Canadian Paediatric Society* (2017). Screen time and young children: Promoting health and development in a digital world. *Paediatrics & Child Health*, 22, 461–468, doi: [doi:org.proxy.bib.uottawa.ca/10.1093/pch/pxx123](https://doi.org/10.1093/pch/pxx123)
- Cao, H., Qian, Q., Weng, T., Yuan, C., Sun, Y., Wang, H., & Tao, F. (2011). Screen time, physical activity and mental health among urban adolescents in China. *Preventive Medicine*, 53, 316-320. doi:10.1016/j.ypmed.2011.09.002
- Carson, V., Pickett, W., & Janssen, I. (2011). Screen time and risk behaviors in 10- to 16-year-old Canadian youth. *Preventive Medicine*, 52, 99-103. doi:10.1016/j.ypmed.2010.07.005
- Cassel, J. (1976). The contribution of the social environment to host resistance. *American Journal of Epidemiology*, 104, 107-123.
- Chamay-Weber, C., Narring, F., & Michaud, P.-A. (2005). Partial eating disorders among adolescents: A review. *Journal of Adolescent Health*, 37, 417-427. doi:10.1016/j.jadohealth.2004.09.014
- Chen, W., & Swalm, R. L. (1998). Chinese and American college students' body-image: Perceived body shape and body affect. *Perceptual and Motor Skills*, 87, 395-403. doi:10.2466/pms.1998.87.2.395
- Cheng, C., Sun, P., & Mak, K.-K. (2015). Internet addiction and psychosocial maladjustment: Avoidant coping and coping inflexibility as psychological mechanisms. *Cyberpsychology, Behavior, and Social Networking*, 18, 539-546. doi:10.1089/cyber.2015.0121
- Cohane, G. H., & Pope, H. G., Jr. (2001). Body image in boys: A review of the literature. *International Journal of Eating Disorders*, 29, 373-379. doi:10.1002/eat.1033
- Cohen, S., & Wills, T. A. (1985). Stress, social support, and the buffering hypothesis. *Psychological Bulletin*, 98, 310-357.

- Compas, B. E., Orosan, P. G., & Grant, K. E. (1993). Adolescent stress and coping: Implications for psychopathology during adolescence. *Journal of Adolescence*, *16*, 331-349.
doi:10.1006/jado.1993.1028
- Cook, S. H., Heinze, J. E., Miller, A. L., & Zimmerman, M. A. (2016). Transitions in friendship attachment during adolescence are associated with developmental trajectories of depression though adulthood. *Journal of Adolescent Health*, *58*, 260-266.
doi:10.1016/j.jadohealth.2015.10.252
- Cooper, M. J., & Fairburn, C. G. (1992). Thoughts about eating, weight and shape in anorexia nervosa and bulimia nervosa. *Behaviour Research and Therapy*, *30*, 501-511. doi:10.1016/0005-7967(92)90034-E
- Coulson, N. S. (2005). Receiving social support online: An analysis of a computer-mediated support group for individuals living with irritable bowel syndrome. *CyberPsychology & Behavior*, *8*, 580-584. doi:10.1089/cpb.2005.8.580
- Crowe, M., Ward, N., Dunnachie, B., & Roberts, M. (2006). Characteristics of adolescent depression. *International Journal of Mental Health Nursing*, *15*, 10-18. doi:10.1111/j.1447-0349.2006.00399.x
- Davis, R. A. (2001). A cognitive-behavioral model of pathological Internet use. *Computers in Human Behavior*, *17*, 187-195. doi:10.1016/S0747-5632(00)00041-8
- Debnam, K., Milam, A. J., Furr-Holden, C. D., & Bradshaw, C. (2016). The role of stress and spirituality in adolescent substance use. *Substance Use & Misuse*, *51*, 733-741.
doi:10.3109/10826084.2016.1155224
- Desjardins, T. L., & Leadbeater, B. J. (2011). Relational victimization and depressive symptoms in adolescence: Moderating effects of mother, father, and peer emotional support. *Journal of Youth and Adolescence*, *40*, 531-544. doi:10.1007/s10964-010-9562-1

- de Vries, D. A., Peter, J., de Graaf, H., & Nikken, P. (2016). Adolescents' social network site use, peer appearance-related feedback, and body dissatisfaction: Testing a mediation model. *Journal of Youth and Adolescence*, 45, 211-224. doi:10.1007/s10964-015-0266-4
- Do, Y. K., Shin, E., Bautista, M. A., & Foo, K. (2013). The associations between self-reported sleep duration and adolescent health outcomes: What is the role of time spent on Internet use? *Sleep Medicine*, 14, 195-200. doi:10.1016/j.sleep.2012.09.004
- Duchesne, S., & Ratelle, C. F. (2014). Attachment security to mothers and fathers and the developmental trajectories of depressive symptoms in adolescence: Which parent for which trajectory? *Journal of Youth and Adolescence*, 43, 641-654. doi:10.1007/s10964-013-0029-z
- Eberhart, N. K., & Hammen, C. L. (2006). Interpersonal predictors of onset of depression during the transition to adulthood. *Personal Relationships*, 13, 195-206. doi:10.1111/j.1475-6811.2006.00113.x
- Eldeleklioğlu, J. (2008). Gender, romantic relationships, Internet use, perceived social support and social skills as the predictors of loneliness. *Egitim Arastirmalari - Eurasian Journal of Educational Research*, 33, 127-140.
- Endler, N. S., & Parker, J. D. A. (1990a). *Coping Inventory for Stressful Situations (CISS)*. Toronto ON: Multi-Health Systems.
- Endler, N. S., & Parker, J. D. A. (1990b). Multidimensional assessment of coping: A critical evaluation. *Journal of Personality and Social Psychology*, 58, 844-854. doi:10.1037/0022-3514.58.5.844
- Eyal, K., & Te'eni-Harari, T. (2013). Explaining the relationship between media exposure and early adolescents' body image perceptions: The role of favorite characters. *Journal of Media Psychology*, 25, 129-141. doi:10.1027/1864-1105/a000094

- Favotto, L., Michaelson, V., & Davison, C. (2017). Perceptions of the influence of computer-mediated communication on the health and well-being of early adolescents. *International Journal of Qualitative Studies on Health and Well-Being*, 12, 1335575.
doi:10.1080/17482631.2017.1335575
- Fergus, S., & Zimmerman, M. A. (2005). Adolescent resilience: A framework for understanding healthy development in the face of risk. *Annual Review of Public Health*, 26, 399-419.
doi:10.1146/annurev.publhealth.26.021304.144357
- Florian, V., Mikulincer, M., & Bucholtz, I. (1995). Effects of adult attachment style on the perception and search for social support. *The Journal of Psychology*, 129, 665-676.
- Folkman, S., Lazarus, R. S., Gruen, R. J. , & DeLongis, A. (1986). Appraisal, coping, health status, and psychological symptoms. *Journal of Personality and Social Psychology*, 50, 571-579.
- Fonagy, P., Target, M., Cottrell, D., Phillips, J., & Kurtz, Z. (2002). What works for whom?: A critical review of treatments for children and adolescents. New York, NY: Guildford Press.
- Fraley, R. C. (2002). Attachment stability from infancy to adulthood: Meta-analysis and dynamic modeling of developmental mechanisms. *Personality and Social Psychology Review*, 6, 123-151.
doi:10.1207/S15327957PSPR0602_03
- Fraley, R. C., & Shaver, P. R. (2000). Adult romantic attachment: Theoretical developments, emerging controversies, and unanswered questions. *Review of General Psychology*, 4, 132-154.
doi:10.1037/1089-2680.4.2.132
- Frison, E., & Eggermont, S. (2015). The impact of daily stress on adolescents' depressed mood: The role of social support seeking through Facebook. *Computers in Human Behaviour*, 44, 315-325.
doi:10.1016/j.chb.2014.11.070
- Furman, W., & Buhrmester, D. (1992). Age and sex differences in perceptions of networks of personal relationships. *Child Development*, 63, 103-115. doi:10.2307/1130905

- George, M. J., Russell, M. A., Piontak, J. R., & Odgers, C. L. (2018). Concurrent and subsequent associations between daily digital technology use and high-risk adolescents' mental health symptoms. *Child Development*, 89, 78-88. doi:10.1111/cdev.12819
- Goldfield, G. S., Moore, C., Henderson, K., Buchholz, A., Obeid, N., & Flamet, M. F. (2010). Body dissatisfaction, dietary restraint, depression, and weight status in adolescents. *The Journal of School Health*, 80, 186-192. doi:10.1111/j.1746-1561.2009.00485.x
- Goldfield, G. S., Murray, M. A., Maras, D., Wilson, A. L., Phillips, P., Kenny, G. P., ... Sigal, R. J. (2016). Screen time is associated with depressive symptomatology among obese adolescents: A HEARTY study. *European Journal of Pediatrics*, 175, 909-919. doi:10.1007/s00431-016-2720-z
- Goldfield, G. S., Saunders, T. J., Kenny, G. P., Hadjiyannakis, S., Phillips, P., Alberga, A. S., ... Sigal, R. J. (2013). Screen viewing and diabetes risk factors in overweight and obese adolescents. *American Journal of Preventive Medicine*, 44(Suppl. 4), S364-S370. doi:10.1016/j.amepre.2012.11.040
- Gorin, A. A., Le Grange, D., & Stone, A. A. (2003). Effectiveness of spouse involvement in cognitive behavioral therapy for binge eating disorder. *International Journal of Eating Disorders*, 33, 421-433. doi:10.1002/eat.10152
- Granic, I., Lobel, A., & Engels, R. C. M. E. (2014). The benefits of playing video games. *American Psychologist*, 69, 66-78.
- Grieve, R., Indian, M., Witteveen, K., Tolan, G. A., & Marrington, J. (2013). Face-to-face or Facebook: Can social connectedness be derived online? *Computers in Human Behaviour*, 29, 604-609.

