

THE INFLUENCE OF PHYSICAL ACTIVITY ON PSYCHOLOGICAL WELL-BEING  
AMONG ADOLESCENTS AND EMERGING ADULTS

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## Abstract

Emerging literature has emphasized the importance of considering psychological factors and individual characteristics that result in both positive and negative outcomes over the course of development. One relatively promising promotive factor for psychological well-being during adolescence and emerging adulthood is engagement in physical activity. Although some evidence exists for a link between physical activity and psychological well-being across development, little is known about the mechanisms through which physical activity leads to positive mental outcomes. Using multi-group structural equation modeling (SEM) with latent variables, the current study explored direct and indirect pathways through which physical activity leads to lower levels of depressive symptoms and greater levels of subjective happiness in a cross-sectional community sample of male and female high school and university students. Self-efficacy, perceived social support, and emotion regulation were explored as possible mediating factors in the model. Physical activity had a direct, positive association with subjective happiness, and a direct, negative association with depressed mood in both the adolescent and emerging adult (EA) samples. For adolescents, emotional and social self-efficacy served as indirect pathways for the association between physical activity and psychological well-being. For EAs, there were significant indirect pathways from physical activity to psychological well-being via emotional self-efficacy and family support. Several gender and developmental differences were noted for the psychosocial constructs and the hypothesized pathways. The results suggest that there may be several factors involved in explaining the improved psychosocial well-being associated with physical activity. The study findings are of relevance to researchers, clinicians, educators, and policy-makers, with important implications for informing school-based mental health promotion and intervention programs for youth.

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## Introduction

Adolescence and emerging adulthood represent two distinctly sensitive developmental periods with respect to psychological well-being. These transitional life-stages are characterized by a unique set of biological and psychological hurdles, strengths, and vulnerabilities (Noam & Valiant, 1994). In order to understand developmental outcomes during these life-stages, health and mental health researchers traditionally take a deficit-focused approach, examining risk or vulnerability factors associated with the emergence of psychopathology and illness more broadly. However, the limitations of a strictly deficit-based model of development are increasingly being recognized in the literature (Damon, 2004). In response, research has shifted towards more inclusive, positive perspectives, such as the health promotion approach, which considers the role of protective (i.e., factors that decrease the likelihood of experiencing negative outcomes for those individuals at risk; Patel & Goodman, 2007) and promotive factors (i.e., factors that actively enhance well-being for all individuals; Patel & Goodman, 2007) in sustaining successful development in adolescence and emerging adulthood. Unlike the deficit framework, which aims to prevent, reduce, and repair deviation from normal functioning within a disease model (Cicchetti & Cohen, 1995), a health promotion approach proposes that it is equally important to understand the factors that contribute to the promotion and maintenance of well-being among individuals as a whole, which is more than just the absence of mental illness (Joubert & Raeburn, 1998; Seligman & Csikszentmihalyi, 2000). Therefore, it is important to consider the positive outcomes and personal traits that facilitate youth to successfully navigate through the many challenges of development and achieve an adaptive life trajectory, despite any ongoing limitations that may arise from mental health problems.



In light of this shift, scholars and clinicians have developed an increasing appreciation for the importance of exploring both negative and positive outcomes that may emerge across development, as these outcomes may not necessarily be mutually exclusive, but rather exist along two distinct continuum as separate yet interrelated constructs (Greenspoon & Saklofske, 2001; Keyes, 2002; Schwartz, Pantin, Coatsworth, & Szapocznik, 2007). In this two-continuum model, one continuum represents the presence or absence of mental health (i.e., positive outcomes, such as subjective happiness) and the other represents the presence or absence of mental illness (i.e., negative outcomes, such as depression; Westerhof & Keyes, 2010). In this way, individuals can fall into any one of four general categories, such as high mental health and low mental illness (e.g., a person without a diagnosed mental illness who is feeling good and functioning well in life), low mental health and high mental illness (e.g., a person who is experiencing mental illness and who may also have difficulty coping with normal stressors in life), high mental health and high mental illness (e.g., a person with schizophrenia who also experiences high levels of subjective well-being and contributes to their community), and low mental health and low mental illness (e.g., a person who has no diagnosable mental illness but is having difficulty coping with the stressors of daily life). The notion of a two continuum model highlights the importance of considering the both the presence and absence of positive and negative outcomes, as they represent separate yet related dimensions that make unique contributions to our understanding of psychological functioning during adolescence and emerging adulthood.

### **Developmental Changes in Psychological Well-Being**

Researchers have identified unique developmental differences with respect to psychological well-being amongst adolescents and emerging adults (EAs). Such age-related

shifts in the patterns and severity of psychopathology may reflect unique developmental progressions characteristic of these periods. Although adolescents and EAs are similar in that most have not yet entered marriage or parenthood, few similarities exist beyond this (Arnett, 2014). Adolescence refers to the transitional period of physical and psychological development between childhood and adulthood (e.g., ages 13-18 years). For the most part, emerging adulthood reflects a period of development marked by increasing independence and autonomy. For example, EAs tend to live away from home, have diverse educational paths, possess adult legal status, and have reached full reproductive maturity (e.g., ages 18-29 years; Arnett, 2014). In these ways, emerging adulthood represents a distinct developmental period from adolescence, not merely an extension.

Generally, the transition from adolescence to emerging adulthood is characterized by self-focused exploration and the navigation of a new set of developmental tasks and expectations; most notably, significant changes in social roles, societal expectations, education and work, relationships, and autonomy (Arnett, 2000, 2014). For the most part, EAs experience more independence than adolescents; however, they have yet to acquire the normative responsibilities of adulthood. Markedly, EAs experience many evolving social opportunities and difficulties, such as gaining independence from parents and a general increase in the level of stability and intimacy of friendships and romantic relationships (Arnett, 2000). Many youth will adjust well to this transition; however, some will falter and flounder, experiencing difficulties with their increasingly adult roles. Provided these developmental disparities between adolescents and emerging adults, it is important to understand how pivotal transitional periods may be uniquely marked by both risk and opportunities to flourish.

Although many youth successfully navigate the biological, social, and cognitive transitions that typify adolescence, this developmental period also represents a time of increased risk for the emergence of certain types of psychopathology (Giedd, Keshavan, & Paus, 2008). One major mental health concern that commonly emerges during adolescence is depression (Kessler, Avenevoli, & Merikangas, 2001). It has been estimated that lifetime prevalence rates for major depression among adolescents between the ages of 15 and 18 are approximately 14%, with a subsequent 11% reporting minor depression (Hammen & Rudolph, 2003). Likewise, depressive symptomatology (i.e., endorsement of symptoms of depression along a continuum of severity that includes both clinical and sub-clinical expression) shows similar trends during adolescence. On average, depressive symptoms tend to remain low during early adolescence and begin to increase during mid-adolescence (Cole, Tram, Martin, Hoffman, Ruiz, Jacquez et al., 2002; Rawana & Morgan, 2014). Marked gender differences are consistently observed by mid-adolescence, with adolescent girls experiencing higher rates of depression and depressive symptoms than boys (Hankin, Abramson, Moffitt, Silva, McGee, & Angell, 1998; Hyde, Mezulis, & Abramson, 2008; Merikangas, He, Brody, Fisher, Bourdon, & Koretz, 2010; Nolen-Hoeksema & Girgus, 1994). Further, depression and depressive symptoms during adolescence tend to recur and persist into adulthood (Lewinsohn, Rohde, Seeley, Klein, & Gotlib, 2003; Rudolph, 2009).

Understanding the factors that contribute to healthy psychological development has recently become a particularly important issue during emerging adulthood. Emerging adulthood is generally characterized by mild improvements in psychological well-being compared to adolescence (Galambos, Barker, & Krahn, 2006; McPhie & Rawana, 2014). However, the occurrence of depression remains notably associated with this life-stage, with first incidence rates remaining relatively similar to those observed in adolescence and considerably higher than

rates reported in adulthood (Rhode, Lewinsohn, Klein, Seeley, & Gau, 2013). Further, national data suggests that approximately 32% of emerging adults report feelings of depression (Arnett & Schwab, 2012). Research utilizing longitudinal trajectory analyses have identified unique developmental pathways for depression across adolescence into emerging adulthood; specifically, results indicate that some youth experience decreased levels of depression during emerging adulthood, while others experience a marked increase or a persistence of elevated levels of depressive symptoms well into emerging adulthood (Mc Donald & Rawana, manuscript in preparation). Longitudinal research during emerging adulthood has demonstrated a narrowing of the gender gap that characterizes depression in adolescence; albeit, women tend to remain at greater risk for depression during emerging adulthood (Galambos, Barker, & Krahn, 2006; McPhie & Rawana, 2015).

The consequences of depression across the lifespan are often widespread and can be severe, resulting in impaired functioning in multiple domains including work and academic performance, interpersonal relationships, and cognitive functioning (Abela & Hankin, 2008). As such, adolescence and emerging adulthood represent important developmental periods to study not only risk and vulnerability factors that contribute to the developmental and ongoing pathology of depression and mental health more broadly, but also protective and promotive factors that foster psychological well-being among all individuals, regardless of risk for psychopathology.

Navigating the unique changes and challenges that characterize adolescence and emerging adulthood may provide opportunities for positive growth and development. Positive mental health has been conceptualized as encompassing a number of key elements, including the ability to enjoy life (i.e., subjective happiness, subjective well-being, and life-satisfaction),

coping and resilience, and emotional and spiritual well-being (Canadian Institute for Health information, 2009). As such, feelings of happiness serve as one key marker of mental health. Subjective well-being is considered to be a general area of scientific study rather than a specific construct, and encompasses the concept of subjective happiness. It has been suggested that happiness does not merely represent the absence of psychopathology, but also encompasses the combination of satisfaction with life and the frequency and intensity of positive and negative affect (Argyle, 1992). Research on the development of subjective happiness during adolescence and emerging adulthood is only in its infancy (Holder, 2012), as much of the attention has been concentrated on understanding happiness in adulthood (Romen, Hamama, Rosenbaum, & Mishely-Yarlap, 2014).

Subjective happiness is important for promoting learning, adjusting to society, and for overall quality of life, especially when individuals encounter additional stressors above and beyond those encountered during normative development (Fredrickson, 2009; Fredrickson, Tugade, Waugh, & Larkin, 2003; Romen et al., 2014). Interestingly, subjective happiness and life satisfaction tend to decline during the transition into adolescence and progression throughout adolescence (Goldbeck, Schmitz, Besier, Herschbach, & Henrich, 2007; Chui & Wong 2016; Uusitalo-Malmivaara, 2014), underscoring the importance of increasing our understanding of the factors that promote and maintain happiness during the adolescent years. Additionally, it is unclear whether gender has a direct association with happiness during adolescence, but there is evidence that gender may influence other variables that contribute to happiness (e.g., academic satisfaction), thereby influencing the manner in which happiness develops in girls and boys (Chui & Wong, 2016; Moljord, Eriksen, Moksnes, & Espnes, 2011).

Trends in subjective happiness during emerging adulthood are yet to be elucidated, although some research demonstrates a worsening in a related construct, life satisfaction, during emerging adulthood (Stone, Schwartz, Broderick, & Deaton, 2010). Arnett (2007) suggests that EAs may possess high expectations for life (e.g., work, love, etc.), and the discrepancy between these expectations and real life may influence subjective happiness. However, emerging adulthood is commonly considered a period of improved psychological well-being, with EAs generally experiencing more positive than negative affect (Galambos & Krahn, 2008). Thus, more research is needed in order to better understand patterns and predictors of subjective happiness during different stages of development.