- Grøntved, A., Singhammer, J., Froberg, K., Møller, N. C., Pan, A., Pfeiffer, K. A., & Kristensen, P. L. (2015). A prospective study of screen time in adolescence and depression symptoms in young adulthood. *Preventive Medicine*, *81*, 108-113. doi:10.1016/j.ypmed.2015.08.009
- Gullone, E., & Robinson, K. (2005). The inventory of parent and peer attachment–Revised (IPPA-R) for children: A psychometric investigation. *Clinical Psychology & Psychotherapy*, *12*, 67-79. doi:10.1002/cpp.433
- Gutierrez, P. M., Muehlenkamp, J. J., Dix-Richardson, F., Barrios, F. X., & Kopper, B. A. (2004). Suicide resilience inventory-25: Development and preliminary psychometric properties. *Psychological Reports*, *94*, 1349-1360.
- Haferkamp, N., & Krämer, N. C. (2011). Social comparison 2.0: Examining the effects of online profiles on social-networking sites. *Cyberpsychology, Behavior, and Social Networking*, *14*, 309-314. doi:10.1089/cyber.2010.0120
- Hamel, A. E., Zaitsoff, S. L., Taylor, A., Menna, R., & Le Grange, D. (2012). Body-related social comparison and disordered eating among adolescent females with an eating disorder, depressive disorder, and healthy controls. *Nutrients*, *4*, 1260-1272. doi:10.3390/nu4091260
- Hamm, M. P., Newton, A. S., Chisholm, A., Shulhan, J., Milne, A., Sundar, P., ... Hartling, L. (2015). Prevalence and effect of cyberbullying on children and young people: A scoping review of social media studies. *JAMA Pediatrics*, *169*, 770-777. doi:10.1001/jamapediatrics.2015.0944
- Harrison, K. (2000). The body electric: Thin-ideal media and eating disorders in adolescents. *Journal of Communication*, *50*, 119-143. doi:10.1093/joc/50.3.119
- Harrison, K., & Hefner, V. (2006). Media exposure, current and future body ideals, and disordered eating among preadolescent girls: A longitudinal panel study. *Journal of Youth and Adolescence*, *35*, 153-163. doi:10.1007/s10964-005-9008-3

- Hawthorne, G. (2008). Perceived social isolation in a community sample: Its prevalence and correlates with aspects of peoples' lives. *Social Psychiatry and Psychiatric Epidemiology*, 43, 140-150. doi:10.1007/s00127-007-0279-8
- Hazan, C., & Shaver, P. (1987). Romantic love conceptualized as an attachment process. *Journal of Personality and Social Psychology*, 52, 511-524. doi:10.1037/0022-3514.52.3.511
- Herman, C. P., & Mack, D. (1975). Restrained and unrestrained eating. *Journal of Personality*, 43, 647-660. doi:10.1111/j.1467-6494.1975.tb00727.x
- Herman, C. P., & Polivy, J. (1980). Restrained eating. In A. J. Stunkard (Ed.), *Obesity* (pp.208-225). Philadelphia, PA: Saunders.
- Herman-Stahl, M. A., Stemmler, M., & Petersen, A. C. (1995). Approach and avoidant coping: Implications for adolescent mental health. *Journal of Youth and Adolescence*, 24, 649-665. doi:10.1007/BF01536949
- Holahan, C. J., Moos, R. H., Holahan, C. K., Brennan, P. L., & Schutte, K. K. (2005). Stress generation, avoidance coping, and depressive symptoms: A 10-year model. *Journal of Consulting and Clinical Psychology*, 73, 658-666. doi:10.1037/0022-006X.73.4.658
- Hummel, A. C., & Smith, A. R. (2015). Ask and you shall receive: Desire and receipt of feedback via Facebook predicts disordered eating concerns. *International Journal of Eating Disorders*, 48, 436-442. doi:10.1002/eat.22336
- Irons, C., & Gilbert, P. (2005). Evolved mechanisms in adolescent anxiety and depression symptoms: The role of attachment and social rank systems. *Journal of Adolescence*, 28, 325-341. doi:10.1016/j.adolescence.2004.07.004
- Jakobsen, I. S., Horwood, L. J., & Fergusson, D. M. (2012). Childhood anxiety/withdrawal, adolescent parent-child attachment and later risk of depression and anxiety disorder. *Journal of Child and Family Studies*, 21, 303-310. doi:10.1007/s10826-011-9476-x

Jensen, M. P., Smith, A. E., Bombardier, C. H., Yorkston, K. M., Miró, J., & Molton, I. R. (2014).

Social support, depression, and physical disability: Age and diagnostic group effects. *Disability & Health Journal*, 7, 164-172. doi:10.1016/j.dhjo.2013.11.001

Jones, J. M., Bennett, S., Olmsted, M. P., Lawson, M. L., & Rodin, G. (2001). Disordered eating

attitudes and behaviours in teenaged girls: A school-based study. *Canadian Medical Association Journal*, 165, 547-552.

Jones, R. A., Hinkley, T., Okely, A. D., & Salmon, J. (2013). Tracking physical activity and sedentary

behavior in childhood: A systematic review. *American Journal of Preventive Medicine*, 44, 651-658. doi:10.1016/j.amepre.2013.03.001

Jonsson, U., Bohman, H., von Knorring, L., Olsson, G., Paaren, A., & von Knorring, A.-L. (2011).

Mental health outcome of long-term and episodic adolescent depression: 15-year follow-up of a community sample. *Journal of Affective Disorders*, 130, 395-404. doi:10.1016/j.jad.2010.10.046

Kaplan, H. I., & Kaplan, H. S. (1957). The psychosomatic concept of obesity. *Journal of Nervous and*

Mental Disease, 125, 181-201.

Katon, W., Richardson, L., Russo, J., McCarty, C. A., Rockhill, C., McCauley, E., ...

Grossman, D. C. (2010). Depressive symptoms in adolescence: The association with multiple health risk behaviors. *General Hospital Psychiatry*, 32, 233-239.

doi:10.1016/j.genhosppsych.2010.01.008

Kendler, K. S., Thornton, L. M., & Prescott, C. A. (2001) Gender differences in the rates of exposure

to stressful life events and sensitivity to their depressogenic effects. *American Journal of Psychiatry*, 158, 587-593.

- Kiefl, B. (2011). *Trends in TV and Internet use: The impact of Internet TV on Canadian programming*. Retrieved from http://www.omdc.on.ca/Assets/Research/Research+Reports/Trends+in+TV+and+Internet+Use/Trends+in+TV+and+Internet+Use_en.pdf
- Kim, D., Nam, J. K., Oh, J., Kang, M. C. (2016). A latent profile analysis of the interplay between PC and smartphone in problematic internet use. *Computers in Human Behavior*, 56, 360-368. doi:10.1016/j.chb.2015.11.009 0747-5632
- Kim, Y., Lee, N., & Lim, Y. (2017). Gender differences in the association of smartphone addiction with food group consumption among Korean adolescents. *Public Health*, 145, 132-135. doi:10.1016/j.puhe.2016.12.026
- Kim, K., Ryu, E., Chon, M.-Y., Yeun, E.-J., Choi, S.-Y., Seo, J.-S., & Nam, B.-W. (2006). Internet addiction in Korean adolescents and its relation to depression and suicidal ideation: A questionnaire survey. *International Journal of Nursing Studies*, 43, 185-192. doi:10.1016/j.ijnurstu.2005.02.005
- Klein, D. N., Shankman, S. A., Lewinsohn, P. M., & Seeley, J. R. (2009). Subthreshold depressive disorder in adolescents: Predictors of escalation to full-syndrome depressive disorders. *Journal of the American Academy of Child & Adolescent Psychiatry*, 48, 703-710. doi:10.1097/CHI.0b013e3181a56606
- Khouja, J., Munafò, M., Tilling, K., Wiles, N., Joinson, C., Etchells, P., ... Cornish, R. (2017). Is increased screen time associated with the development of anxiety or depression in young people? *European Psychiatry*, 41, S530-S531. doi:10.1016/j.eurpsy.2017.01.719

- Kovess-Masfety, V., Keyes, K., Hamilton, A., Hanson, G., Bitfoi, A., Golitz, D., ... Pez, O. (2016). Is time spent playing video games associated with mental health, cognitive and social skills in young children? *Social Psychiatry and Psychiatric Epidemiology*, 51, 349-357.
doi:10.1007/s00127-016-1179-6
- Kraemer, H. C., Kazdin, A. E., Offord, D. R., Kessler, R. C., Jensen, P. S., & Kupfer, M. D. (1997). Coming to terms with the terms of risk. *Archives of General Psychiatry*, 54, 337-343.
doi:10.1001/archpsyc.1997.01830160065009
- Kraut, R., Patterson, M., Lundmark, V., Kiesler, S., Mukopadhyay, T., & Scherlis, W. (1998). Internet paradox: A social media that reduces social involvement and psychological well-being? *The American Psychologist*, 53, 1017-1031. doi:10.1037/0003-066X.53.9.1017
- Kremer, P., Elshaug, C., Leslie, E., Toumbourou, J. W., Patton, G. C., & Williams, J. (2014). Physical activity, leisure-time screen use and depression among children and young adolescents. *Journal of Science and Medicine in Sport*, 17, 183-187. doi:10.1016/j.jsams.2013.03.012
- Larson, R. W., Richards, M. H., Moneta, G., Holmbeck, G., & Duckett, E. (1996). Changes in adolescents' daily interactions with their families from ages 10 to 18: Disengagement and transformation. *Developmental Psychology*, 32, 744-754. doi:10.1037/0012-1649.32.4.744
- Lazarus, R. S., & Folkman, S. (1984). Stress, appraisal, and coping. New York, NY: Springer.
- Leatherdale, S. T., & Ahmed, R. (2011). Screen-based sedentary behaviours among a nationally representative sample of youth: Are Canadian kids couch potatoes? *Chronic Diseases and Injuries in Canada*, 31, 141-146.
- Leatherdale, S. T., Faulkner, G., & Arbour-Nicitopoulos, K. (2010). School and student characteristics associated with screen-time sedentary behavior among students in grades 5-8, Ontario, Canada, 2007-2008. *Preventing Chronic Disease*, 7, A128.

- Leatherdale, S. T., & Harvey, A. (2015). Examining communication- and media-based recreational sedentary behaviors among Canadian youth: Results from the COMPASS study. *Preventive Medicine, 74*, 74-80. doi:10.1016/j.ypmed.2015.02.005
- Lee, S. Y. (2014). How do people compare themselves with others on social networking sites?: The case of Facebook. *Computers in Human Behavior, 32*, 253-260. doi:10.1016/j.chb.2013.12.009
- Lei, L., & Wu, Y. (2007). Adolescents' paternal attachment and Internet use. *Cyberpsychology and Behavior, 10*, 633-639. doi:10.1089/cpb.2007.9976
- Lemmens, J. S., Valkenburg, P. M., & Gentile, D. A. (2015). The Internet Gaming Disorder Scale. *Psychological Assessment, 27*, 567-582. doi:10.1037/pas0000062
- Lemola, S., Perkinson-Gloor, N., Brand, S., Dewald-Kaufmann, J. F., & Grob, A. (2015). Adolescents' electronic media use at night, sleep disturbance, and depressive symptoms in the smartphone age. *Journal of Youth and Adolescence, 44*, 405-418. doi:10.1007/s10964-014-0176-x
- Lenhart, A. (2015, April 9). Teens, social media & technology overview 2015. *Pew Research Centre*. Retrieved from <http://www.pewinternet.org/2015/04/09/teens-social-media-technology-2015/>
- Leung, L. (2007). Stressful life events, motives for Internet use, and social support among digital kids. *CyberPsychology & Behavior, 10*, 204-214. doi:10.1089/cpb.2006.9967
- Levine, M. P., & Smolak, L. (2006). *The prevention of eating problems and eating disorders: Theory, research, and practice*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Little, S. A., & Garber, J. (2005). The role of social stressors and interpersonal orientation in explaining the longitudinal relation between externalizing and depressive symptoms. *Journal of Abnormal Psychology, 114*, 432-443. doi:10.1037/0021-843X.114.3.432
- Lohaus, A., Ball, J., Klein-Hessling, J., & Wild, M. (2005). Relations between media use and self-reported symptomatology in young adolescents. *Anxiety, Stress, and Coping, 18*, 333-341. doi:10.1080/10615800500258123

- Lorant, V., Deliège, D., Eaton, W., Robert, A., Philippot, P., & Ansseau, M. (2003). Socioeconomic inequalities in depression: A meta-analysis. *American Journal of Epidemiology*, 157, 98-112. doi:10.1093/aje/kwfl82
- Luppino, F. S., de Wit, L. M., Bouvy, P. F., Stijnen, T., Cuijpers, P., Penninx, B. W. J. H., & Zitman, F. G. (2010). Overweight, obesity, and depression: A systematic review and meta-analysis of longitudinal studies. *Archives of General Psychiatry*, 67, 220-229. doi:10.1001/archgenpsychiatry.2010.2
- Maras, D., Flament, M. F., Murray, M., Buchholz, A., Henderson, K. A., Obeid, N., & Goldfield, G. S. (2015). Screen time is associated with depression and anxiety in Canadian youth. *Preventive Medicine*, 73, 133-138. doi:10.1016/j.ypmed.2015.01.029
- Marino, C., Gini, G., Vieno, A., & Spada, M. M. (2018). The associations between problematic Facebook use, psychological distress and well-being among adolescents and young adults: A systematic review and meta-analysis. *Journal of Affective Disorders*, 226, 274-281. doi:10.1016/j.jad.2017.10.007
- Markey, C. N. (2010). Invited commentary: Why body image is important to adolescent development. *Journal of Youth and Adolescence*, 39, 1387-1391. doi: <http://psycnet.apa.org/doi/10.1007/s10964-010-9510-0>
- Masheb, R. M., & Grilo, C. M. (2006). Emotional overeating and its associations with eating disorder psychopathology among overweight patients with binge eating disorder. *International Journal of Eating Disorders*, 39, 141-146. doi:10.1002/eat.20221
- Maslow, A. H. (1968). *Toward a psychology of being* (2nd ed.). New York, NY: Van Nostrand.
- Matud, M. P. (2004). Gender differences in stress and coping styles. *Personality and Individual Differences*, 37, 1401-1415. doi:10.1016/j.paid.2004.01.010

- McCabe, M. P., & Ricciardelli, L. A. (2004). Body image dissatisfaction among males across the lifespan: A review of past literature. *Journal of Psychosomatic Research*, *56*, 675-685. doi:10.1016/S0022-3999(03)00129-6
- McCarthy, M. (1990). The thin ideal, depression and eating disorders in women. *Behaviour Research and Therapy*, *28*, 205-215. doi:10.1016/0005-7967(90)90003-2
- Meier, E. P., & Gray, J. (2014). Facebook photo activity associated with body image disturbance in adolescent girls. *Cyberpsychology, Behavior, and Social Networking*, *17*, 199-206. doi:10.1089/cyber.2013.0305
- Messias, E., Castro, J., Saini, A., Usman, M., & Peeples, D. (2011). Sadness, suicide, and their association with video game and Internet overuse among teens: Results from the Youth Risk Behavior Survey 2007 and 2009. *Suicide and Life Threatening Behaviour*, *41*, 307-315. doi:10.1111/j.1943-278X.2011.00030.x
- Mikulincer, M., & Florian, V. (1995). Appraisal of and coping with a real-life stressful situation: The contribution of attachment styles. *Personality and Social Psychology Bulletin*, *21*, 406-414. doi:10.1177/0146167295214011
- Mojtabai, R., Olfson, M., & Han, B. (2016). National trends in the prevalence and treatment of depression in adolescents and young adults. *Pediatrics*, *138*, 1-10. doi:10.1542/peds.2016-1878
- Moretti, M. M., & Holland, R. (2003). The journey of adolescence: Transitions in self within the context of attachment relationships. In S. M. Johnson & V. E. Whiffen (Eds.), *Attachment processes in couple and family therapy* (pp. 234-257). New York, NY: Guildford Press.
- Moriarty, C. M., & Harrison, K. (2008). Television exposure and disordered eating among children: A longitudinal panel study. *Journal of Communication*, *58*, 361-381. doi:10.1111/j.1460-2466.2008.00389.x

- Munro, F., & Huon, G. (2005). Media-portrayed idealized images, body shame, and appearance anxiety. *International Journal of Eating Disorders*, 38, 85-90. doi:10.1002/eat.20153
- Neira, C. J. B., & Barber, B. L. (2014). Social networking site use: Linked to adolescents' social self-concept, self-esteem, and depressed mood. *Australian Journal of Psychology*, 66, 56-64. doi:10.1111/ajpy.12034
- Nelis, S. M., & Rae, G. (2009). Brief report: Peer attachment in adolescents. *Journal of Adolescence*, 32, 443-447. doi:10.1016/j.adolescence.2008.03.006
- Newman, B. M., Newman, P. R., Griffen, S., O'Connor, K., & Spas, J. (2007). The relationship of social support to depressive symptoms during the transition to high school. *Adolescence*, 42, 441-459.
- Nguyen-Michel, S. T., Unger, J. B., & Spruijt-Metz D. (2007). Dietary correlates of emotional eating in adolescence. *Appetite*, 49, 494-499. doi:10.1016/j.appet.2007.03.005
- O'Keeffe, G. S., & Clarke-Pearson, K. (2011). The impact of social media on children, adolescents, and families. *Pediatrics*, 127, 800-804. doi:0.1542/peds.2011-0054
- Olivardia, R., Pope, H. G., Jr., Borowiecki, J. J., III., & Cohane, G. H. (2004). Biceps and body image: The relationship between muscularity and self-esteem, depression, and eating disorder symptoms. *Psychology of Men & Masculinity*, 5, 112-120. doi:10.1037/1524-9220.5.2.112
- Ongen, D. (2006). The relationships between coping strategies and depression among Turkish adolescents. *Social Behavior and Personality*, 34, 181-196.
- Ouwens, M. A., van Strien, T., & van Leeuwe, J. F. J. (2009). Possible pathways between depression, emotional and external eating. A structural equation model. *Appetite*, 53, 245-248. doi:10.1016/j.appet.2009.06.001

- Pantic, I., Damjanovic, A., Todorovic, J., Topalovic, D., Bojovic-Jovic, D., Ristic, S., & Pantic, S. (2012). Association between online social networking and depression in high school students: Behavioural physiology viewpoint. *Psychiatria Danubina*, 24, 90-93.
- Parker, G., Holmes, S., & Manicavasagar, V. (1986). Depression in general practice attenders: "Caseness", natural history, and predictors of outcome. *Journal of Affective Disorders*, 10, 27-35. doi:10.1016/0165-0327(86)90046-7
- Patton, G. C., Johnson-Sabine, E., Wood, K., Mann, A. H., & Wakeling, A. (1990). Abnormal eating attitudes in London schoolgirls – a prospective epidemiological study: Outcome at twelve month follow-up. *Psychological Medicine*, 20, 383-394. doi:10.1017/S0033291700017700
- Pendley, J. S., Kasmien, L. J., Miller, D. L., Donze, J., Swenson, C., & Reeves, G. (2002). Peer and family support in children and adolescents with type 1 diabetes. *Journal of Pediatric Psychology*, 27, 429-438.
- Penley, J. A., Tomaka, J., & Wiebe, J. S. (2002). The association of coping to physical and psychological health outcomes: A meta-analytic review. *Journal of Behavioral Medicine*, 25, 551-603. doi:10.1023/A:1020641400589
- Anderson, A., & Jiang, J. (2018). Teens, social media, and technology 2018. *Pew Research Center*. Retrieved from <http://www.pewinternet.org/2018/05/31/teens-social-media-technology-2018/>
- Piko, B. (2001). Gender differences and similarities on adolescents' ways of coping. *The Psychological Record*, 51, 223-235. doi:10.1007/BF03395396
- Plant, E. A., & Sachs-Ericsson, N. (2004). Racial and ethnic differences in depression: The roles of social support and meeting basic needs. *Journal of Consulting and Clinical Psychology*, 72, 41-52. doi:10.1037/0022-006X.72.1.41
- Polivy, J., & Herman, C. P. (1985). Dieting and bingeing: A causal analysis. *American Psychologist*, 40, 193-201. doi:10.1037/0003-066X.40.2.193

- Pollice, C., Kaye, W. H., Greeno, C. G., & Weltzin, T. E. (1997). Relationship of depression, anxiety, and obsessionality to state of illness in anorexia nervosa. *International Journal of Eating Disorders*, 21, 367-376. doi:10.1002/(SICI)1098-108X(1997)21:4<367::AID-EAT10>3.0.CO;2-W
- Presnell, K., Bearman, S. K., & Stice, E. (2004). Risk factors for body dissatisfaction in adolescent boys and girls: A prospective study. *International Journal of Eating Disorders*, 36, 389-401. doi:10.1002/eat.20045
- Primack, B. A., Shensa, A., Sidani, J. E., Whaite, E. O., Lin, L. Y., Rosen, D., ... Miller, E. (2017). Social media use and perceived social isolation among young adults in the U.S. *American Journal of Preventive Medicine*, 53, 1-8. doi:10.1016/j.amepre.2017.01.010
- Primack, B. A., Swanier, B., Georgiopoulos, A. M., Land, S. R., & Fine, M. J. (2009). Association between media use in adolescence and depression in young adulthood: A longitudinal study. *Archives of General Psychiatry*, 66, 181-188. doi:10.1001/archgenpsychiatry.2008.532
- Przybylski, A. K., Murayama, K., DeHaan, C. R., & Gladwell, V. (2013). Motivational, emotional, and behavioral correlates of fear of missing out. *Computers in Human Behavior*, 29, 1841-1848. doi:10.1016/j.chb.2013.02.014
- Przybylski, A. K., Weinstein, N., & Murayama, K. (2017). Internet gaming disorder: Investigating the clinical relevance of a new phenomenon. *The American Journal of Psychiatry*, 174, 230-236. doi:10.1176/appi.ajp.2016.16020224
- Ptacek, J. T., Smith, R. E., & Dodge, K. L. (1994). Gender differences in coping with stress: When stressor and appraisals do not differ. *Personality and Social Psychology Bulletin*, 20, 421-430. doi:10.1177/0146167294204009
- Ptacek, J. T., Smith, R. E., & Zanas, J. (1992). Gender, appraisal, and coping: A longitudinal analysis. *Journal of Personality*, 60, 747-770. doi:10.1111/j.1467-6494.1992.tb00272.x