### **Risk and Protective Factors for Psychological Well-Being Across Development**

Research is progressively widening its scope to account for the unique contribution of protective and promotive factors to adolescent and EA psychological development and well-being. To date, the extant literature has identified a number of psychological and psychosocial factors that serve as protective factors for depressive symptomatology, or promotive factors for happiness and psychological well-being more broadly. Among youth, scientific evidence has linked lower levels of depressive symptomatology with higher levels of self-efficacy (Joshi, Sharma, & Mehra, 2009; Muris, Schmidt, Lambrichs, & Meesters, 2001; Sawatzky, Ratner, Richardson, Washburn, Sudmant, & Mirwaldt, 2012), greater social support and family connectedness (Li, Albert, & Dwelle, 2014; Van Voorhees, Paunesku, Kuwabara, Basu, Gollan, Hankin et al., 2008; Vaughan, Foshee, & Ennett, 2010), and utilization of adaptive emotion regulation strategies (Matheson & Anisman, 2003; Muris et al., 2001). Less empirical support exists for factors that promote increased experiences of subjective happiness during adolescence and EA. Research suggests that happiness in both adults and youth is associated with a number

of factors, including personality traits and temperament (e.g., high extraversion and low neuroticism; Furnham & Cheng, 2000; McKnight, Huebner, & Suldo, 2002), social relationships and popularity among peers (Chaplin, 2009; Holder & Coleman, 2009; Uusitalo-Malmivaara & Lehto, 2013), self-esteem and self-efficacy (Caprara, Patrizia, Gerbino, Paciello, Vecchio, 2006; Huebner, Gilman, & Laughlin, 1999), and better academic performance (Uusitalo-Malmivaara, 2014).

One relatively promising promotive factor for psychological well-being in youth that is spurring interest in numerous fields of research is physical activity. Physical activity refers to any structured or unstructured activity involving bodily movement produced by the skeletal muscles and requires more energy than resting (e.g., jogging, skipping, cycling, participation in sports; World Health Organization, 2017). Engagement in physical activity may serve to both prevent undesirable outcomes, such as depressive symptoms (Jerstad, Boutelle, Ness, & Stice, 2010; Taliaferro, Rienzo, Pigg, Miller, & Dodd, 2009) as well as promote desired outcomes, such as subjective happiness (Martinez, 2005; Moljord, Eriksen, Moksnes, & Espnes, 2011). Much of the research examining the link between physical activity and psychological well-being has focused almost exclusively on adult samples (McPhie & Rawana, 2012); however, the importance of examining this link among adolescent and emerging adult populations is being increasingly recognized in the literature. Health behaviours, such as engagement in physical activity, are extremely important to understand among youth, as health-related habits, values, and lifestyles formed during adolescence often endure across the lifespan, and consequently, influence vulnerability to the course of health and well-being throughout life (Maggs, Schulenberg, & Hurrelmann, 1997; Taylor & Sherman, 2004). Further, the transition to emerging adulthood is often associated with further increase in autonomy and a decrease in structure and

stability (Arnett, 2000); thus, EAs are given the opportunity to experience different ways of living, which may include changes in health related behaviours that were previously enforced by parents. Of concern, research has demonstrated that the greatest reductions in engagement in physical activity occur during adolescence (Center for Disease Control and Prevention, 1997), with even further reductions observed in emerging adulthood (Bray & Born, 2004), most notably in those transitioning to university (Kwan, Cairney, Faulkner, & Pullenayegum, 2012). These findings highlight the need to understand the link between physical activity and psychological well-being among adolescent and emerging adult populations.

Although physical activity is gaining attention for its potential contribution to psychological well-being in adolescence and emerging adulthood, at present, the relation is not well understood (Dishman, Hales, Pfeiffer, Felton, Saunders, Ward et al., 2006; McPhie & Rawana, 2012). There is a growing body of evidence that suggests adolescents and EAs who engage in physical activity have improved social and psychological well-being, including better academic performance, self-esteem, subjective happiness, life satisfaction, parental relationships, as well as reduced depressive symptomatology, anxiety, and anger (Holder, Coleman, & Sehn, 2009; Maher, Doerksen, Elavsky, Hyde, Pincus, Ram et al., 2013; Sacker & Cable, 2006; Valois, Zullig, Huebner, & Drane, 2004; Moljord et al., 2011; Taliaferro et al., 2009). However, this literature is marked by conflicting results regarding the directionality of the relation between physical activity and psychological well-being (Birkeland, Jerstad, Boutelle, Ness, & Stice, 2010; Raudsepp & Neissaar, 2012). For instance, it is not entirely clear whether physical activity protects against depression or whether depression hinders an individual from engaging in physical activity. Further, only a limited number of studies have considered specific aspects of physical activity (i.e., intensity, frequency, duration, and type) that may differentially contribute



to the mental health and well-being of youth (Eime, Young, Harvey, Charity, & Payne, 2013). Moreover, provided the unique developmental differences that characterize adolescence and emerging adults, the present literature requires a better understanding of potential developmental variations that may exist with respect to the link between physical activity and psychological well-being.

Little is known about why and how engagement in physical activity enhances psychological well-being. Accordingly, researchers in the field have recognized the need to deepen our understanding of the potential mechanisms of influence (e.g., Dishman et al., 2006; Jerstad et al., 2010). Several factors have been identified as possible underlying mechanisms for the link between physical activity and depressive symptoms in youth, including biological (e.g., Brain-Derived Neurotrophic factor; Mata, Thompson, & Gotlib, 2010) and psychological factors, such as self-esteem and self-concept (Dishman et al., 2006, McPhie & Rawana, 2012; White, Kendrick & Yardley, 2009) and positive and negative affect (White et al., 2009). While researchers have suggested several mechanisms at play for the physical activity-depression link, intervening factors that may explain the beneficial effects of physical activity on subjective happiness have not yet been explored. For example, it may be that physical activity serves as a protective factor, buffering against symptoms of depression, perhaps by promoting social connectedness, increasing self-esteem or self-efficacy, or providing an adaptive means for managing one's emotions (Jerstad et al., 2010; McPhie & Rawana, 2012).

A number of hypotheses have been put forth to explain the beneficial influence of physical activity on psychological well-being. More specifically, several psychosocial mechanisms have been proposed, including distraction, self-efficacy, social interaction, and mental toughness (Monterio-Peluso & Guerra de Andrade, 2005). In terms of distraction, it is

believed that participation in physical activity provides a diversion from unfavourable stimuli, generating feelings of well-being during and post-activity. The self-efficacy supposition proposes that because physical activity can be viewed as a challenging task, the ability to get involved and remain engaged can lead to positive feelings of accomplishment and capability. Lastly, the social interaction hypothesis purports that the contexts in which physical activity occur provide opportunities for social connection and support among individuals engaging in physical activity, which in turn, play an important role in the effects of physical activity on psychological well-being. Furthermore, Gerber and colleagues have proposed a related idea, that of mental toughness, a concept related to hardiness (Gerber, Kalak, Lemola, Clough, Pühse, Elliot et al., 2012). Mental toughness is comprised of four elements: control (e.g., feelings of control over circumstances), commitment (e.g., ability to set goals and stick with them), challenge (e.g., ability to push beyond boundaries and embrace change), and confidence (e.g., belief in one's own abilities to manage conflict and challenge; Clough & Sewell, 2002). Gerber et al. (2012) suggest that these mental toughness attributes may be fostered through participation in physical activity, consequently promoting psychological well-being.

In summary, additional research is needed to understand the plausible mechanisms and developmental pathways underlying the positive influence of physical activity on psychological well-being. The following section will highlight some of the key developmental differences in psychological and psychosocial functioning among adolescence and EA, potentially serving as unique mechanisms through which physical activity promotes psychological well-being. The few existing studies examining these psychosocial constructs as mediators of the physical activity and psychological well-being relationship will be highlighted.

### **Developmental Trends in Psychosocial Factors**

Over the years, a considerable amount of research has explored the developmental changes in a range of psychosocial factors during the transition from adolescence to EA. These psychological and social factors tend to be differentially associated with psychological well-being during these two stages of life. This may result from new opportunities and demands that emerge across development, requiring adolescents and EAs to develop novel approaches to manage these changes. Differences in psychosocial factors might explain why some youth are able to cope effectively with developmental challenges while others may withdraw; thereby, putting themselves at risk for unhappiness and depression (Vecchio, Gerbino, Pastorelli, Bove, & Caprara, 2007). As such, it is important to highlight the salient differences and similarities in psychosocial functioning across the life-span, as these changes have important implications for understanding the unique pathways towards healthy development and how best to promote positive outcomes.

**Emotion regulation.** Effective emotion regulation is an integral part of healthy development (Zeman, Cassano, Perry-Parrish, & Stegall, 2006). Difficulties with emotion regulation have been linked to psychological problems across the life span, including depression, eating disturbances, anxiety, and substance use disorders, whereas adaptive strategies serve a protective role (Aldao, Nolen-Hoeksema, & Schweizer, 2010). Broadly, emotion regulation refers to the process by which we automatically or deliberately, at a conscious or unconscious level, implement various strategies in order to manage and express emotions (Gross & Thompson, 2007). These strategies are aimed at both increasing and decreasing negative (e.g., sadness, anger, etc.) and positive emotions (e.g., joy, interest, etc.). Two main types of ER strategies have been identified: antecedent-focused and response-focused (Gross, 1998). Antecedent-focused refers to strategies that are implemented before the emotion is completely

expressed, for example, selecting certain situations or diverting attention towards or away from something in order to manipulate one's emotional reaction. On the other hand, response-focused strategies are implemented after the emotional response has taken place, for example, diminishing, prolonging, or inhibiting an emotion (Schmidt, Tinti, Levine, & Testa, 2010).

The transition from adolescence to emerging adulthood represents a key period for emotion regulation, as there are considerable psychological, cognitive, and social changes that occur during these stages of development. A review of the literature reveals notable developmental changes in emotion regulations strategies. Generally, there appears to be a decline in emotion regulation across adolescence with a gradual increase as youth transition into emerging adulthood (Vukman & Licardo, 2010). Further, there is a trend towards stronger efficacy beliefs related to the ability to regulate negative emotions across the developmental stages (Schillinger, 2005). Taken together, differences in the emotion regulation strategies used across development likely have important implications for psychological well-being; as such, the present study will consider the unique role of emotion regulation as an intervening factor in the relation between physical activity and psychological well-being among adolescents and emerging adults.

Only one known study has examined the mediating role of emotion regulation. Craft (2005) used a small sample ( $N = 19$ ) of middle-aged women with physician diagnosed clinical depression. The study examined whether a chronic exercise intervention would reduce depressive symptoms via a number of psychosocial mediators. The study found limited support for the emotion regulation strategy, distraction, as a potential underlying mechanism. Some limitations of this study include the use of a small sample consisting of only female participants and the ability for participants to choose their study condition. Thus, while this study offers some

preliminary evidence for the mediating role of emotion regulation, it is unknown how this relationship unfolds in a normative sample of male and female youth.

**Social support.** Another important psychosocial factor that has implications for well-being is perceived social support. Broadly, perceived social support represents the belief that one is cared for and loved, has help available from others, and belongs to a supportive social network or group (Cobb, 1976). Social support is increasingly important for psychological well-being during stressful or transitional periods of life, often serving to buffer negative consequences (Cobb, 1976). There is compelling theoretical and empirical rationale to expect that the relative importance of various sources of social support (i.e., parental, peer, romantic) change across development. For instance, there is an observable shift during adolescence in which youth become less influenced by parents and increasingly influenced by peers (Berndt, 1979); as such, parental influence tends to wane during adolescence relative to peers. During emerging adulthood, social support systems tend to evolve as youth transition to university or into careers. Interestingly, although EAs tend to report less contact with their parents, the nature of their relationship appears to change in a positive way, with EAs reporting more open communication and affection in their relationships (Lefkowitz, 2005). For the most part, there appears to be a general decline in the quality of peer and romantic relationships during the transition from high school into postsecondary institutions, with parental support becoming increasingly salient (Larose & Boivin, 1998). Moreover, women tend to report greater levels of perceived social support compared to males (Bruwer, Emsley, Kidd, Lochner, & Seedat, 2008).