- Rafnsson, F. D., Jonsson, F. H., & Windle, M. (2006). Coping strategies, stressful life events, problem behaviors, and depressed affect. *Anxiety, Stress & Coping, 19*, 241-257.
doi:10.1080/10615800600679111
- Raja, S. N., McGee, R., & Stanton, W. R. (1992). Perceived attachments to parents and peers and psychological well-being in adolescence. *Journal of Youth and Adolescence, 21*, 471-485.
doi:10.1007/BF01537898
- Renk, K., & Creasey, G. (2003). The relationship of gender, gender identity, and coping strategies in late adolescents. *Journal of Adolescence, 26*, 159-168. doi:10.1016/S0140-1971(02)00135-5
- Ricca, V., Castellini, G., Lo Sauro, C., Ravaldi, C., Lapi, F., Mannucci, E., ... Faravelli, C. (2009). Correlations between binge eating and emotional eating in a sample of overweight subjects. *Appetite, 53*, 418-421. doi:10.1016/j.appet.2009.07.008
- Richards, R., McGee, R., Williams, S. M., Welch, D., & Hancox, R. J. (2010). Adolescent screen time and attachment to parents and peers. *Archives of Pediatrics & Adolescent Medicine, 164*, 258-262. doi:10.1001/archpediatrics.2009.280
- Rigby, K., & Slee, P. (1999). Suicidal ideation among adolescent school children, involvement in bully-victim problems, and perceived social support. *Suicide and Life-Threatening Behavior, 29*, 119-130. doi:10.1111/j.1943-278X.1999.tb01050.x
- Roberts, J. A., Yaya, L. H. P., & Manolis, C. (2014). The invisible addiction: Cell-phone activities and addiction among male and female college students. *Journal of Behavioral Addictions, 3*, 254-265. doi:10.1556/JBA.3.2014.015
- Roberts, K. C., Yao, X., Carson, V., Chaput, J. P., Janssen, I. & Tremblay, M. S. (2017). Meeting the Canadian 24-hour movement guidelines for children and youth. *Health Reports, 18*, 3-7.

- Roza, S. J., Hofstra, M. B., van der Ende, J., & Verhulst, F. C. (2003). Stable prediction of mood and anxiety disorders based on behavioral and emotional problems in childhood: A 14-year follow-up during childhood, adolescence, and young adulthood. *The American Journal of Psychiatry*, *160*, 2116-2121. doi:10.1176/appi.ajp.160.12.2116
- Rudolph, K. D., Flynn, M., Abaied, J. L., Groot, A., & Thompson, R. (2009). Why is past depression the best predictor of future depression? Stress generation as a mechanism of depression continuity in girls. *Journal of Clinical Child and Adolescent Psychology*, *38*, 473-485. doi:10.1080/15374410902976296
- Rutter, M. (1985). Resilience in the face of adversity: Protective factors and resistance to psychiatric disorder. *British Journal of Psychiatry*, *147*, 598-611. doi:10.1192/bjp.147.6.598
- Sagioglou, C., & Greitemeyer, T. (2014). Facebook's emotional consequences: Why Facebook causes a decrease in mood and why people still use it. *Computers in Human Behavior*, *35*, 359-363. doi:10.1016/j.chb.2014.03.003
- Sampasa-Kanyinga, H., & Lewis, R. F. (2015). Frequent use of social networking sites is associated with poor psychological functioning among children and adolescents. *Cyberpsychology, Behavior, and Social Networking*, *18*, 380-385. doi:10.1089/cyber.2015.0055
- Sanders, C. E., Field, T. M., Diego, M., & Kaplan, M. (2000). The relationship of Internet use to depression and social isolation among adolescents. *Adolescence*, *35*, 237-242.
- Sands, E. R., & Wardle, J. (2003). Internalization of ideal body shapes in 9–12-year-old girls. *International Journal of Eating Disorders*, *33*, 193-204. doi:10.1002/eat.10121
- Santarossa, S., & Woodruff, S. J. (2017). #SocialMedia: Exploring the relationship of social networking sites on body image, self-esteem, and eating disorders. *Social Media + Society*, *3*, 1-10. doi:10.1177/2056305117704407

- Sarason, I. G., Levine, H. M., Basham, R. B., & Sarason, B. R. (1983). Assessing social support: The Social Support Questionnaire. *Journal of Personality and Social Psychology*, 44, 127-139. doi:10.1037/0022-3514.44.1.127
- Scaramella, L. V., Conger, R. D., & Simons, R. L. (1999). Parental protective influences and gender-specific increases in adolescent internalizing and externalizing problems. *Journal of Research on Adolescence*, 9, 111-141. doi:10.1207/s15327795jra0902_1
- Seiffge-Krenke, I. (2004). Adaptive and maladaptive coping styles: Does intervention change anything? *European Journal of Developmental Psychology*, 1, 367-382. doi:10.1080/17405629.2004.11453396
- Seiffge-Krenke, I., & Klessinger, N. (2000). Long-term effects of avoidant coping on adolescents' depressive symptoms. *Journal of Youth and Adolescence*, 29, 617-630.
- Selig, J. P., & Preacher, K. J. (2009). Mediation models for longitudinal data in developmental research. *Research in Human Development*, 6, 144-164. doi:10.1080/15427600902911247
- Shafer, D. M. (2012). Causes of state hostility and enjoyment in player versus player and player versus environment video games. *Journal of Communication*, 62, 719-737. doi:10.1111/j.1460-2466.2012.01654.x
- Shang, L., Wang, J., O'Loughlin, J., Tremblay, A., Mathieu, M.-È., Henderson, M., & Gray-Donald, K. (2015). Screen time is associated with dietary intake in overweight Canadian children. *Preventive Medicine Reports*, 2, 265-269. doi:10.1016/j.pmedr.2015.04.003
- Shaw, L. H., & Gant, L. M. (2002). In defense of the Internet: The relationship between Internet communication and depression, loneliness, self-esteem, and perceived social support. *CyberPsychology & Behavior*, 5, 157-171. doi:10.1089/109493102753770552

- Smith, A. R., Hames, J. L., & Joiner, T. E., Jr. (2013). Status update: Maladaptive Facebook usage predicts increases in body dissatisfaction and bulimic symptoms. *Journal of Affective Disorders, 149*, 235-240. doi:10.1016/j.jad.2013.01.032
- Stice, E., Hayward, C., Cameron, R. P., Killen, J. D., & Taylor, C. B. (2000). Body-image and eating disturbances predict onset of depression among female adolescents: A longitudinal study. *Journal of abnormal psychology, 109*, 438-444. doi:10.1037/0021-843X.109.3.438
- Stice, E., & Shaw, H. E. (1994). Adverse effects of the media portrayed thin-ideal on women and linkages to bulimic symptomatology. *Journal of Social and Clinical Psychology, 13*, 288-308. doi:10.1521/jscp.1994.13.3.288
- Striegel-Moore, R. H., & Bulik, C. M. (2007). Risk factors for eating disorders. *American Psychologist, 62*, 181-198. doi:10.1037/0003-066X.62.3.181
- Suchert, V., Hanewinkel, R., & Isensee, B. (2015). Sedentary behavior and indicators of mental health in school-aged children and adolescents: A systematic review. *Preventive Medicine, 76*, 48-57. doi:10.1016/j.ypmed.2015.03.026
- Sund, A. M., & Wichstrøm, L. (2002). Insecure attachment as a risk factor for future depressive symptoms in early adolescence. *Journal of the American Academy of Child & Adolescent Psychiatry, 41*, 1478-1485. doi:10.1097/01.CHI.0000024870.60748.3D
- Tao, Z. L., & Liu, Y. (2009). Is there a relationship between Internet dependence and eating disorders? A comparison study of Internet dependents and non-Internet dependents. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity, 14*, 77-83. doi:10.1007/BF03327803
- Thompson, J. K., Heinberg, L. J., Altabe, M., & Tantleff-Dunn, S. (1999). *Exacting beauty: Theory, assessment, and treatment of body image disturbance*. Washington, DC: American Psychological Association.

- Tiggemann, M., & McGill, B. (2004). The role of social comparison in the effect of magazine advertisements on women's mood and body dissatisfaction. *Journal of Social and Clinical Psychology, 23*, 23-44. doi:10.1521/jscp.23.1.23.26991
- Torstveit, M. K., Agedal-Mortensen, K., & Stea, T. H. (2015). More than half of high school students report disordered eating: A cross sectional study among Norwegian boys and girls. *PLoS ONE, 10*, e0122681. doi:10.1371/journal.pone.0122681
- Tylka, T. L., & Subich, L. M. (2004). Examining a multidimensional model of eating disorder symptomatology among college women. *Journal of Counseling Psychology, 51*, 314-328. doi:10.1037/0022-0167.51.3.314
- Ulfvebrand, S., Birgegård, A., Norring, C., Högdahl, L., & von Hausswolff-Juhlin, Y. (2015). Psychiatric comorbidity in women and men with eating disorders results from a large clinical database. *Psychiatry Research, 230*, 294-299. doi:10.1016/j.psychres.2015.09.008
- U.S. National Library of Medicine. (2015). *Screen time and children*. Retrieved from <https://medlineplus.gov/ency/patientinstructions/000355.htm>
- Valkenburg, P. M., & Peter, J. (2011). Online communication among adolescents: An integrated model of its attraction, opportunities, and risks. *Journal of Adolescent Health, 48*, 121-127. doi:10.1016/j.jadohealth.2010.08.020
- Valkenburg, P. M., Peter, J., & Schouten, A. P. (2006). Friend networking sites and their relationship to adolescents' well-being and social self-esteem. *CyberPsychology & Behavior, 9*, 584-590. doi:10.1089/cpb.2006.9.584
- van Strien, T., Frijters, J. E., Bergers, G. P., & Defares, P. B. (1986). The Dutch Eating Behaviour Questionnaire (DEBQ) for assessment of restrained, emotional, and external eating behavior. *International Journal of Eating Disorders, 5*, 295-315. doi:10.1002/1098-108X(198602)5:2<295::AID-EAT2260050209>3.0.CO;2-T

- van Strien, T., Schippers, G. M., & Cox, W. M. (1995). On the relationship between emotional and external eating behavior. *Addictive Behaviors*, 20, 585-594. doi:10.1016/0306-4603(95)00018-8
- Vogt, W. P. (1993). Dictionary of statistics and methodology: A nontechnical guide for the social sciences. Thousand Oaks, CA: Sage.
- Wade, T. J., Cairney, J., & Pevalin, D. J. (2002). Emergence of gender differences in depression during adolescence: National panel results from three countries. *Journal of the American Academy of Child and Adolescent Psychiatry*, 41, 190-198. doi:10.1097/00004583-200202000-00013
- Wang, H. R., Cho, H., & Kim, D.-J. (2018). Prevalence and correlates of comorbid depression in a nonclinical online sample with DSM-5 Internet gaming disorder. *Journal of Affective Disorders*. Advance online publication.
- Wardle, J. (1987). Eating style: A validation study of the Dutch Eating Behaviour Questionnaire in normal subjects and women with eating disorders. *Journal of Psychosomatic Research*, 31, 161-169. doi:10.1016/0022-3999(87)90072-9
- Washburn-Ormachea, J. M., Hillman, S. B., & Sawilowsky, S. S. (2004). Gender and gender-role orientation differences on adolescents' coping with peer stressors. *Journal of Youth and Adolescence*, 33, 31-40. doi:10.1023/A:1027330213113
- Weber, S., Puskar, K. R., & Ren, D. (2010). Relationships between depressive symptoms and perceived social support, self-esteem, & optimism in a sample of rural adolescents. *Issues in Mental Health Nursing*, 31, 584-588. doi:10.3109/01612841003775061
- Weersing, V. R., Iyengar, S., Kolko, D. J., Birmaher, B., & Brent, D. A. (2006). Effectiveness of cognitive-behavioral therapy for adolescent depression: A benchmarking investigation. *Behavior Therapy*, 37, 36-48. doi:10.1016/j.beth.2005.03.003

- Wilkinson, R. B., Walford, W. A., & Espnes, G. Å. (2000). Coping styles and psychological health in adolescents and young adults: A comparison of moderator and main effects models. *Australian Journal of Psychology*, 52, 155-162. doi:10.1080/00049530008255383
- Williamson, D. A., White, M. A., York-Crowe, E., & Stewart, T. M. (2004). Cognitive-behavioural theories of eating disorders. *Behaviour Modification*, 28, 711-738. doi:10.1177/0145445503259853
- Windle, M. (1992). A longitudinal study of stress buffering for adolescent problem behaviors. *Developmental Psychology*, 28, 522-530. doi:10.1037/0012-1649.28.3.522
- World Health Organization (2018). Adolescents and Mental Health. Retrieved from http://www.who.int/maternal_child_adolescent/topics/adolescence/mental_health/en/
- Yee, N. (2006). The demographics, motivations, and derived experiences of users of massively-multiuser online graphical environments. *PRESENCE: Teleoperators and Virtual Environments*, 15, 309-329. 10.1162/pres.15.3.309
- You, S., Shin, K., & Kim, A. Y. (2017). Body image, self-esteem, and depression in Korean adolescents. *Child Indicators Research*, 10, 231-245. doi:10.1007/s12187-016-9385-z
- Zeeck, A., Stelzer, N., Linster, H. W., Joos, A., & Hartmann, A. (2011). Emotion and eating in binge eating disorder and obesity. *European Eating Disorders Review*, 19, 426-437. doi:10.1002/erv.1066

Appendix A: Consent Forms

Research on Eating and Adolescent Lifestyle
REAL Study
INFORMATION DOCUMENT FOR FOLLOW-UP

Research Team:

Dr. Martine Flament – Principal investigator – martine.flament@rohcg.on.ca; (613)722-6521 ext. 6801

Dr. Annick Buchholz – Co-investigator – buchholz@cheo.on.ca ; (613) 737-7600 ext. 2837

Dr. Katherine Henderson - Co-investigator – henderson_k@cheo.on.ca; (613) 737-7600 ext. 5895

Dr. Gary Goldfield – Co-investigator – ggoldfield@cheo.on.ca; (613) 737-7600 ext. 3288

Dear parent/guardian and student,

Dr. Martine Flament and a research team from the University of Ottawa Institute of Mental Health Research at the Royal Ottawa Mental Health Centre (ROMHC) and the Children's Hospital of Eastern Ontario (CHEO), in Ottawa, are doing a study on self-image and eating behaviours in adolescents. The project will help determine how lifestyle plays a role in the development of healthy or unhealthy eating behaviours and body weight. In the end, we hope to understand how eating and weight disorders develop, and how to prevent them.

Since November of 2004, we have been collecting information from over 2,000 adolescents in grades 7 to 12 from the Ottawa-Carleton and surrounding regions. If you recall, your child completed a questionnaire that was administered during class time, which asked about things like eating habits, dieting, self-esteem, body image, personal and family lifestyle, feelings, emotions, and relationships with family and peers. At the time of the study last year, you and your child were asked whether you gave us permission to re-contact you in one year's time. We are grateful that you agreed to participate last year, and we hope you will choose to participate again this year. Students who choose to participate again in the study at their school will be included in a draw for the chance to win an iPod nano (1 iPod nano per 40 participants). Alternatively, the participating students may be offered a pizza party after or upon completion of the survey. If the adolescent completes the study at another location (i.e. the Royal Ottawa Mental Health Centre) due to the researchers being unable to perform the study in his/her school, he/she will be offered a reimbursement of \$20 as compensation for their time.

All the answers to the survey are confidential. Each questionnaire will be numbered and students will be asked not to write their name on it. No one besides the research team will have access to the information recorded, whether they are parents, teachers, or other students. The answers to the questionnaire will be kept in a secure place at the Royal Ottawa Mental Health Centre, and will be used for this research only. Because some of the questions can be personal, some students might feel uncomfortable. If this were to happen, we will do our best to help by answering any questions they might have during or after the survey.

However, if any of the answers indicate that a student may be in serious danger (one of the following situations: wants to kill him/herself, possible depressive or eating disorder), a member of the research team will meet with your child for a brief and confidential assessment. If at that time the professional believes that further intervention is needed, they will contact a parent/guardian to ensure that the participant is provided with the proper environmental and/or professional support. Students will also be informed that in the event that they are experiencing any other problems, be it anxiety or general emotional problems, they should talk to someone like a parent, family doctor, or school personnel. The school has been provided with a list of mental health resources available for youth in the Ottawa area. As an additional safeguard after the survey, all participants will be given a “thank you” letter including the name and address of at least one member of the research team, should they wish to make future contact. All data collected will be retained for 10 years post publication. This is a requirement of the Research Ethics Board of the Royal Ottawa Mental Health Centre.

The questionnaire will again be given to the students during class time, on a date that is convenient for their school. Students will complete it during a regular class period (approximately 50 to 70 minutes). After the questionnaire is completed, we will measure each student’s height and weight. This will be performed individually and confidentially in a private space. If for some reason we are unable to locate a specific student at their school, we will invite the participant, either via telephone or email, to complete the survey at a different location (i.e., at the Royal Ottawa Mental Health Centre). The participant will also be weighed and measured upon completion of the survey.

We ask parents and guardians to indicate if they want their child to participate in this study by signing a consent form. Students will also be given the choice to participate or not before the questionnaire package is distributed on the day of the study. Students can stop participating at any time, or refuse to answer any particular questions without penalty. Their decision will not affect their marks and will not appear on any school document.

We will again be asking permission to re-contact the students in a year’s time for another follow-up, in order to determine changes that may take place over time. In no way does consenting to be re-contacted now indicate your consent to participate in the study next year.

When the research is completed, results for the entire group of participants as a whole will be available to schools, parents, and students who are interested.

The study has been reviewed by the Research Ethics Boards of the ROMHC and CHEO. A Research Ethics Board consists of a group of people from scientific and non-scientific background that review research studies. Their goal is to ensure the rights and welfare of people involved in research are protected. The study has also been approved by the Ottawa-Carleton Research Advisory Committee, as well as the principal from your own school. For any questions about ethical considerations and the rights of participants, you may call the Chair of the ROMHC Research Ethics Board at (613) 722-6521 ext. 6226, or the Chair of the CHEO Ethics Board at (613) 737-7600 ext. 3272.

For any other questions, please call Dr. Martine Flament (Principal Investigator) at (613) 722-6521 ext. 6801.

Research on Eating and Adolescent Lifestyle

*REAL Study***CONSENT FORM FOR PARENTS/GUARDIANS AT FOLLOW-UP**

I have read and I understand the information document concerning the study on self-image, eating behaviours, and lifestyle in adolescents. I have had the opportunity to ask questions, and I know everything I need to know in order to decide whether or not my child should participate in this study. I also understand that my permission is required in order for my child to participate.

I know that a questionnaire will be administered in my child's classroom. It will contain certain questions of a personal nature on many aspects of his/her lifestyle like eating habits, dieting, self-esteem, body image, feelings, emotions, and relationships with family and peers. I have been assured that every effort will be made to minimize any discomfort that could be caused by certain questions. I have also been advised that participation in this study is completely voluntary, and that my child has the right not to participate, to withdraw consent and discontinue participation at any time, or to refuse to answer particular questions without any negative effect on his/her marks, relationship with teachers, or academic record.

Every student in the classroom who has agreed to participate will be given a questionnaire, and will have to hand it in at the end of the period. A number will be assigned to each questionnaire, and my child will not be asked to write his/her name on any part of it. After the questionnaire is completed, a researcher will measure my child's height and weight individually in a private space. Participating students will be compensated for their time either in the form of a prize draw or a pizza party. If for some reason my child cannot complete the survey at his/her school, he/she will be invited either via telephone or email to complete it at a different location (i.e., at the Royal Ottawa Mental Health Centre), where he/she will also be weighed and measured, and be reimbursed for their time in the form of money.

I have been assured that all answers will remain confidential and that the completed questionnaires will be kept in a secure location that is only accessible to the researchers. However, if any of the answers indicate that my child may be in serious danger (one of the following situations: wants to kill him/herself, possibly diagnosable depressive or eating disorder), a member of the research team will get in touch, individually and confidentially with him/her and assess the situation, to ensure that my child is provided with the proper environmental and/or professional support. I am aware that my child will be informed that he/she should speak with a parent, family physician, or school staff member if he/she is experiencing any anxiety-related or other emotional problems. As an additional safeguard after the survey, all participants will be given a "thank you" letter including the name and address of at least one member of the research team, should they wish to make future contact. I understand that all data collected will be retained for 10 post publication, and that this is a requirement of the Research Ethics Board of the Royal Ottawa Mental Health Centre.

If I have any questions about my child's rights as a study participant, I can call Dr. Martine Flament (Principal Investigator) at (613) 722-6521 ext. 6801.