Numerous studies have explored the relationship between social support and depressive symptoms (e.g., Needham, 2008; Vaughan, Foshee, & Ennett, 2010). Among adolescents, both parental and peer support appear to have continued importance for depressive symptoms across

adolescence, with greater levels of perceived social support associated with lower level of depressive symptomatology (Vaughan, Foshee, & Ennett, 2010). Generally, research has demonstrated that perceived social support increases during emerging adulthood and tends to be associated with a decrease in depression (Schulenberg, O'Malley, Bachman, & Johnston, 2005). Specifically, perceived support from family has been associated with decreased depressive symptoms in emerging adulthood, while perceived social support from friends appears to have negligible effects on depressive symptoms (Pettit, Roberts, Lewinsohn, Seeley, & Yaroslavsky, 2011). Thus, the relative salience of various forms of social support tends to evolve across development, having important implications for our understanding of risk for depression during different life stages.

There is some existing research focused on the relationship between social support and physical activity among adolescence. Specifically, this line of research has examined the influence of different types and sources of social support on engagement in physical activity among youth (e.g., Mendonça & de Farias, 2015). For example, research has considered the role of parental or peer support in terms of providing encouragement or transportation for physical activity (Mendonça & de Farias, 2015). Generally, the literature has consistently demonstrated that social support is associated with physical activity levels in adolescence both cross-sectionally and longitudinally, in that those youth who receive more social support from parents or friends report greater levels of physical activity (Mendonça, Cheng, Mélo, & de Farias, 2014). On the other hand, few studies have explicitly examined the role of physical activity in promoting perceived social support among youth. For instance, it has been suggested that engagement in physical activity, such as team-based sports, may provide additional opportunities to forge social connections with others and promote a sense of social support (Jerstad et al.,

2010; McPhie & Rawana, 2012). For example, within the context of sport involvement, youth often spend extensive time traveling to and from training and competitions with parents and also experience numerous stressors related to sport. These situations may provide a context suitable for parent-child bonding and help children develop a sense of optimism, independence, and important coping skills for dealing with adverse events (Côté, 1999; Fraser-Thomas & Côté, 2009; Lauer, Gould, Roman, & Pierce, 2010; Tamminen & Holt, 2012). Further, sport provides opportunities to build strong friendships with teammates, relationships with different aged peers, and a sense of community (Fraser-Thomas & Côté, 2009).

One study that utilized an adult sample examined the role of social support in explaining the relationship between physical activity and depression (Harvey, Hotopf, Øverland, & Mykletun, 2010). The authors found the social benefits of physical activity (i.e., social support and social engagement) were important in explaining this relationship. Similarly, Babiss and Gangwisch (2009) found support for the mediating role of social support in the relation between sport participation and depression in a sample of adolescents. On the other hand, North, McCullagh, and Tran (1990) did not find support for the role of social interaction among adults. As such, the present study will consider the role of physical activity in fostering a sense of social support in a sample of adolescents and EAs, and whether this association, in turn, promotes psychological well-being.

**Self-efficacy.** Bandura (1997) defined self-efficacy as one's perceived confidence in their ability to carry out a desired action. Self-efficacy can be further divided into specific domains, such as social self-efficacy (i.e., perceived ability to manage social difficulties), academic self-efficacy (i.e., perceived ability to manage academic material and requirements), and self-regulatory self-efficacy (i.e., perceived ability to withstand peer pressure to engage in risky

behaviours; Muris, 2001). Self-efficacy has also been examined in other domains, such as health-related behaviours (e.g., physical activity self-efficacy; William & French, 2011).

A large body of research has focused on the relation between self-efficacy and psychological well-being in youth. Among adolescents, studies have demonstrated low levels of self-efficacy to be predictive of long-term depression (Bandura, Pastorelli, Barbaranelli, & Caprara, 1999), while high levels of self-efficacy are predictive of greater life satisfaction (Vecchio et al., 2007). To a much lesser extent, research has considered the role of self-efficacy in psychological well-being among EAs. Research has established a negative relationship between self-efficacy and depression in young adults (Lavasani, Khezriazar, Hemin, Javad, & Malahmadi, 2011; Singh, Singh, & Singh, 2014); albeit, the majority of research on self-efficacy during this life stage has largely focused on the role of self-efficacy as a moderator or mediator between psychosocial constructs and health behaviours (i.e., social support, smoking cessation, etc.) and depression in EA populations (Mee, 2014; Wang, Wang, & Yao, 2008).

The few published studies examining the mediating role of self-efficacy in the physical activity - psychological well-being link are limited to adult populations or psychiatric populations and, for the most part, consider self-efficacy as it specifically relates to physical self-efficacy and efficacy to regulate exercise behaviours (Ryan, 2008; White et al., 2009). Although one study did examine the relation amongst physical activity, self-efficacy, and depression, the researchers used a psychiatric sample of adolescents (Brown, Welsh, Labbé, Vitulli, & Kulkarni, 1992). Further, the study examined how physical activity leads to changes in self-efficacy and depression over the course of an exercise intervention, but not necessarily the mediating role of self-efficacy; albeit, physical activity was positively associated with self-efficacy and negatively associated with depression (Brown et al., 1992). The previously described study by Craft (2005),



which used a sample of clinically depressed women, also considered the role of coping self-efficacy. The results demonstrated an increase in coping self-efficacy across the exercise intervention and a decrease in depressive symptoms, offering empirical support for the explanatory role of self-efficacy. Given the limitations of the previous studies, additional studies are required to build our understanding of the role of self-efficacy in healthy development during adolescence and emerging adulthood. Moreover, forthcoming research should further examine whether the positive effects of in physical activity extend beyond physical self-efficacy to more general domains of self-efficacy (e.g., emotional, social, academic).

In general, more research is required to determine, which, if any, of the previously outlined psychosocial constructs are important mechanisms at play in the physical activity and psychological well-being relationship. Indeed, various mechanisms may be differentially important at specific times during development, at different points in the natural course of mental illness, or may have differing effects for men versus women.

**Gender.** Gender represents a social construct that broadly refers to the behavioural, cultural, or psychological traits associated with men and women. On the other hand, sex refers to the biological and physiological differences that define men and women. Given the focus of the current study, the term gender will be used when referring to differences between men and women. There are distinct gender differences observed in rates of depressive symptoms among adolescents and emerging adults, with girls and women more often reporting higher rates than boys and men. Likewise, notable gender differences have been observed in patterns of physical activity during adolescence and emerging adulthood. During adolescence, boys tend to report higher levels of physical activity compared to girls (Kwan et al., 2012; McPhie & Rawana 2012, 2015). Moreover, longitudinal studies have suggested that during the transition to university,

men demonstrate the greatest decline in rates of physical activity compared to women; however, women similarly display a reduction in physical activity, albeit, more modest in nature (Kjønniksen, Torsheim, & Wold, 2008; Kwan et al., 2012).

These gender differences in level of engagement of physical activity might explain some of the variation in psychological well-being among girls and women and boys and men during adolescence and emerging adulthood. To date, studies examining gender differences in the association between physical activity and depression have generated mixed findings (e.g., McKercher, Sanderson, Schmidt, Otahal, Patton, Dwyer et al., 2014; McPhie & Rawana, 2015). Further, no known research has considered potential gender differences in the link between physical activity and subjective happiness among youth. As such, this remains an important area of research for future studies to explore.

The aforementioned literature highlights the distinct developmental trends in engagement in physical activity and psychological and psychosocial functioning among adolescents and EAs. As such, it is imperative to take into account these important developmental differences when constructing explanatory models for the relationship between physical activity and psychological well-being.

### **Theoretical Frameworks**

Two theoretical frameworks are particularly useful for conceptualizing the present line of research, which considers factors related to both negative and positive outcomes in adolescents and EAs: developmental psychopathology and health promotion perspective.

**Developmental psychopathology.** The developmental psychopathology perspective considers the interplay among the various developmental tasks (i.e., biological, psychological, and social) that are important for understanding how individual differences in outcomes progress

across development (Cicchetti & Toth, 1998). Within this framework, youth are thought to face many risk (i.e., factors extrinsic to the individual; Blum, McNeely, & Nonnemaker, 2001) and vulnerability factors (i.e., an internal feature of the individual that increases their susceptibility to negative outcomes; Ingram, Miranda, & Segal, 1998) as a consequence of the various developmental challenges characteristic of this period (Cicchetti & Rogosch, 2002). For instance, developmental processes that might explain the marked increase in depression symptomatology during adolescence include puberty-linked hormonal changes (Ge, Conger, & Elder, 2001); cognitive changes, including the enhanced capacity for abstract thinking, rumination, and self-reflection (Nolen-Hoeksema, 1994); and increased psychological stress resulting from normative developmental transitions or changes in interpersonal relationships (Hankin, Mermelstein, & Roesch, 2007; Koenig & Gladstone, 1998). On the other hand, this perspective also provides some consideration of the role of protective factors and promotive factors, as developmental transitions and challenges do not only result in increased susceptibility to psychopathology, but also provide opportunities for personal growth and achievement (Cicchetti & Rogosch, 2002). This perspective is also concerned with typical or normative development, as it informs our understanding of the emergence of psychopathology (Cicchetti & Rogosch, 2002).

A developmental psychopathology perspective is useful for exploring how various developmental risk and protective factors may result in adaptive (i.e., happiness) or maladaptive outcomes (i.e., depressive symptoms) in adolescence and emerging adulthood. Additionally, this perspective is interested in the mechanisms and processes that moderate the outcome of risk and protective factors (Cicchetti & Lynch, 1993). As such, the perspective can be applied to understanding the various intervening factors (i.e., variables that might help to explain the relationship between an independent and dependent variable) at play when considering the link

between physical activity and mental health and well-being in adolescence and emerging adulthood. Although the developmental psychopathology framework significantly contributes to our understanding of both positive and negative developmental outcomes across the lifespan, it tends to focus on maladaptive outcomes. Given the present study's focus on fostering positive outcomes, a logical extension is to complement this model with a framework focused on understanding factors that enhance psychological well-being in all individuals, such as the health promotion perspective.

**Health promotion perspective.** Health promotion is an emerging field of action that is broadly defined as improving the health of individuals by acting on the full range of modifiable determinants of health (World Health Organization, 1998). Accordingly, health is defined as “a state of complete physical, mental, and social well-being, and not merely the absence of disease or infirmity” (World Health Organization, 2004). Mental health promotion is encompassed under the broader umbrella of health promotion (Pearson, 2010). Within this framework, positive mental health is conceptualized as an individual's subjective sense of well-being, including positive emotions, such as feelings of happiness, quality of life, and resilience. More specifically, the World Health Organization (2001) defines mental health as “a state of well-being in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community.” Mental health promotion strives to support well-being and resilience, strengthen mental health, and empower individuals and communities (World Health Organization, 2009), and includes a range of strategies to increase the probability of more individuals experiencing positive mental health. As such, any action initiated to protect or improve mental health can be considered part of mental health promotion. Another key tenet of mental health promotion is the emphasis on

considering the population as a whole, including those individuals who are at risk for mental health problems (Christodoulou & Kontaxakis, 1994). Thus, the mental health promotion framework provides the impetus for examining factors that contribute to psychological well-being among all youth in order to facilitate action and advocacy for mental health promotion initiatives.

Researchers have proposed the idea that positive and negative outcomes are not mutually exclusive; that is, they can occur simultaneously within an individual (Greenspoon & Saklofske, 2001; Schwartz et al., 2007). It is hypothesized that there are two continuums, one representing mental illness and the other mental health. It is then increasingly important to consider mutual factors that may be associated with both adaptive or maladaptive development outcomes among youth. Thus, the integration of a health promotion and developmental psychopathology perspective will serve as the theoretical underpinnings of the current study.