Please turn over



_____ I authorize my child to participate in this study

_____ I do not authorize my child to participate in this study

There are two copies of this consent form. Please return one to your child's school and keep the other for your files

Name of child: _____

Name of Parent/Guardian: _____

Signature: _____ Date: _____

Name of Investigator: _____

Signature: _____ Date: _____

Research on Eating and Adolescent Lifestyle

*REAL Study***CONSENT FORM FOR PARENTS/GUARDIANS AT FOLLOW-UP****Permission for student to be re-contacted for the third phase of the study**

I have read and I understand the information document concerning the study on self-image, eating behaviours, and lifestyle in adolescents. I have had the opportunity to ask questions, and I know everything I need to know in order to decide whether or not my child may be re-contacted to participate in a follow-up study. I also understand that my permission would be required again in order for my child to participate in any further study.

I know that the investigator may re-contact my child via home phone number or my child's email address.

_____ I authorize my child to be possibly re-contacted for a follow-up study

_____ I do not authorize my child to be possibly re-contacted for a follow-up study

There are two copies of this consent form. Please return one to your child's school and keep the other for your files

Name of child: _____

Home phone number: _____

Work phone number: _____

Cell phone number: _____

Email address: _____

Name of Parent/Guardian: _____ Signature: _____ Date: _____

Name of Investigator: _____ Signature: _____ Date: _____

Appendix B: Assent Forms

Research on Eating and Adolescent Lifestyle

*REAL Study***ASSENT FORM FOR STUDENT AT FOLLOW-UP**

I have read and I understand the information document concerning the study on self-image and eating behaviours in adolescents. I have had the opportunity to ask questions, and I know everything I need to know in order to decide whether or not I will participate in this study. I also understand that in order for me to participate, my parent/guardian must give their permission.

I know that a questionnaire will be given out to all students who decided to participate. It will contain certain personal questions on many aspects of my lifestyle like eating habits, dieting, self-esteem, body image, feelings, emotions, and relationships with family and peers. I have been assured that researchers will make every effort to help me if certain questions make me uncomfortable. I have also been told that participation in this study is completely voluntary and that I have the right not to participate, to stop participating at any time, or to refuse to answer particular questions without any consequences.

Every student in the classroom who has agreed to participate will be given a questionnaire and will have to hand it in at the end of the period. A number will be assigned to my questionnaire, and I will not be asked to write my name on any part of it. Once the questionnaire is completed, a researcher will measure my height and weight individually in a private space. Participating students will be thanked for completing the survey, in the form of either a prize draw or a pizza party. If for some reason the study researchers are unable to find me at my school, then I understand that I will be asked either by phone or my email to come to another location (i.e., the Royal Ottawa Mental Health Centre) in order to complete the study. I also understand that I will be weighed and measured at that same location, and that I will be paid for my time.

I have been assured that all answers will be kept confidential, that the completed questionnaires will be kept in a secure location that is only accessible to the researchers, and that the data that is collected will be kept for 10 years post publication. However, if any of my answers indicate that I may be in serious danger (such as, I want to harm myself or I suffer from a depressive or eating disorder), a member of the research team will get in touch, individually and confidentially, to make sure that I receive support and help if needed.

If I have any questions about my rights as a study participant, I can call Dr. Flament (Principal Investigator) at (613) 722-6521 ext. 6801.

_____ I agree to participate in this study

_____ I do not agree to participate in this study

There are two copies of this form; you may keep one of them

Name: _____ Signature: _____ Date: _____

Name of Investigator: _____ Signature: _____ Date: _____

**ASSENT FORM FOR STUDENT AT FOLLOW-UP to be re-contacted for the
THIRD phase of the study**

We thank you for participating again in the REAL study. Another follow-up may be done next year, and we wish to ask for your permission to re-contact you once more in one year's time.

Please be assured that you will in no way be obligated to participate in any further follow-up even if you agree to be contacted again, and your decision will not affect your participation in the current study.

_____ I agree to possibly be contacted by the investigators in one year's time

My phone number is: _____

My email address is: _____

The school I plan on attending next year is: _____

_____ I do not agree to possibly be contacted by the investigators in one year's time

There are two copies of this form. Please return one to your school and keep the other

Name: _____ Signature: _____ Date: _____

Name of investigator: _____ Signature: _____ Date: _____



Appendix C: Participant Thank You Letter at Follow-up

Research on Eating and Adolescent Lifestyle REAL Study



Thank you for taking the time to be part of our study! We really appreciate your commitment and effort. As you know, we developed this study to look at self-image and eating behaviours in adolescents. It is our hope that your answers will help us determine what in the adolescent lifestyle plays a role in the development of his/her body image, and healthy or unhealthy eating and weight.

Once the study is completed, the results will be shared in summary form – your identity will never be revealed. We will have a summary of the results available to schools, students and parents who are interested.

Before and after completion of the questionnaire, you had the opportunity to ask the researchers questions about the study and discuss feelings you may have had as a result of some questions asked. However, should you later feel distressed or feel you need to talk to someone about the study, please don't hesitate to call Dr. Martine Flament (principal investigator) at (613) 722-6521 ext. 6801. Again, thank you for taking the time to be part of our study!

Appendix D: Demographics Questionnaire

Date:

day month year

Teacher (name)

*For each question, please pick up the answer that is true (or most true) for you.
There are no right or wrong answers. We just want to learn more about youth like you.
Your answers are confidential (your name will not appear anywhere on the questionnaire).
If you have problems with any questions, please raise your hand and we'll come to help.*

Please give ONE answer for each question by circling the corresponding number and/or filling in the blanks (grey zones)

1. What is your date of birth?

day month year

2. What grade are you in?

1. 7th

2. 8th

3. 9th

4. 10th

5. 11th

6. 12th

3. What is your gender?

1. Male

2. Female

4. How much school has your mother had?

1. She didn't finish High School know

2. High School diploma

3. College or University degree

4. I don't know

5. How much school has your father had?

1. He didn't finish High School know

2. High School diploma

3. College or University degree

4. I don't know

6. Which of the following groups best describes your ethnic origin?

(you can mark two responses IF YOUR PARENTS each have a DIFFERENT origin)

1. European

2. Aboriginal

3. Caribbean

4. Central or South American

5. Oceanian (Australia, New Zealand)

6. North American (Canada, US)

7. African

8. Asian

9. Middle Eastern

10. Other (which one?):

7. What is the main language you speak at home with your parents? (mark ONLY ONE)

1. English

2. French

3. Italian

4. German

5. Arabic

6. Chinese

7. Vietnamese

8. Spanish

9. Somali

10. Other (which one?):

Appendix E: Godin Leisure-Time Exercise Questionnaire (GODIN)

How many times per week, on average, do you do the following types of exercise for more than 15 minutes at a time, during your free time (not part of a mandatory school schedule) ?

	Number of times per week
A. Strenuous Exercise (heart beats rapidly) i.e., running, jogging, hockey, football, soccer, squash, basketball, cross country skiing, judo, roller skating, vigorous swimming, vigorous long distance bicycling	
B. Moderate Exercise (not exhausting) i.e., fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine skiing, popular and folk dancing	
C. Mild Exercise (minimal effort) i.e., yoga, archery, fishing from river bank, bowling, horseshoes, golf, snow-mobiling, easy walking	

D. During your leisure time, how often per week do you engage in any activity **long enough to work up a sweat** (heart beats rapidly)? **1.** Never/Rarely **2.** Sometimes **3.** Often

E. Do you feel 'guilty' that you have 'let yourself down' when you miss an exercise session?

1. Never **2.** Rarely **3.** Sometimes **4.** Often **5.** Always

Appendix F: Leisure-Time Sedentary Activities Scale

On school days, how many hours a day, on average, do you:

	Not at all	Less than	1-3 hours	3-5 hours	5-8 hours	
More than						
hours		1 hour				8
1. Watch TV (including videos and DVD's)?.....	0	1	2	3	4	5
2. Play videogames or computer games?.....	0	1	2	3	4	5
3. Use the computer for other reasons (internet, email, study, chat, instant messaging, etc.)?.....	0	1	2	3	4	5

On weekends and holidays, how many hours a day, on average, do you:

	Not at all	Less than	1-3 hours	3-5 hours	5-8 hours	
More than						
hours		1 hour				8
1. Watch TV (including videos and DVD's)?.....	0	1	2	3	4	5
2. Play videogames or computer games?.....	0	1	2	3	4	5
3. Use the computer for other reasons (internet, email, study, chat, instant messaging, etc.)?.....	0	1	2	3	4	5

Appendix G: Children's Depression Inventory (CDI)

From each group of 3 sentences, pick one sentence that describes you BEST for THE PAST TWO WEEKS

Youth sometimes have DIFFERENT FEELINGS AND IDEAS



From each group of 3 sentences, pick one sentence that describes you BEST for THE PAST TWO WEEKS

1. ☐ I am sad once in a while ☐ I am sad many times ☐ I am sad all the time	14. ☐ I look OK ☐ There are some bad things about my looks ☐ I look ugly
2. ☐ Nothing will ever work out for me ☐ I am not sure if things will work out for me ☐ Things will work out for me	15. ☐ I have to push myself all the time to do my schoolwork ☐ I have to push myself many times to do my schoolwork ☐ Doing my schoolwork is not a big problem
3. ☐ I do most things OK ☐ I do many things wrong ☐ I do everything wrong	16. ☐ I have trouble sleeping every night ☐ I have trouble sleeping many nights ☐ I sleep pretty well
4. ☐ I have fun in many things ☐ I have fun in some things ☐ Nothing is fun at all	17. ☐ I am tired once in a while ☐ I am tired many days ☐ I am tired all the time
5. ☐ I am bad all the time ☐ I am bad many times ☐ I am bad once in a while	18. ☐ Most days I do not feel like eating ☐ Many days I do not feel like eating ☐ I eat pretty well
6. ☐ I think about bad things happening to me once in a while ☐ I worry that bad things will happen to me ☐ I am sure that terrible things will happen to me	19. ☐ I do not worry about aches and pains ☐ I worry about aches and pains many times ☐ I worry about aches and pains all the time
7. ☐ I hate myself ☐ I do not like myself ☐ I like myself	20. ☐ I do not feel alone ☐ I feel alone many times ☐ I feel alone all the time
8. ☐ All bad things are my fault ☐ Many bad things are my fault ☐ Bad things are not usually my fault	21. ☐ I never have fun at school ☐ I have fun at school only once in a while ☐ I have fun at school many times.
9. ☐ I do not think about killing myself ☐ I think about killing myself but I would not do it ☐ I want to kill myself	22. ☐ I have plenty of friends ☐ I have some friends but I wish I had more ☐ I do not have any friends
10. ☐ I feel like crying every day ☐ I feel like crying many days ☐ I feel like crying once in a while	23. ☐ My schoolwork is all right ☐ My schoolwork is not as good as before ☐ I do very badly in subjects I used to be good in
11. ☐ Things bother me all the time ☐ Things bother me many times ☐ Things bother me once in a while	24. ☐ I can never be as good as other kids ☐ I can be as good as other kids if I want to ☐ I am just as good as other kids
12. ☐ I like being with people	25. ☐ Nobody really loves me

☐ I do not like being with people many times ☐ I do not want to be with people at all	☐ I am not sure if anybody loves me ☐ I am sure that somebody loves me
13. ☐ I cannot make up my mind about things ☐ It is hard to make up my mind about things ☐ I make up my mind about things easily	26. ☐ I usually do what I am told ☐ I do not do what I am told most times ☐ I never do what I am told
27. ☐ I get along with people ☐ I get into fights many times ☐ I get into fights all the time	

Appendix H: Body Esteem Scale for Adolescents and Adults (BESAA)

Indicate HOW OFTEN YOU AGREE with the following statements ABOUT YOURSELF by circling the appropriate number

	Never	Seldom	Sometimes	Often	Always
1. I like what I look like in pictures.....	0	1	2	3	4
2. Other people consider me good looking.....	0	1	2	3	4
3. I'm proud of my body.....	0	1	2	3	4
4. I am preoccupied with trying to change my body weight	0	1	2	3	4
5. I think my appearance would help me get a job.....	0	1	2	3	4
6. I like what I see when I look in the mirror.....	0	1	2	3	4
7. There are lots of things I'd change about my looks if I could.....	0	1	2	3	4
8. I am satisfied with my weight	0	1	2	3	4
9. I wish I looked better	0	1	2	3	4
10. I really like what I weigh.....	0	1	2	3	4
11. I wish I looked like someone else.....	0	1	2	3	4
12. People my own age like my looks.....	0	1	2	3	4
13. My looks upset me.....	0	1	2	3	4
14. I'm as nice looking as most people.....	0	1	2	3	4
15. I'm pretty happy about the way I look.....	0	1	2	3	4
16. I feel I weigh the right amount for my height.....	0	1	2	3	4
17. I feel ashamed of how I look.....	0	1	2	3	4
18. Weighing myself depresses me.....	0	1	2	3	4
19. My weight makes me unhappy.....	0	1	2	3	4
20. My looks help me to get dates.....	0	1	2	3	4
21. I worry about the way I look.....	0	1	2	3	4
22. I think I have a good body.....	0	1	2	3	4
23. I'm looking as nice as I'd like to.....	0	1	2	3	4



Appendix I: Dutch Eating Behaviour Questionnaire (DEBQ)

WHEN AND HOW DO YOU EAT?

Circle the number that shows how often the statement is true for you

	Never	Seldom	Some- times	Often	Very often
1. If you have put on weight, do you eat less than you usually do?.....	1	2	3	4	5
2. Do you try to eat less at mealtimes than you would like to eat?.....	1	2	3	4	5
3. How often do you refuse food or drink offered because you are concerned about your weight?.....	1	2	3	4	5
4. Do you watch exactly what you eat?.....	1	2	3	4	5
5. Do you deliberately eat foods that are slimming?.....	1	2	3	4	5
6. When you have eaten too much, do you eat less than usual the following days?.....	1	2	3	4	5
7. Do you deliberately eat less in order not to become heavier?.....	1	2	3	4	5
8. How often do you try not to eat between meals because you are watching your weight?..	1	2	3	4	5
9. How often in the evening do you try not to eat because you are watching your weight? ...	1	2	3	4	5
10. Do you take into account your weight with what you eat?.....	1	2	3	4	5
11. Do you have the desire to eat when you are irritated?.....	1	2	3	4	5
12. Do you have a desire to eat when you have nothing to do?.....	1	2	3	4	5
13. Do you have a desire to eat when you are depressed or discouraged?.....	1	2	3	4	5
14. Do you have a desire to eat when you are feeling lonely?.....	1	2	3	4	5

15. Do you have a desire to eat when somebody lets you down?.....1 2 3 4 5
16. Do you have a desire to eat when you are cross?.....1 2 3 4 5
17. Do you have a desire to eat when you are approaching something unpleasant
to happen?1 2 3 4 5
18. Do you have a desire to eat when you are anxious, worried or tense?.....1 2 3 4 5
19. Do you have a desire to eat when things are going against you or when things
have gone wrong?.....1 2 3 4 5
20. Do you have a desire to eat when you are frightened?.....1 2 3 4 5
21. Do you have a desire to eat when you are disappointed?.....1 2 3 4 5
22. Do you have a desire to eat when you are emotionally upset?.....1 2 3 4 5
23. Do you have a desire to eat when you are bored or restless?.....1 2 3 4 5
24. If food tastes good to you, do you eat more than usual?.....1 2 3 4 5
25. If food smells and looks good, do you eat more than usual?.....1 2 3 4 5
26. If you see or smell something delicious, do you have the desire to eat it?.....1 2 3 4 5
27. If you have something delicious to eat, do you eat it straight away?.....1 2 3 4 5
28. If you walk past the bakery, do you have a desire to buy something delicious?.....1 2 3 4 5
29. If you walk past a snack bar or a café, do you have a desire to buy something
delicious?.....1 2 3 4 5

30. If you see others eating, do you also have a desire to eat?.....1 2 3 4 5

31. Can you resist eating delicious foods?.....1 2 3 4 5

32. Do you eat more than usual when you see others eating?.....1 2 3 4 5

33. When preparing a meal, are you inclined to eat something?.....1 2 3 4 5

Appendix J: Sample Excel Spreadsheet Demonstrating how Coefficients and Standard Errors Were Estimated Across the 17 Databases in Study 1

Table 8.2

Imputation	θ_i	SE_i	SE_i^2	$(\theta_i - \theta)^2$	
1	-0.05934	0.02122	0.000450	0.000014	
2	-0.05668	0.02191	0.000480	0.000001	
3	-0.05076	0.02166	0.000469	0.000024	
4	-0.06415	0.02152	0.000463	0.000073	
5	-0.06203	0.02119	0.000449	0.000041	
6	-0.06121	0.02136	0.000456	0.000031	
7	-0.05520	0.02126	0.000452	0.000000	
8	-0.05320	0.02173	0.000472	0.000006	
9	-0.05858	0.02109	0.000445	0.000009	
10	-0.05400	0.02183	0.000477	0.000003	
11	-0.05370	0.02154	0.000464	0.000004	
12	-0.05750	0.02156	0.000465	0.000003	
13	-0.05147	0.02186	0.000478	0.000017	
14	-0.04400	0.02178	0.000474	0.000135	
15	-0.05486	0.02117	0.000448	0.000001	
16	-0.05521	0.02164	0.000468	0.000000	
17	-0.05382	0.02161	0.000467	0.000003	
	-0.945710		0.007878	0.000365	
	17	n =	17	df =	16
$\theta =$	-0.05563	$V_W =$	0.000463404	$V_B =$	0.000023
					$V_T =$ 0.000487328
					SE = 0.022075498
					UL= -0.01236
					LL= -0.09889

Appendix K: Adolescent Relationship Questionnaire (A-RSQ)

Below are FOUR DIFFERENT WAYS PEOPLE MAY FEEL ABOUT OTHERS

 *Read each paragraph carefully, then tell how much the description sounds like you by circling ONE number from 1= 'not at all like me' to 7= 'very much like me'*

- A.** It is easy for me to feel close to people. I feel OK asking people for help and I know that they will usually help me. When people ask me for help, they can count on me. I don't worry about being alone and I don't worry about others not liking me.

Not at all like me							Very much like me
1	2	3	4	5	6	7	

- B.** It is hard for me to feel close to people. I want to be close to people, but I find it hard to trust them. I find it hard to ask people for help. I worry that if I get too close to people, they will end up hurting me

Not at all like me							Very much like me
1	2	3	4	5	6	7	

- C.** I want to be really close to people, but they don't want to get that close to me. I am unhappy if I don't have people that I feel close to. I sometimes think that I care about people more than they care about me

Not at all like me							Very much like me
1	2	3	4	5	6	7	

- D.** I don't care if I am close to people. It is very important for me not to ask for help, because I like to do things on my own.
I don't like it if people ask me for help

Not at all like me							Very much like me
1	2	3	4	5	6	7	

Appendix L: Coping Inventory for Stressful Situations-24 (CISS)***When I encounter a difficult, stressful or upsetting situation...***

	Not at all			Very much	
	1	2	3	4	5
1. I try to be with other people.....	1	2	3	4	5
2. I feel anxious about not being able to cope.....	1	2	3	4	5
3. I become very tense.....	1	2	3	4	5
4. I blame myself for being too emotional about the situation.....	1	2	3	4	5
5. I go out for a snack or meal.....	1	2	3	4	5
6. I become very upset.....	1	2	3	4	5
7. I buy myself something.....	1	2	3	4	5
8. I determine a course of action and follow it.....	1	2	3	4	5
9. I spend time with a special person.....	1	2	3	4	5
10. I blame myself for not knowing what to do.....	1	2	3	4	5
11. I go to a party.....	1	2	3	4	5
12. I work to understand the situation.....	1	2	3	4	5
13. I phone a friend.....	1	2	3	4	5
14. I take corrective action immediately.....	1	2	3	4	5
15. I wish that I could change what had happened or how I felt.....	1	2	3	4	5
16. I visit a friend.....	1	2	3	4	5
17. I worry about what I am going to do.....	1	2	3	4	5
18. I see a movie.....	1	2	3	4	5
19. I get control of the situation.....	1	2	3	4	5
20. I talk to someone whose advice I value.....	1	2	3	4	5
21. I make an extra effort to get things done.....	1	2	3	4	5
22. I come up with several different solutions to the problem.....	1	2	3	4	5
23. I try to be organized so I can be on top of the situation.....	1	2	3	4	5
24. I think about the good times I've had.....	1	2	3	4	5

Appendix K: McKnight Risk Factor Survey-IV Support/Sharing Subscale

The questions below ask about what it is like to be a teenager today. Please circle the number that BEST APPLIES TO YOU

" In the past year, how often...

	Never Always	Rarely	Sometimes	Often	
12. Have you had someone you can count on to listen to you when you need to talk?.....	1	2	3	4	5
16. Have you had someone to share your most private worries and fears with?.....	1	2	3	4	5
39. Have you had someone to help you understand a problem when you needed it?.....	1	2	3	4	5

Appendix N: University of Ottawa Ethics Certificates

File Number: H04-16-18

Date (mm/dd/yyyy): 06/04/2016



Université d'Ottawa
Bureau d'éthique et d'intégrité de la recherche

University of Ottawa
Office of Research Ethics and Integrity

Certificate of Ethics Approval

Health Sciences and Science REB

Principal Investigator / Supervisor / Co-investigator(s) / Student(s)

<u>First Name</u>	<u>Last Name</u>	<u>Affiliation</u>	<u>Role</u>
Gary	Goldfield	Medicine / Medicine	Supervisor
Marissa	Murray	Social Sciences / Psychology	Student Researcher

File Number: H04-16-18

Type of Project: PhD Thesis (Secondary use of data)

Title: Screen time activities and depressive symptomatology among adolescents: A longitudinal investigation of cognitive, behavioural and interpersonal pathways.