### **Current Study**

Research on adolescent and emerging adult mental health has been exceedingly focused on understanding the emergence and maintenance of psychopathology; however, the equal importance of considering factors contributing to positive mental health is being recognized. As such, the proposed study aims to contribute to the growing body of literature looking at the promotion and maintenance of psychological well-being among all adolescents and EAs. Furthermore, the vast majority of extant research has focused on simpler models involving only one or two predictors of mental well-being. Consequently, there is a growing need to construct and test more complex models of developmental pathways to psychological well-being, particularly among adolescents and EAs who are at higher risk for depression (Riggs & Han, 2009).

The current study examined a hypothesized sequence of paths linking physical activity to various psychosocial factors in predicting psychological well-being during two developmental periods (see Figures 1, 2, 3 and 4). Specifically, the study considered how engagement in physical activity affects broadly defined positive outcomes (i.e., subjective happiness) as well as negative outcomes (i.e., depressive symptoms), while taking into account the potential role of intervening factors (i.e., social support, emotion regulation, and self-efficacy), in a normative sample of adolescents and EAs. Of note, in the present study, the notion of “psychological well-being” was defined largely as a positive outcome, indicated by low levels of depressive symptoms and high levels of subjective happiness. The current research project was composed of two separate samples (i.e., adolescent and EA sample), thus, allowing for a greater understanding of the unique contribution and relative salience of these factors during developmentally distinct periods of life. Moreover, the role of gender as a social construct was considered.

### **Objectives**

The overarching goal of the proposed research agenda was to gain a better insight into the health-promoting role of physical activity in protecting against depressive symptoms and promoting feelings of happiness during two developmental stages. Specifically, the current study strived to address the following research objectives:

- 1) to examine the relationship between engagement in physical activity and depressive symptoms and subjective happiness among adolescents and EAs.
- 2) to examine whether various psychological and social constructs, namely self-efficacy, perceived social support, and emotion regulation, serve as key mechanisms through which physical activity promotes subjective happiness and protects against depressive symptoms among adolescents and EAs.

- 3) to further our understanding of how the relationship between physical activity and psychological well-being might vary by gender.
- 4) to explore how physical activity and various psychosocial factors may differentially contribute to psychological well-being during developmentally distinct life stages (i.e., adolescence and emerging adulthood).

### **Hypotheses**

The following hypotheses are proposed for each study objective:

- 1) with respect objective 1, it was hypothesized that engagement in higher levels of physical activity would be related to lower levels of depressive symptoms and greater levels of subjective happiness among both adolescents and emerging adults.
- 2) regarding objective 2, it was hypothesized that greater engagement in physical activity would be associated with higher levels of perceived social support, more adaptive emotion regulation, and greater perceived self-efficacy, which in turn, would be related to fewer depressive symptoms and greater levels of subjective happiness among adolescents and emerging adults alike. Furthermore, it was hypothesized that EAs would more often employ adaptive ER strategies compared to adolescents and report higher levels of social support from parents while adolescents would report higher levels of social support from peers. No specific developmental predictions were offered for self-efficacy, as there is no clear literature highlighting notable developmental changes in this construct.
- 3) there were several hypotheses with respect to objective 3. First, it was expected that males participants would have higher levels of physical activity in both adolescence and emerging adulthood. Additionally, it was hypothesized that female participants would have higher levels of depressive symptoms during adolescence and emerging adulthood;

however, depressive symptomatology was expected to decline during emerging adulthood. Second, no specific developmental gender hypotheses were made for subjective happiness, as existing research is generally inconclusive. Third, provided the exploratory nature of the research project, no specific hypotheses were offered for how the full models might vary by gender.

- 4) there were several broad and exploratory hypotheses pertaining to objective 4. First, it was hypothesized that there would be developmental differences with respect to the contribution of physical activity and the various intervening psychosocial factors on psychological well-being in adolescents and EAs. Second, it was hypothesized that specific domains of psychosocial factors would uniquely contribute to well-being in each developmental period. For example, based on the literature, it was predicted that parental social support would have a greater contribution to well-being during EA, while peer support would contribute more to psychological well-being during adolescence. Third, relative to adolescents, it was expected that EAs would have lower levels of physical activity, depressed mood, and subjective happiness, and higher levels of social support, and adaptive emotion regulation.

## **Method**

### **Procedure**

Data was collected from a normative sample of ethnically diverse adolescents and EAs. Ethics approval was obtained from York University Research Ethics Board.

A community sample of adolescents (ages 14-18) was drawn from secondary schools within the Greater Toronto Area. Prior to data collection, parental consent (required for youth under age 18) and youth assent (required for all student participants) were collected (see



Appendix A). Data collection occurred on four separate occasions from 2013 to 2014 at York University as part of the Psychology portion of the Faculty of Health Information Day for high school students. As part of the one-time information session, youth had the opportunity to complete a paper and pencil battery of self-report measures, which took approximately 20-30 minutes to complete. Participants were provided with information for counselling and support services at the end of the survey.

A sample of EAs was drawn from Introduction to Psychology courses at York University via the Undergraduate Research Participant Pool (URPP). Interested students were required to complete a 30-minute online survey of self-report measures. Prior to completing the survey, participants were required to fill out the electronic consent form (See Appendix A). Due to the sensitive nature of some of the study questions, all participants were provided with information for counseling and support services at the end of the study (See Appendix B). At any point in the survey, participants had the option to elect not to answer any question or discontinue their participation in the survey. Participants were awarded course credit for their participation. For a number of reasons, the current sample of EAs is likely not representative of EAs more broadly. For one, the sample has selected for those young adults who are attending university versus those in the work force. Second, York University tends to be characterized as a commuter school; thus, a large proportion of the participants are likely still living at home with their parents.

### **Participants**

**Adolescent sample.** A total of 387 students enrolled in secondary schools in a large, urban area in south-central Ontario participated in the current study (66.2% girls,  $M_{age} = 16.28$ ,  $SD = 0.63$ , age range = 14-18 years). Participants had expressed an interest in attending an information session about psychology at a local university. With regards to ethnicity, 18.6%

identified as European, 19.1% Asian, 32.5% South-Asian, 13.1% African/Caribbean, 2.6% Latin American, 12.4% “other”, and 1.8% did not indicate any ethnicity. 76.3% of participants reported that they were born in Canada, 22.2% indicated that they were born elsewhere with the average length of time living in Canada being 10.1 years ( $SD = 4.52$ ), and 1.5% did not respond.

**EA sample.** A total of 413 students attending a large, urban university in Canada participated in the current study (77.5% women,  $M_{age} = 19.84$   $SD = 2.13$ , age range = 18-29 years). Participants were enrolled in undergraduate introductory psychology courses and received credit for participating in the study. 55.9% students were in their first year of university, 28.8% in their second year, 7.7% in their third year, 4.4% in their fourth year, and 3.1% indicated “other” or “N/A.” The majority of students indicated that they still lived with their parents (83.3%), followed by off campus (11.4%), campus residence (2.7%), “other” (1.2%), and “N/A” (1.5%). With regards to ethnicity, 21.3% identified as European, 15.5% Asian, 30.3% South-Asian, 8.7% African/Caribbean, 2.4% Latin American, 18.6% “other”, and the remaining 3.1% did not indicate any ethnicity. 62.2% of participants reported that they were born in Canada, while 37.8% indicated that they were born elsewhere with the average length of time living in Canada being 8.97 years ( $SD = 5.65$ ). A series of chi-square tests suggests that the two samples significantly differ in terms of the frequency of ethnicities,  $\chi^2 (7) = 26.12, p < .001$ , gender,  $\chi^2 (1) = 12.19, p < .001$ , and whether or not they were born in Canada,  $\chi^2 (1) = 22.41, p < .001$ .

## Measures

The current study used the following measures that were administered as part of the larger study protocol. The battery of measures used for the adolescent and EA sample were

largely the same. Instances are noted when a modified or adult version of a measure was substituted.

**Demographic information.** Participants provided information regarding their age, gender, and ethnicity.

**Physical activity.** The Physical Activity Questionnaire for Adolescents (PAQ-A; Kowalski, Crocker, & Donen, 2004) is a self-report, 7-day recall instrument of physical activity in adolescents aged 14-20 who are currently in the school system (used in the adolescent sample; see Appendix C). The PAQ-A measures general levels of physical activity throughout the school year. It is comprised of nine items, with items 1 to 8 scored on a 5-point scale. A total activity summary score is derived by summing values for items 1 to 8 and then taking the mean of the 8 items. Item 9 is used to identify students who may have had unusual physical activity during the past week due to illness, but is not used as part of the summary score. Summary activity scores range from 1 to 5, with higher scores reflecting high physical activity. The PAQ-A has been demonstrated to have good convergent validity as a measure of general physical activity level for high school students (Kowalski, Crocker, & Kowalski, 1997). The PAQ-A was found to have good reliability in the current study (Cronbach's alpha = .85). For the SEM, two parcels were used as observed indicators of the general latent construct of "physical activity" (see Analysis section on latent variables for more information regarding the construction of parcels in SEM).

The Physical Activity Questionnaire for Adults (PAQ-AD; Copeland, Kowalski, Donen, & Tremblay, 2005) is an 8-item adult version of the PAQ-A (used in the EA sample; see Appendix D). The questionnaire remains largely the same as the adolescent version; however, several items were modified to make them more developmentally appropriate for an adult population. For instance, several items on the activity checklist were modified (e.g., *skipping* was

replaced with *rock climbing*). Further, rather than being anchored around structured school activities (e.g., *recess, lunch hour, etc.*), the PAQ-AD is anchored around day segments (e.g., *morning, after lunch, etc.*). Lastly, the PAQ-AD was adjusted to include adult-appropriate activity examples. A total activity summary score is derived by summing values for items 1 to 7 and then taking the mean of the 7 items. Item 8 is used to identify instances in which illness may have prevented typical physical activity levels, but is not used as part of the summary score. Summary activity scores range from 1 to 5, with higher scores reflecting high physical activity. The PAQ-AD has been shown to correlate moderately with other commonly used measures of physical activity in adults (e.g., LTEQ; Copeland et al., 2005). The PAQ-AD was found to have good reliability in the current study (Cronbach's alpha = .81). For the SEM, two parcels were used as observed indicators of the general latent construct of "physical activity."

**Perceived social support.** The Multidimensional Scale of Perceived Social Support (MSPSS; Zimet, Dahlem, Zimet, & Farley, 1988) is a self-report measure of subjective social support adequacy from three specific sources: family (items 3, 4, 8, and 11), friends (items 6, 7, 9, and 12), and significant other (items 1, 2, 5, and 10; used in both samples; see Appendix E). The items comprising the various scales are designed to allow participants to interpret them in a manner that is most relevant to them. For instance, the items in the significant other domain refer to a "special person," which may be interpreted as a boyfriend/girlfriend, teacher, sports coach, counselor, etc. (Canty-Mitchell & Zimet, 2000). Twelve-item ratings are made on a 7-point Likert-type scale ranging from 1 (*very strongly disagree*) to 7 (*very strongly agree*). The MSPSS is scored as a total summed score for each of the subscores (i.e., family, friends, and significant other), with subscores ranging from 4 to 28. Higher scores reflect a higher level of perceived social support. The MSPSS has been shown to have good psychometric properties in samples of

youth (Bruwer et al., 2008; Wilson, Washington, Engel, Ciol, & Jensen, 2006). In the current study, the MSPSS was found to have good reliability in both the adolescent (Cronbach's alpha = .92) and EA samples (Cronbach's alpha = .92). For the SEM, the three subscales were used to represent latent constructs of "perceived social support from friends," "perceived social support from family," and "perceived social support from significant other." Two parcels were used as observed indicators for each of the latent constructs.