Approval Date (mm/dd/yyyy)

Expiry Date (mm/dd/yyyy)

06/04/2016

06/03/2017

Special Conditions / Comments:

N/A

File Number: H04-16-18

Date (mm/dd/yyyy): 05/26/2017



Université d'Ottawa **University of Ottawa**
 Bureau d'éthique et d'intégrité de la recherche Office of Research Ethics and Integrity

Ethics Approval Notice

Health Sciences and Science REB

Principal Investigator / Supervisor / Co-investigator(s) / Student(s)

<u>First Name</u>	<u>Last Name</u>	<u>Affiliation</u>	<u>Role</u>
Gary	Goldfield	Medicine / Medicine	Supervisor
Marissa	Murray	Social Sciences / Psychology	Student Researcher

File Number: H04-16-18

Type of Project: Secondary use of data

Title: Screen time activities and depressive symptomatology among adolescents: A longitudinal investigation of cognitive, behavioural and interpersonal pathways

Renewal Date (mm/dd/yyyy)	Expiry Date (mm/dd/yyyy)	Approval Type
06/04/2017	06/03/2018	Renewal

Special Conditions / Comments:
 N/A

Appendix O: Children's Hospital of Eastern Ontario Ethics Certificates



CHEO Research Ethics Board Approval - Delegated Review

Principal Investigator: Dr. Gary Goldfield

REB Protocol No: 16/78X

Romeo File No: 20160282

Project Title: CHEOREB# 16/78X - Screen Time Activities and Depressive Symptomatology among Adolescents : A Longitudinal Investigation of Cognitive, Behavioural, and Interpersonal Pathways

Primary Affiliation: HALO\HALO

Protocol Status: Active

Approval Date*: July 05, 2016

Valid Until:** June 15, 2017

Annual Renewal Submission Deadline: May 15, 2017

Documents Reviewed & Approved:

Document Name	Comments	Version Date
Protocol	Goldfield and Murray Minimal Risk Protocol June 28 2016	2016/06/28
Case Report Form	Study Questionnaires extracted from the original study battery	

This is to notify you that the Children's Hospital of Eastern Ontario Research Ethics Board has granted approval to the above named research study on the date noted above. Your project was reviewed under the delegated review stream, which is reserved for projects that involve no more than minimal risk to human subjects.

In respect to this study, my signature below certifies, that as a representative of this Research Ethics Board:

1. The membership of this Research Ethics Board complies to the Tri-Council Policy Statement on Ethical Conduct for Research involving Humans;
2. The membership of this Research Ethics Board complies with the membership requirements for Research Ethics Boards defined in Part C Division 5 of the *Food and Drug Regulations* and Part 4 of the *Natural Health Products Regulations*;
3. This Research Ethics Board carries out its functions in a manner consistent with ICH Good Clinical Practices: consolidated guidelines and applicable laws and regulations of Ontario and Canada; and
4. This Research Ethics Board has reviewed and approved the protocol; which is to be conducted by the qualified investigator named above at the specified site. This approval and the views of this Research Ethics Board have been documented in writing.

Final approval is granted for the above noted study, with the understanding that the investigator agrees to comply with the following requirements:

1. The investigator must conduct the study in compliance with the protocol and any additional conditions set out by the Board.
2. Investigators must submit an annual renewal report to the REB 30 days prior to the expiration date stated above.
3. The investigator must not implement any deviation from, or changes to, the protocol, consents or assents without the approval of the REB.
4. The investigator must, prior to use, submit to the Board changes to the study documentation, e.g., changes to the informed consent letters, recruitment materials.
5. Investigators must provide the Board with French versions of the consent form, unless a waiver has been granted. An interpreter should be offered to participants as required or at the request of the participant throughout the course of research.



RESEARCH INSTITUTE
INSTITUT DE RECHERCHE

Research Ethics Board 2017 Annual Renewal (Delegated)

Principal Investigator: Dr. Gary Goldfield

REB Protocol No: 16/78X

Romeo File No: 20160282

Project Title: CHEOREB# 16/78X - Screen Time Activities and Depressive Symptomatology among Adolescents : A Longitudinal Investigation of Cognitive, Behavioural, and Interpersonal Pathways

Primary Affiliation: HALO\HALO

Protocol Status: Active

Approval Date: May 26, 2017 **Approval Valid Until:** June 15, 2018

Annual Renewal Submission Deadline: May 15, 2018

Documents Reviewed & Approved:

Document Name	Comments	Version Date
Protocol	Protocol	2016/06/28

This is to notify you that the CHEO REB has granted approval to the renewal for the above named research study for a period of one year. The renewal was reviewed and approved by the Chair or a delegate of the Chair. Decisions made by the Chair under delegated review are ratified by the full Board at its subsequent meeting.

Approval is granted with the understanding that the investigator agrees to comply with the following requirements:

- 1 The investigator must conduct the study in compliance with the protocol and any additional conditions set out by the Board.
- 2 The investigator is responsible for complying with all applicable guidelines and regulations regarding human research ethics conduct, as applicable to the research project.
- 3 Investigators must submit an annual renewal report to the REB 30 days prior to the expiration date stated on the final approval letter.
- 4 The investigator must not implement any deviation from, or changes to, the protocol without the approval of the REB except where necessary to eliminate an immediate hazard to the research subject, or when the change involves only logistical or administrative aspects of the study (e.g., change of telephone number or research staff). As soon as possible, however, the implemented deviation or change, the reasons for it and, if appropriate, the proposed protocol amendment(s) should be submitted to the Board for review.

- 5 The investigator must, prior to use, submit to the Board changes to the study documentation, e.g., changes to the informed consent letters, recruitment materials.
- 6 Investigators must provide the Board with French version of the consent form, unless a waiver has been granted. An interpreter should be offered to participants as required or at the request of the participant throughout the course of research.
- 7 For clinical drug or device trials, investigators must promptly report to the REB all adverse events that are both serious and unexpected (SAEs) or unexpected and untoward occurrences (including the loss or theft of study data and other such privacy breaches.
- 8 For SAE reports on clinical drug trials, the investigator must also comply with the hospital-wide Policy regarding, Procedures for Considering Medical Error in the Differential Diagnosis of Severe Adverse Events (SAE) Associated with the Drugs Administered in a Clinical Trial .
- 9 Investigators must promptly report to the REB any new information regarding the safety of research subjects (e.g., changes to the product monograph or investigator's brochure of drug trials). Where available, any reports produced by the Data Safety Monitoring Board should also be promptly submitted to the REB.
- 10 Investigators must notify the REB of any study closures (closed to accrual, temporary, premature or permanent).
- 11 Investigators must submit a final report at the conclusion of the study.

If you have any questions, pertaining to this letter, please contact the Research Ethics Board Office at [613\) 737-7600, ext. 3350](tel:6137377600) or 2128.

Regards,

Richard Carpentier, PhD

Chair, Research Ethics Board

Président, Comité d'éthique de la recherche

Appendix P: Royal Ottawa Mental Health Centre Ethics Certificates



Mental Health - Care & Research
Santé mentale - Soins et recherche

1145 avenue Carling Avenue
Ottawa ON K1Z 7K4
theroyal.ca / leroyal.ca

Tel. / Tél. 613.722.6521
Toll free / Ligne sans frais 1.800.987.6424

RESEARCH ETHICS BOARD

August 12, 2016

Marissa Murray, PhD candidate
Principal Investigator

Re: REB# 2016016
Screen Time Activities and Depressive Symptomatology Among Adolescent: A Longitudinal Investigation of Cognitive, Behavioural, and Interpersonal Pathways

Dear Ms. Murray,

This letter is to acknowledge receipt of your application (received 23, 2016) which received *delegated review* by members of the Research Ethics Board for the above-titled protocol.

Your protocol has now received approval for the period of one (1) year from the date of this letter.

This approval is contingent upon maintaining adherence to the normal approval process, namely,

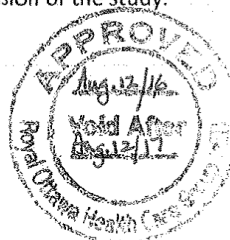
- Reporting to the Board any adverse events of the project in progress
- Seeking prior approval from the Board of any direct use of public media to recruit research participants

Approval will be reconsidered if Hospital/Institutional resources are used beyond those specified on the Checklist of Resources or the Impact on Hospital resources and/or if Grant funding applied for is not received. However, in either case the protocol can be re-submitted with revised Checklist information and will be reconsidered.

Annual progress reports must be submitted to the Board for continuation of Research Ethics approval. A *termination report* is required at the conclusion of the study.

Sincerely, on behalf of the Board,

Pierre Blier, MD PhD
Chair, Research Ethics Board



Royal Ottawa
Mental Health Centre
Centre de santé mentale
Royal Ottawa

University of Ottawa
Institute of Mental Health Research
Institut de recherche en santé mentale
de l'Université d'Ottawa

Royal Ottawa
Foundation for Mental Health
Fondation de santé mentale
Royal Ottawa

Brockville
Mental Health Centre
Centre de santé mentale
Brockville



Mental Health - Care & Research
Santé mentale - Soins et recherche

1145 avenue Carling Avenue
Ottawa ON K1Z 7K4
theroyal.ca / leroyal.ca

Tel. / Tél. 613.722.6521
Toll free / Ligne sans frais 1.800.987.6424

RESEARCH ETHICS BOARD

June 19, 2017

Gary Goldfield, PhD, C. Psych.
Principal Investigator

Re: REB# 2016016
Screen Time Activities and Depressive Symptomatology Among Adolescents: A
Longitudinal Investigation of Cognitive, Behavioural and Interpersonal Pathways

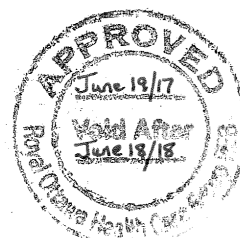
Dear Dr. Goldfield,

This letter is to acknowledge receipt of your annual progress report (dated May 24, 2017) and request for renewal of the above-titled protocol.

The study has now received **re-approval for the period of one (1) year from the date of this letter.**

Sincerely, on behalf of the Board,

Pierre Blier, MD PhD
Chair, Research Ethics Board



Royal Ottawa
Mental Health Centre
Centre de santé mentale
Royal Ottawa

University of Ottawa
Institute of Mental Health Research
Institut de recherche en santé mentale
de l'Université d'Ottawa

Royal Ottawa
Foundation for Mental Health
Fondation de santé mentale
Royal Ottawa

Brockville
Mental Health Centre
Centre de santé mentale
Brockville