**Self-efficacy.** The Self-Efficacy Questionnaire for Children (SEQ-C; Muris, 2001) is a 24-item self-report measure of perceived self-efficacy in youth (used in both samples; see Appendix F). The SEQ-C measures three domains of self-efficacy: social self-efficacy (i.e., perceived capability for peer relations and assertiveness), academic self-efficacy (i.e., perceived capability to manage one's own learning behaviour, to master academic subjects, and fulfill academic expectation), and emotional self-efficacy (i.e., perceived capability of coping with negative emotions). The wording of several items was modified for the EA sample in order to make it more age-appropriate (e.g., changing *children* to *peers*, and *teachers* to *professors/TAs*). Each item is scored on a 5-point scale with responses ranging from 1 (*not at all*) to 5 (*very well*). The total self-efficacy score and subscale scores are obtained by summing across all relevant items. The SEQ-C has been shown to possess good internal consistency (Muris, 2001; Muris, 2002). The SEQ-C was found to have good reliability in the current study, with Cronbach's alphas of .88 and .91 for the adolescent and EA samples, respectively. For the SEM, the three subscales were used to represent latent constructs of "emotional self-efficacy," "social self-efficacy," and "academic self-efficacy." Two parcels were used as observed indicators for each of the latent constructs.

**Emotion regulation.** The Emotion Regulation Questionnaire (ERQ; Gross & John, 2003) is a 10-item measure designed to assess two emotion regulation strategies, cognitive reappraisal and suppression (used in both samples; see Appendix G). The cognitive reappraisal subscale (Items 1, 3, 5, 7, 8, and 10) measures the extent to which an individual modifies his or her emotional response by changing the way he or she views a particular situation. A sample item for this subscale is: “*I control my emotions by changing the way I think about the situation I’m in.*” The suppression subscale (Items 2, 4, 6, and 9) measures the extent to which an individual inhibits his or her external expression of internal emotional feelings. A sample item for suppression subscale is: “*I control my emotions by not expressing them.*” Items are rated on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*). Higher scores reflect greater use of the emotion regulation strategy. The ERQ has been shown to have adequate internal consistency and test-retest reliability (Gross & John, 2003) and used with adolescent samples (Hsieh & Stright, 2012). The ERQ was found to have relatively good reliability in the current study. The internal reliability of ERQ total scale in the adolescent (Cronbach’s alpha = .68) and EA sample (Cronbach’s alpha = .65) was lower than expected. In the adolescent sample, the ERQ-R and ERQ-S demonstrated mixed reliabilities, with Cronbach’s alphas of .77 and .63, respectively. Examination of reliabilities when scale items were excluded did not yield notable improvement in consistency. The ERQ-S and ERQ-R subscales demonstrated good reliability in the EA sample, with Cronbach’s alphas of .74 and .83, respectively. For the SEM, the two ER strategies (i.e., suppression and reappraisal) were treated as separate latent constructs, each with two parcels serving as indicators of the latent variables “ER suppression” and “ER reappraisal.”

**Depressive symptoms.** Depressive symptomatology was measured by a shortened version of the Center for Epidemiologic Studies-Depression Scale (CES-D; Radloff, 1977)

originally used in the National Longitudinal Study of Children and Youth (NLSCY), a large Canadian population health survey (used in both samples; see Appendix H). This revised version of the CES-D was reduced from the original 20 items to 12 items (Puolin Hand, Boudreau, & Santor, 2005). The shortened CES-D asks about 12 symptoms of depression in the past 7 days. Participants were asked to rate the duration of their mood on a 4-point Likert scale from 1 (*rarely or none of the time, less than 1 day*) to 4 (*most of or all of the time, 5-7 days*) to determine how they felt in the past week. Scores are summed to create a total score ranging from 0 to 36, with higher scores reflecting greater severity of depressive symptomatology. The CES-D was found to have good reliability in the current study for both the adolescent (Cronbach's alpha = .86) and EA samples (Cronbach's alpha = .87). For the SEM, three parcels were used as manifest indicators of the general latent variable "depressive symptomatology."

**Subjective happiness.** Participants' feelings of happiness were assessed using the Subjective Happiness Scale (SHS; Lyubormirsky & Lepper 1999; used in both samples; see Appendix I). The SHS is a 4-item measure that assesses general happiness, happiness relative to others, enjoyment of life, and general unhappiness. Responses are rated on a 7-point Likert scale with higher scores indicative of greater subjective happiness. One item is reverse scored and all four items are summed and averaged to provide a composite score for global subjective happiness. The SHS has been validated for use with adolescent samples (Raboteg-Saric & Sakic, 2014). The SHS has been shown to have good internal consistency, test-retest reliability, and convergent and divergent validity (Lyubormirsky & Lepper 1999). The SHS was found to have good reliability in the current study for both the adolescent (Cronbach's alpha = .81) and EA samples (Cronbach's alpha = .85). For the SEM, two parcels were used as observed indicators to represent the broad latent construct of "subjective happiness."

## Analysis

With regards to statistical analysis, there were two main objectives of the current study. The first objective was to determine the nature of the relationship between physical activity and psychological well-being, as indicated by depressive symptomatology and subjective happiness. The second objective was to explore the role of potential mediating variables of the physical activity – psychological well-being link. For both objectives, gender and developmental differences were also considered.

Analyses were carried out using SPSS version 22.0 and R. Data underwent standard procedures for screening and verifying statistical assumptions of univariate and multivariate normality. Preliminary analyses of both samples indicated no issues related to non-linear relationships, indication of multicollinearity, or significant departure from univariate normality. There was some evidence of multivariate non-normality for the EA sample; Mardia's test (1970) of multivariate skew and kurtosis yielded a normalized multivariate kurtosis statistics in the problematic range (i.e., >7). It has been suggested that univariate kurtosis values approaching 7 and multivariate kurtosis values greater than 3 can become problematic for results obtained with maximum likelihood (ML) estimation in structural equation modeling (SEM; West, Finch, & Curran, 1995). For instance, non-normality can result in biased standard errors, leading to an inflated number of statistically significant parameters. As such, the Yuan-Bentler procedure was used for estimation of SEM models in order to deal with the degree of multivariate non-normality present in the data (Yuan, Chan, Bentler, 2000).

Missing data was assessed using missing value analysis (MVA), which suggested that the data was missing at random (MAR) for both samples. Assuming ignorable missingness, missing data in the present study was handled using full-information maximum likelihood



estimation (FIML). FIML involves estimating model parameters using all available information, irrespective of whether that information comes from cases with incomplete data (Preacher, 2010). FIML has been determined to reduce bias and generate more efficient results compared to more standard methods of handling missing data, such as pairwise or listwise deletion (Allison, 2003; Enders & Bandalos, 2001). Due to the multivariate non-normality and missing data present in the samples, the final assessment of statistical fit was based on FIML estimation and the Yuan-Bentler method, which corrects for these violations.

### **Structural Equation Modeling (SEM)**

The analytic objectives were addressed using a structural equation modeling (SEM) approach. Broadly, SEM is a term for a collection of statistical techniques for describing and estimating multivariate linear models. SEM is a powerful multivariate technique that allows for the study of complex and dynamic relations among variables, unobserved or hypothetical; thus, making it a particularly well-suited statistical method for the proposed study. Further, SEM is a useful technique for non-experimental study designs, as it permits researchers to test theoretical propositions through a conceptual model or path diagram. In SEM, the multivariate causal relations being tested are represented by a series of structural (i.e., regression) equations and presented pictorially in order to facilitate a clearer conceptualization of the proposed model under investigation (ovals represent latent variables and boxes depict observed variables; Byrne, 2010).

SEM possesses several unique features compared to more traditional statistical approaches; SEM models can incorporate both observed and unobserved (i.e., latent) or hypothetical constructs (Coffman & MacCallum, 2005). Latent variables are more accurate due to their ability to account for measurement error (Kline, 1998). Further, a variable can serve as

both an independent variable (i.e., predictor) and a dependent variable (i.e., outcome) in the same model. This is particularly useful when considering the role of mediating and moderating factors. With SEM, all parameters are estimated simultaneously, eliminating the need to run multiple independent regression analyses.

**Latent variables.** In the current study, latent variables were constructed using item parceling for the various indicators (Coffman & MacCallum, 2005). Parceling exhibits several advantages. For one, parcels generally have greater reliability than single items (Kishton & Widaman, 1994) and the use of parcels reduces the number of measured variables in the model. Another advantage of parceling is that it can be beneficial when working with non-normally distributed variables. Combining non-normal items into parcels can generate indicators that are more normally distributed than the original items (West, Finch, & Curran, 1995). Several methods for constructing item parcels have been proposed. Although there is debate in the literature with respect to the best approach to item parceling, Coffman and MacCallum (2005) have demonstrated that the manner in which parcels are created is less important than the fact that they are utilized.

The construction of parcels involves summing a subset of items from the complete multi-item scale and using the resulting sum as an indicator for the latent construct of interest. In the present study, items that load onto a particular scale or subscale were summed to create multiple indicators for that latent construct. For example, the CES-D is a 12-item scale measuring depressive symptomatology. As such, groups of 4 items were summed to create three parcels. These three parcels served as the observed indicators for the latent construct “depressive symptomatology.” Generally, three or more observed indicators (e.g., parcels or individual items) are recommended to represent each latent variable (Russell, Kahn, Spoth, & Altmaier,

1998); however, the argument has also been made for the adequacy of two observed indicators (Maruyama, 1998).

**Model fit.** Model fit was assessed using three commonly used fit indices: root-mean-square error of approximation (RMSEA), comparative fit index (CFI), and Tucker-Lewis index (TLI; Hu & Bentler, 1999; MacCallum & Austin, 2000). General rule-of-thumb guidelines suggest that values larger than or equal to .95 for the TLI and CFI, and less than or equal to .06 for RMSEA, are indicative of good fit between the hypothesized model and the observed data (Hu & Bentler, 1999). Values approximating .90 for the CFI and TLI, and less than or equal to .08 for the RMSEA, are associated with acceptable fit (Bentler & Bonett, 1980; Hu & Bentler 1998; MacCallum, Browne, & Sugawara, 1996). The chi-square statistic represents another gauge of model fit; however, it can become problematic when sample sizes are large (Bollen & Curran, 2006). When constructing models, one should strive for the best fitting model while taking into account model parsimony and meaningfulness (Bryne, 2010). Standardized path coefficients provide information regarding effect size. Values less than .10 may indicate a “small” effect, values around .30 suggest a “medium” effect, and values great than .50 indicate a “large” effect (Suhr, 2008).

**Model specification.** All SEM analyses followed a general two-step method for testing a full structural model with latent variables. (1) First, the validity of the overall measurement model is tested. The measurement model specifies the relationship between latent variables and the observed variables used to measure them. Observed exogenous variables are regressed onto the endogenous latent variables, which represent imperfect indicators of the hypothetical constructs. The constructs are permitted to correlate freely. The scale is set by constraining the variance of each latent variable to equal one. Measurement invariance is necessary in order to

compare structural parameters of factor means, regression coefficients, variances, and covariances. (2) Second, following the confirmation of the validity of the measurement model, the structural model with latent variables is estimated. The structural model specifies the regression relationships among the latent variables. The measurement and structural models are evaluated in terms of model fit and the sign and magnitude of the parameter estimates (i.e., intercept, factor loadings, regression coefficients, latent means, and latent variance and covariance).

**Multi-group analysis.** Application of SEM is readily extended to the investigation of interaction effects of categorical moderators, such as gender (Campbell-Sills & Brown, 2006). Multiple-group SEM can be used to evaluate group differences in measurement and structural SEM solutions. In multiple-group SEM, separate models for two or more groups are specified, but the separate models are estimated simultaneously. This approach is used to test whether the hypothesized model differs depending on the level of the moderator (i.e., male vs. female participants). In this way, increasingly restrictive parameters are tested in logical order in order to determine potential sources of non-equivalence between groups (Jöreskog, 1971). If the model is found to be invariant across groups, it is recommended that the groups be pooled and all subsequent examinations be based on single-group analysis.

Multi-group SEM follows the same general approach outlined in the previous section. The first step of multi-group analysis involves the scrutiny of the measurement model, a requirement for group comparisons (Jöreskog, 1971). Measurement invariance involves assessing the degree to which the psychometric properties of the observed indicators are comparable across different groups. That is, ensuring that the same construct is being measured in the same manner across different groups and that any group differences represent true

differences in the variability of the latent construct. The degree of measurement invariance can be tested via model fit of a series of nested multi-group models.

Starting with the measurement model, parameters are fixed to be equal across groups (i.e., male and female participants). If the parameters between the groups on the measurement model do not differ, then the parameters remain fixed to be equal in testing future model restrictions, as the parameters are deemed to be invariant across groups. The chi-square difference is used to determine whether model parameters significantly differ across groups. If the chi-square difference test is significant, this suggests that the model fits better when each group takes on unique parameter estimates, indicating that certain points in the model are moderated by group status. Inspection of modifications indices can be used to identify non-invariant parameters in the model that should be allowed to vary between groups. Modification indices correspond to the change in chi-square associated with freeing a single parameter in the model. With one degree of freedom, the critical chi-square value for  $\alpha = .05$  is 3.84; thus, a modification index is considered large if it exceeds the 3.84 threshold.

Tests of measurement invariance are continued in this manner, placing increasingly restrictive equality constraints on the model for multiple groups. Specifically, nested models are tested in order to determine whether the measurement models differ between groups on various parameters, such as factor loadings and intercepts. In this way, models with fewer freely estimated parameters are compared to models with more freely estimated parameters in order to determine whether the nested model (i.e., more restricted) fits better or worse than the model with a greater number of freely estimated parameters.

Measurement equivalency testing was conducted in the following sequential steps (Vandenberg & Lance, 2000): unconstrained model (full sample), baseline model (each group

separately), configural invariance model, metric invariance model (i.e., weak), and scalar invariance model (i.e., strong). The *unconstrained model* uses the entire sample and thus does not separate by group or impose equality constraints. The *baseline model* represents the model in which all model parameters are allowed to differ across groups and serves as the model for further comparisons (the model is fit separately for each group). The *configural invariance model* tests whether groups have the same factor structure (i.e., SEM picture). The *metric invariance model* tests whether the factor loadings are equivalent across different groups. The *scalar invariance model* tests whether item intercepts are invariant across different groups. Typically, the last step to testing measurement invariance involves testing the *residual invariance model*, which determines whether different groups have the same item residual variances. However, there is disagreement as to whether this step is necessary when using latent variables because measurement errors are taken into account as part of the full structural model (Beaujean, 2014). As such, this step is generally only conducted if one is interested in evaluating the reliability of the construct that the latent variable represents, otherwise, it is considered to be an overly restrictive test of the data (Bryne, 2010). As such, the current study did not test the residual invariance model. In some steps, it is also possible to achieve partial invariance. In this case, the invariant parameters are constrained to be equal while the variant parameters are set free (Bryne, Shavelson, & Muthén, 1989).

After assessing the measurement model and determining which measures are group invariant, these parameters are fixed to be equal while testing the degree of invariance in the structural parameters (Bryne, 2010). Structural equivalency involves assessing how the latent constructs are distributed and related to one another across different groups. In other words, variance in the structural model represents true difference in the latent variable across groups

(e.g., difference in the latent construct “depression”). The following parameters can be tested when assessing structural equivalency: factor variances, factor covariances, regression coefficients, and latent means. Specifically, assessing multi-group equivalence of the causal model can address the following questions (Bryne, 2010): (1) are the paths in a structural model invariant across groups? and (2) are the latent means of a particular construct equivalent across groups? The various parameters are fixed across groups and the model fit is examined. Groups are said to be non-invariant on a particular parameter if the model fit becomes worse when the parameter is forced to be equal across the different groups.

***Mediation.*** A significant advantage of latent variable modeling is the ability to test indirect effects. Indirect paths represent compound structural paths comprised of multiple direct variable-to-variable paths (Leth-Steensen & Gallitto, 2016). Indirect effects refer to cases in which the effect of one latent or observed variable is fully or partially mediated by one or more other intervening variables (Brown, 1997). Additionally, testing models with multiple rather than single mediators, takes into account the possible existence of opposing mediating processes (Cerin, 2010). The key advantage of implementing a multiple mediator models is the ability to test the unique contribution of a particular intervening variable, independent of the effects of other mediators included in the model (Cerin, 2010). When exploring mechanisms of the physical activity influence on mental health, Cerin (2010) recommended the following model building approach: researchers should first test single mediator models to gain a better understanding of the mediation process, followed by the estimation of a comprehensive multiple mediator model. The results from the multiple mediation models are reported.

The test of joint significance (TJS; Kenny, Kashy, & Bolger, 1998) is a straightforward procedure for evaluating mediation effects in SEM. Simulation studies have demonstrated that

the use of the TJS to test indirect effects in SEM is superior to other methods, such as bias-corrected bootstrapping (Leth-Steensen & Gallitto, 2016). The TJS involves assessing if the separate paths comprising the full pathway (i.e., indirect effect) are all significant. If each individual path is significant, then the corresponding indirect effect is regarded as significant (Leth-Steensen & Gallitto, 2016). Point estimates of the size of the indirect effects are obtained by multiplying the component path coefficients. The TJS approach was used in the current study when testing for the significance of various proposed mediators in the indirect SEM models.

## **Results**

Descriptive statistics for both cross-sectional samples are provided in Table 1. Gender differences on the latent variables were tested via the multi-group SEM. A correlation matrix of variables of interest is presented in Table 2. Bivariate correlations between physical activity and depressive symptoms were in the negative direction, while correlations between physical activity and subjective happiness were in the positive direction.

Two multi-group SEM models were tested in order to evaluate the extent to which physical activity predicts depressive symptomatology and subjective happiness in the adolescent and EA samples (direct effects model). To test for mediation, two additional models were constructed (indirect effects model). These models build on the previous models by incorporating the proposed latent mediators (i.e., self-efficacy, social support, and emotion regulation). Gender differences were evaluated for all models via multi-group analysis approach. The procedures for model testing followed those outlined in the previous section. To assess developmental differences, the models were compared qualitatively to explore possible differences between adolescents and EAs. Due to differences in the sampling methods and contexts between the two samples, it was not appropriate to pool the samples in order look at age



differences via multi-group SEM, as these factors can influence participant responses (Tipping, Hope, Pickering, Erens, Roth, & Mindell, 2010). As such, it would not be possible to distinguish data collection mode differences from age differences.

Table 1.

*Characteristics of Study Participants and Variables of Interest.*

	Full Sample	Female	Male	Scale Range
		Participants	Participants	
	<i>M (SD)</i> or <i>N (%)</i> for categorical variables	<i>M (SD)</i> or <i>N (%)</i> for categorical variables	<i>M (SD)</i> or <i>N (%)</i> for categorical variables	
<i>Adolescents</i>	n = 387	n = 257	n = 130	
Demographic variables				
Gender		257 (66.2%)	130 (33.5%)	
Age	16.28 (0.63)	16.29 (0.58)	16.27 (0.72)	
Self-efficacy total (SEQ)	3.31 (0.55)	3.27 (0.53)	3.39 (0.59)	1 – 5
Emotional	3.03 (0.74)	2.90 (0.70)	3.30 (0.76)	
Social	3.54 (0.63)	3.51 (0.62)	3.59 (0.64)	
Academic	3.34 (0.70)	3.37 (0.67)	3.29 (0.75)	
Social support total (MSPSS)	5.09 (1.21)	5.17 (1.89)	4.94 (1.25)	1 – 7
Friends	5.26 (1.35)	5.32 (1.35)	5.13 (1.37)	

	Full Sample	Female	Male	Scale Range
	<i>M (SD)</i> or <i>N (%)</i>	<i>M (SD)</i> or <i>N (%)</i>	<i>M (SD)</i> or <i>N (%)</i>	
	for categorical variables	for categorical variables	for categorical variables	
Family	4.77 (1.59)	4.82 (1.64)	4.68 (1.51)	
Significant other	5.23 (1.49)	5.36 (1.47)	4.97 (1.50)	
Emotion regulation total (ERQ)	4.47 (0.79)	4.41 (0.80)	4.60 (0.75)	1 – 7
ER- suppression	4.30 (1.15)	4.25 (1.43)	4.39 (1.15)	
ER- reappraisal	4.91 (1.03)	4.82 (1.05)	5.12 (0.92)	
Physical activity (PAQ-A)	2.13 (0.82)	1.95 (0.71)	2.48 (0.92)	1 – 5
Depressive symptoms (CES-D)	2.09 (0.62)	2.18 (0.61)	1.90 (0.60)	1 – 4
Subjective happiness (SHS)	4.60 (0.91)	4.52 (0.90)	4.77 (0.91)	1 – 7
<i>Emerging Adults</i>	n = 413	n = 320	n = 90	
Demographic variables				
Gender		320 (77.5%)	93 (22.5%)	

	Full Sample	Female	Male	Scale Range
		Participants	Participants	
	<i>M (SD) or N (%)</i> for categorical variables	<i>M (SD) or N (%)</i> for categorical variables	<i>M (SD) or N (%)</i> for categorical variables	
Age	19.84 (2.12)	19.78 (2.13)	20.05 (2.09)	
Self-efficacy (SEQ)	3.38 (0.58)	3.35 (0.59)	3.47 (0.56)	1 – 5
Emotional	3.22 (0.73)	3.14 (0.72)	3.46 (0.70)	
Social	3.50 (0.67)	3.47 (0.67)	3.59 (0.68)	
Academic	3.42 (0.70)	3.41 (0.70)	3.46 (0.71)	
Social support total (MSPSS)	5.25 (1.25)	5.31 (1.27)	5.03 (1.16)	1 – 7
Friends	5.27 (1.45)	5.32 (1.48)	5.12 (1.36)	
Family	5.08 (1.64)	5.13 (1.65)	4.93 (1.63)	
Significant other	5.35 (1.66)	5.46 (1.62)	4.98 (1.74)	
Emotion regulation total (ERQ)	4.62 (0.74)	4.66 (0.76)	4.51 (0.67)	1 – 7
ER- suppression	3.98 (1.22)	3.90 (1.25)	4.24 (1.08)	
ER- reappraisal	5.03 (1.05)	5.04 (1.08)	4.99 (0.95)	

	Full Sample	Female	Male	
		Participants	Participants	
	$M (SD)$ or $N (%)$	$M (SD)$ or $N (%)$	$M (SD)$ or $N (%)$	Scale Range
	for categorical variables	for categorical variables	for categorical variables	
Physical activity (PAQ-AD)	2.03 (0.66)	1.95 (0.63)	2.34 (0.68)	1 – 5
Depressive symptoms (CES-D)	1.96 (0.61)	2.00 (0.62)	1.80 (0.55)	1 – 4
Subjective happiness (SHS)	4.82 (1.30)	4.82 (1.32)	4.82 (1.24)	1 – 7

*Note.* Percentages are based on the number of participants that responded to each question, as a result the categories may not sum to the total sample size due to missing data. SEQ = Self-Efficacy Questionnaire; MSPSS = Multidimensional Scale of Perceived Social Support; ERQ = Emotion Regulation Questionnaire PAQ- A = Physical Activity Questionnaire – Adolescents; PAQ- AD = Physical Activity Questionnaire – Adults; CES-D = Center for Epidemiologic Studies-Depression Scale; SHS = Subjective Happiness Scale.

Table 2.

*Summary of Pearson Correlations for Study Variables Used in the Structural Equation Models*

Variable	1	2	3	4	5	6	7	8	9	10	11
1. PAQ		-.19**	.20***	.08	.09	.31***	.23***	.11*	.06	.07	-.05
2. CES-D	-.18**		-.68***	.23***	-.26***	-.49***	-.36***	-.31***	-.34***	-.40***	-.25***
3. SHS	.27***	-.50***		-.21***	.30***	.59***	.39***	.33***	.40***	.45***	.30***
4. ERQ-S	-.02	.28***	-.20***		.14**	-.01	-.15**	-.09	-.14**	-.12*	-.25***
5. ERQ-R	.16**	-.31***	.34***	-.03		.39***	.18**	.19***	.27***	.27***	.19***
6. SEQ- Emo	.28***	-.57***	.56***	-.14*	.41***		.58***	.50***	.28***	.27***	.14**
7. SEQ- Soc	.27***	-.32***	.47***	-.29***	.23***	.54***		.55***	.36***	.27***	.21***
8. SEQ- Aca	.11	-.40***	.34***	-.23***	.26***	.45***	.43***		.15**	.32***	.17**
9. MSPSS- Fri	.15**	-.23***	.17**	-.31***	.15**	.34***	.33***	.32***		.45***	.51***
10. MSPSS- Fam	.08	-.44***	.32***	-.29***	.23***	.38***	.30***	.45***	.43***		.39***
11. MSPSS- SO	.15**	-.19**	.16**	-.34***	.12*	.21***	.25***	.27***	.66***	.44***	

*Note.* Adolescents' correlations displayed on the lower diagonal, EAs' displayed in the upper diagonal. PAQ = Physical Activity Questionnaire – Adolescents/Adults; CES-D = Center for Epidemiologic Studies-Depression Scale; SHS = Subjective Happiness Scale; ERQ-S = Emotion Regulation Questionnaire – Suppression; ERQ-R = Emotion Regulation Questionnaire- Reappraisal; SEQ = Self-Efficacy Questionnaire, Emo = emotional, Soc = social, and Aca = academic; MSPSS = Multidimensional Scale of Perceived Social Support, Fri = friends, Fam = family, SO = significant other.

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

## Direct Effects Model

Results for the direct effects multi-group SEM, which tested the relationship between physical activity and depressive symptomatology and subjective happiness, are presented below for the adolescent and EA sample, respectively.

**Adolescent sample.** Table 3 presents the fit indices for the multi-group invariance tests for the adolescent sample. Figure 1 depicts the hypothesized direct path model.

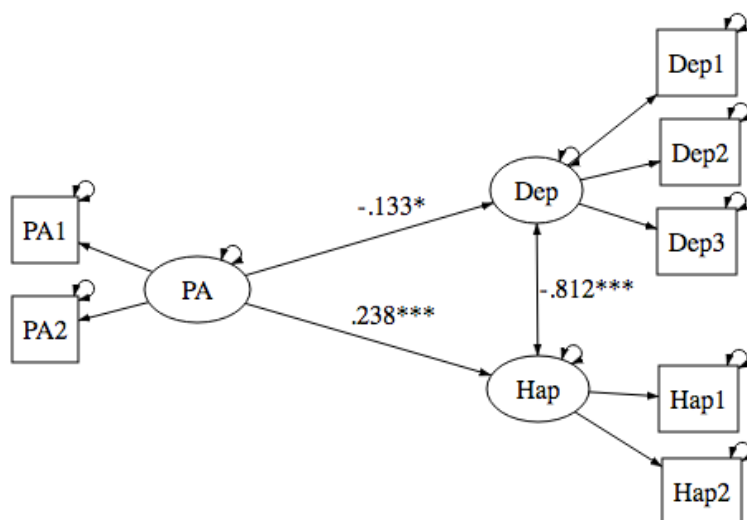


Figure 1. Hypothesized direct path diagram for adolescents. Standardized path coefficients were obtained from analysis based on the female participant group. Solid and dashed lines represent significant and non-significant paths, respectively. Double headed curved arrows represent error terms. PA = physical activity; Dep = depressive symptomatology; Hap = subjective happiness. Squares represent the observed indicators (i.e., item parcels) for the latent variables.

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

**Measurement model.** The measurement model produced an improper solution due to a negative estimated error variance. As such, the model was revised to constrain the error variance of Parcel2 of the physical activity latent variable to zero. There was a significant  $\chi^2$  change for the configural invariance model and the metric invariance model ( $p < .05$ ), suggesting factor-loading non-invariance. As such, partial invariance of the metric model was tested. The factor

loadings for Parcel2 and Parcel3 of the depression latent variable were permitted to vary between the groups. This partial metric invariance model was re-estimated and compared to the configural model. The  $\chi^2$  change was non-significant ( $p > .05$ ); thus, partial metric invariance was established and it is reasonable to retain this model for further testing. Next, the scalar invariance model was tested. The  $\chi^2$  change was significant between the partial metric invariance model and the scalar invariance model ( $p < .001$ ), indicating intercept non-invariance. As such, the partial scalar invariance model was tested. The intercept of Parcel1 for the physical activity latent construct was permitted to vary between the groups. The partial scalar model was re-estimated and compared to the partial metric model. The  $\chi^2$  change was non-significant; thus, partial scalar invariance was established and this model was used as the final measurement model.

The final measurement model was found to have good fit to the data, with all fit indices within the recommended range of acceptability:  $\chi^2(29) = 40.57, p = .075$ , RMSEA = .044 with 90% CI intervals (.000, .076), CFI = .99, and TLI = .98. All items significantly and positively loaded on to their respective latent factors (all  $ps < .001$ ), suggesting that the various latent variables are psychometrically sound.

**Structural model.** The  $\chi^2$  change was significant when latent means were constrained to be equal across groups ( $p < .001$ ). Model fit improved when groups were allowed to vary on their latent means. Compared with female participants, male participants had higher mean values on the physical activity latent variable (standardized  $B = .544, p < .001$ ) and lower mean values on the depression latent variable (standardized  $B = -.509, p < .001$ ). Next, equality of regression path coefficients was tested. The  $\chi^2$  change was non-significant; thus, the groups did not differ in terms of the regressions estimates. Lastly, equality of the latent variable variance and covariance was tested. The  $\chi^2$  change between the latent variable variance and covariance model and the



regression model was non-significant. Thus, this model was retained as the final model for interpretation.

The final structural model was found to have good fit to the data, with all fit indices within the recommended range of acceptability:  $\chi^2(35) = 51.18$ ,  $p = .038$ , RMSEA = .049 with 90% CI intervals (.013, .076), CFI = .98, and TLI = .98. Final model parameters are presented in Table 5. There were significant, negative direct effects between physical activity and depressive symptoms and significant positive direct effects between physical activity and subjective happiness. The covariance between the latent factors depressive symptomatology and subjective happiness was significant and in the negative direction. Overall, the model accounted for 1.8% and 5.7% of the variance in depressive symptomatology and subjective happiness among the sample of adolescents, respectively.

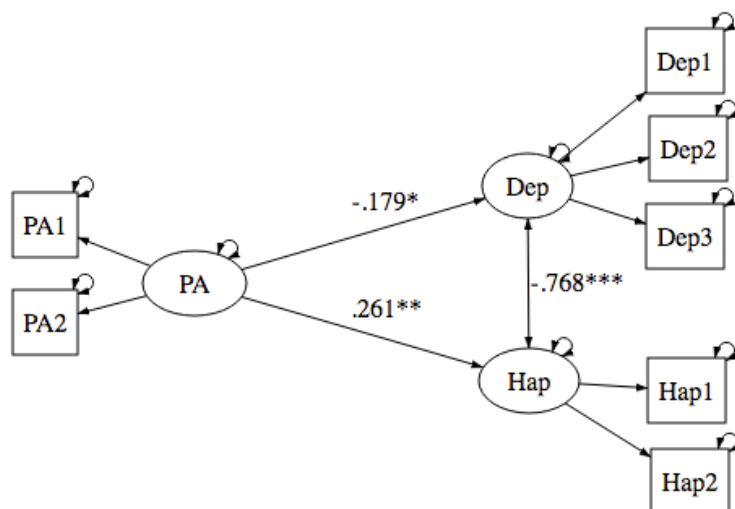
Table 3.

*Model Fit Indices for the Multi-Group Invariance Tests for Male and Female Adolescents (Direct Effects Model)*

	Description	$\chi^2$	df	<i>p</i>	CFI	TLI	RMSEA (95% CI)	Ref	<i>p-value for <math>\Delta\chi^2</math></i>
Measurement Models									
1	Unconstrained model	20.83	12	.053	.99	.99	.044 (.000, .074)	–	–
2	Female model	10.09	12	.608	1.0	1.0	.000 (.000, .054)	–	–
3	Male model	21.09	12	.050	.97	.95	.076 (.005, .129)	–	–
4	Configural model	31.02	24	.153	.99	.99	.039 (.000, .074)	–	–
5	Metric model (Factor weights)	42.45	28	.039	.99	.99	.052 (.013, .081)	4	.027
6	Partial metric model	37.41	26	.069	.99	.99	.048 (.000, .079)	4	.052
7	Scalar model (Intercepts)	56.49	30	.002	.97	.96	.068 (.040, .094)	6	< .001
8	Partial Scalar model	40.57	29	.075	.99	.98	.046 (.000, .076)	6	.350
Structural Models									
9	Means model	76.23	32	.000	.95	.94	.085 (.061, .109)	8	< .001
10	Regression model	44.85	31	.051	.99	.98	.048 (.004, .077)	8	.106
11	Invariance & covariance model	51.18	35	.038	.98	.98	.049 (.013, .076)	10	.178

*Note.* CFI = Comparative Fit Index; TLI = Tucker Lewis Index; RMSEA = Root Mean Square Error Average with 95% confidence intervals; Ref= reference model used for comparison.

**EA sample.** Table 4 presents the fit indices for the multi-group invariance tests for the EA sample. Figure 2 depicts the hypothesized direct path model.



*Figure 2.* Hypothesized direct path diagram for EAs. Standardized path coefficients were obtained from analysis based on the female participant group. Solid and dashed lines represent significant and non-significant paths, respectively. Double headed curved arrows represent error terms. PA = physical activity; Dep = depressive symptomatology; Hap = subjective happiness. Squares represent the observed indicators (i.e., item parcels) for the latent variables. \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

**Measurement model.** Invariance testing of the measurement model for the EA sample suggests that the model parameters are invariant across male and female participants (i.e.,  $\Delta\chi^2$  non-significant for all nested models; see Table 4). Thus, configural, metric, and scalar invariance was established. The scalar invariance model, where restrictions were placed on equal factor loadings and intercepts, was retained for future testing and interpretation.

The final measurement model was found to have good fit to the data, with all fit indices within the recommended range of acceptability:  $\chi^2(30) = 31.73$ ,  $p = .38$ , RMSEA = .017 with 90% CI intervals (.000, .056), CFI = 1.0, and TLI = 1.0. All items significantly and positively loaded on to their respective latent factors (all  $ps < .001$ ), suggesting that the various latent variables are psychometrically sound.

**Structural model.** First, invariance of the latent means model was tested. The  $\chi^2$  change was significant ( $p < .001$ ), suggesting non-invariance in the latent factor means. As such, the latent means were permitted to vary across groups. Compared to female participants, male participants had higher mean values on the physical activity latent construct (standardized  $B = .756, p < .001$ ). The  $\chi^2$  change for the regression model was non-significant, suggesting that the regression path coefficients are invariant across groups. The  $\chi^2$  change for the variance and covariance model was non-significant, indicating that latent variable variances and covariances are also invariant across groups. This final model, in which the latent means were freely estimated and the regression coefficients and latent variable variances and covariances constrained to be equal, was retained for interpretation.

The final structural model was found to have good fit to the data, with all fit indices within the recommended range of acceptability:  $\chi^2(36) = 33.86, p = .62, RMSEA = .000$  with 90% CI intervals (.000, .043), CFI = 1.0, and TLI = 1.0. Final model parameters are presented in Table 5. There was a significant negative, direct effect between physical activity and depressive symptoms and a significant, positive direct effective between physical activity and subjective happiness. The covariance between the latent factors depressive symptomatology and subjective happiness was significant and in the negative direction. Overall, the model accounted for 3.2% and 6.8% of the variance in depressive symptomatology and subjective happiness among the sample of EAs, respectively.

Table 4.

*Model Fit Indices for the Multi-Group Invariance Tests for Male and Female EAs (Direct Effects Model)*

	Description	$\chi^2$	df	<i>P</i>	CFI	TLI	RMSEA (95% CI)	Ref	p-value for $\Delta\chi^2$
Measurement Models									
1	Unconstrained model	20.06	11	.044	.99	.98	0.045 (.006, .076)	–	–
2	Female model	17.53	11	.093	.99	.99	.043 (.000-.080)	–	–
3	Male model	7.22	11	.781	1.0	1.0	.000 (.000, .068)	–	–
4	Configural model	23.85	22	.355	1.0	1.0	.022 (.000, .062)	–	–
5	Metric model (Factor weights)	27.42	26	.387	1.0	1.0	.016 (.000, .058)	4	.161
6	Scalar model (Intercepts)	31.73	30	.380	1.0	1.0	.017 (.000, .056)	5	.120
Structural Models									
7	Means model	64.90	33	.001	.97	.96	.068 (.044, .092)	6	< .001
8	Regression model	31.40	32	0.497	1.0	1.0	.000 (.000, .050)	6	.981
9	Invariance & covariance model	33.86	36	0.621	1.0	1.0	.000 (.000, .043)	8	.855

*Note.* CFI = Comparative Fit Index; TLI = Tucker Lewis Index; RMSEA = Root Mean Square Error Average with 95% confidence intervals; Ref= reference model used for comparison.

Table 5.

*Latent Variable Structural Regression Results for the Adolescent and EA Samples (Direct Effects Model)*

Endogenous latent variable	Predictor	<i>B</i>	<i>SE(B)</i>	<i>Z</i>	<i>p</i>	<i>B*</i>
<i>Adolescents</i>						
Depressive symptoms						
	Physical activity	-.169	.074	-2.267	.016	-.133
Subjective happiness						
	Physical activity	.598	.140	4.277	< .001	.238
<i>Emerging adults</i>						
Depressive symptoms						
	Physical activity	-.206	.086	-2.402	.023	-.179
Subjective happiness						
	Physical activity	.657	.190	3.465	< .001	.261

*Note.* *B\** = completely standardized regression slope estimates.

### Indirect Effects Model

The indirect effects model tested the role of mediators in the association between physical activity and psychological well-being (see Figures 3 and 4). For the indirect SEM path diagrams, the observed indicators have been omitted from the model along with covariances in order to enhance readability. The results for the indirect model for the adolescent and EA samples are presented in the following sections.

**Adolescent sample.** Table 6 presents the fit indices for the multi-group invariance tests for the adolescent sample. Figure 3 represents the hypothesized indirect model.

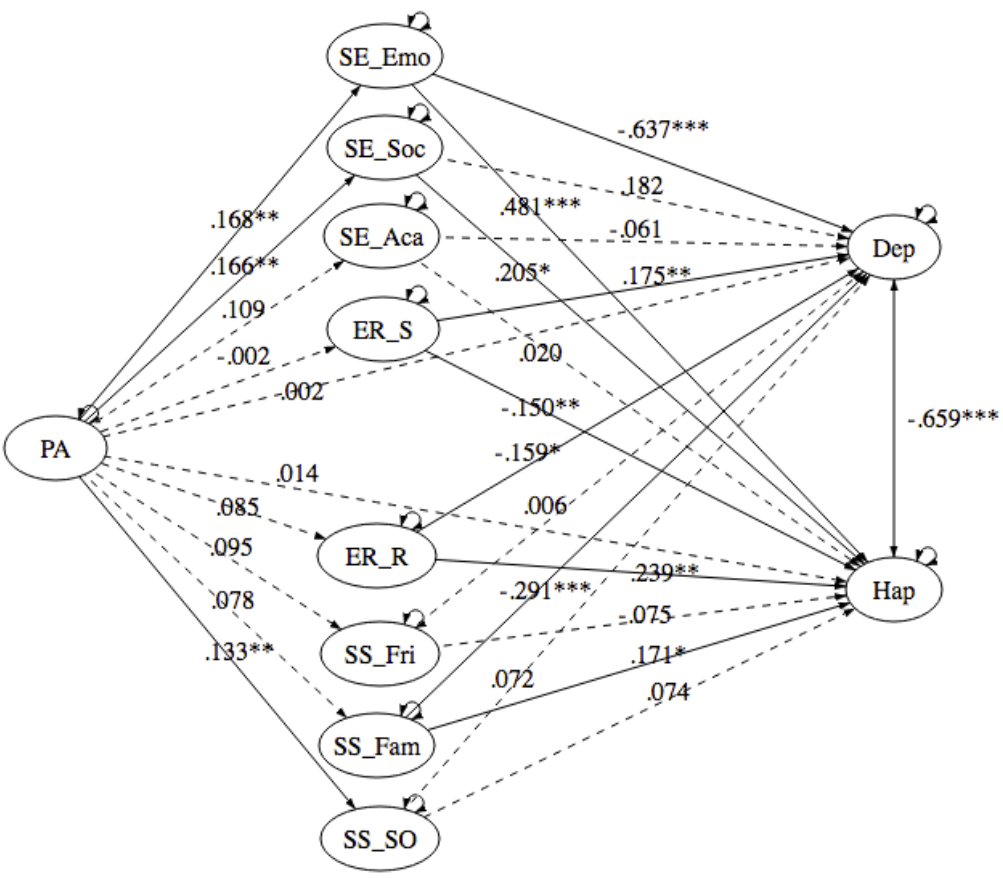


Figure 3. Hypothesized indirect path diagram for adolescents. Standardized path coefficients were obtained from analysis based on the female participant group. Solid and dashed lined



represent significant and non-significant paths, respectively. Double headed curved arrows represent error terms. PA = physical activity; SE\_Emo = emotional self-efficacy; SE\_Soc = social self-efficacy; SE\_Aca = academic self-efficacy; ER\_S = emotion regulation – suppression; ER\_R = emotion regulation – reappraisal; SS\_Fri = social support – friends; SS\_Fam = social support – family; SS\_SO = social support – significant other; Dep = depressive symptomatology; Hap = subjective happiness.

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

**Measurement model.** The measurement model produced an improper solution due to a negative estimated error variance. As such, the model was revised to constrain the error variance of Parcel1 of the physical activity latent variable and Parcel2 of the emotion regulation-suppression latent variable to zero. Invariance testing of the measurement model for the adolescent sample suggests that the model parameters are invariant for the configural and metric models (see Table 6); thus configural and metric invariance is established. There was a significant  $\chi^2$  change between the metric invariance model and the scalar invariance model ( $p < .05$ ), indicating intercept non-invariance. As such, partial invariance of the scalar model was tested. The intercept for the physical activity latent variable indicator, Parcel1, was set free and allowed to vary between groups. The model was re-estimated and compared to the metric model. The  $\chi^2$  change was non-significant; thus, this model was retained for future testing and was used as the final measurement model for interpretation.

The final measurement model was found to have good fit to the data, with all fit indices within the recommended range of acceptability:  $\chi^2(375) = 504.34$ ,  $p < .001$ , RMSEA = .042 with 90% CI intervals (.032, .051), CFI = .97, and TLI = .96. All items significantly and positively loaded on to their respective latent factors (all  $ps < .001$ ), suggesting that the various latent variables are psychometrically sound.

**Structural model.** First, invariance of the latent means model was tested. When the latent means were constrained to be equal across groups, the  $\chi^2$  change was significant ( $p < .001$ ). As

such, the latent means were permitted to vary across groups and the model was re-estimated. Compared to female adolescents, male adolescents had higher mean values for physical activity latent variable (standardized  $B = .640, p < .001$ ) and the emotional self-efficacy latent variable (standardized  $B = .492, p < .001$ ), and lower values for social support- significant other latent variable (standardized  $B = -.424, p < .001$ ). The  $\chi^2$  change for the regression model was non-significant; thus, the regression path coefficients were found to be invariant across groups. The  $\chi^2$  change for the latent variable variances and covariances model was significant ( $p < .05$ ). The variance of the physical activity latent variable was set free and the partial latent variable variance and covariance model was re-estimated and compared to the regression model. The  $\chi^2$  change for the partial latent variable variance and covariance model was non-significant; thus, this model was retained as the final structural model for interpretation.

The final structural model was found to have good fit to the data, with all fit indices within the recommended range of acceptability:  $\chi^2(438) = 833.63, p < .001$ , RMSEA = .064 with 90% CI intervals (.057, .071), CFI = .91, and TLI = 90. Final model parameters are presented in Table 7. For the model pictured in Figure 3, physical activity had significant direct relations with emotional self-efficacy, social self-efficacy, and social support- significant other. Significant path coefficients were also found from self-efficacy, emotion regulation- suppression, emotion regulation- reappraisal, and social support- family to depressive symptomatology and from emotional self-efficacy, social self-efficacy, emotion regulation- suppression, emotion regulation- reappraisal, and social support- family to subjective happiness. Physical activity had an indirect relation with depressive symptomatology that was mediated by emotional self-efficacy (effect size female participants = .107; effect size male participants = .154). Physical activity also had an indirect relation with subjective happiness that was mediated by emotional

self-efficacy (effect size for female and male participants = .08) and social self-efficacy (effect size for females and males = .034). When mediators were included in the model, physical activity no longer directly predicted depressive symptomatology or subjective happiness. There was a significant, negative covariance between the depressive symptomatology and subjective happiness latent constructs. Overall, the model accounted for 44.6% and 45.3% of the variance in depressive symptomatology and 54.6% and 55.9% of the variance in subjective happiness among female and male adolescents, respectively.

Table 6.

*Model Fit Indices for the Multi-Group Invariance Tests for Male and Female Adolescents (Indirect Effects Model)*

Model	Description	$\chi^2$	Df	$p$	CFI	TLI	RMSEA (95% CI)	Ref	p-value for $\Delta\chi^2$
Measurement Models									
1	Unconstrained model	253.51	176	<.001	.98	.97	.034 (.024, .042)	–	–
2	Female model	262.95	176	<.001	.97	.95	.044 (.033, .054)	–	–
3	Male model	210.19	176	.040	.97	.96	.039 (.010, .057)	–	–
4	Configural model	473.81	352	<.001	.97	.96	.042 (.032, .052)	–	–
5	Metric model (Factor weights)	495.01	364	<.001	.97	.95	.043 (.033, .052)	4	.061
6	Scalar model (Intercepts)	519.41	376	<.001	.96	.95	.045 (.035, .053)	5	.016
7	Partial scalar model	504.34	375	.000	.97	.96	.042 (.032, .051)	5	.611
Structural Models									
7	Baseline structural model	797.09	420	.000	.90	.88	.068 (.061, .075)	–	–
8	Means model	874.15	430	.000	.89	.87	.073 (.066, .080)	7	<.001
9	Regression model	820.31	445	.000	.90	.89	.066 (.059, .073)	7	.64

Model	Description	$\chi^2$	Df	$p$	CFI	TLI	RMSEA (95% CI)	Ref	p-value for $\Delta\chi^2$
10	Invariance & covariance model	833.63	438	.000	.90	.88	.069 (.062, .075)	9	< .05
11	Partial invariance & covariance model	833.63	438	.000	.91	.90	.064 (.057, .071)	9	.73

*Note.* CFI = Comparative Fit Index; TLI = Tucker Lewis Index; RMSEA = Root Mean Square Error Average with 95% confidence intervals; Ref= reference model used for comparison.

Table 7.

*Latent Variable Structural Regression Results for the Adolescent Sample (Indirect Effects Model)*

Endogenous latent variable	Predictor	$B$	$SE(B)$	$Z$	$p$	$B^*$	
						Girls	Boys
Emotional SE							
	Physical activity	.168	.054	3.127	<.01	.168	.241
Social SE							
	Physical activity	.140	.047	2.996	<.01	.166	.236
Academic SE							

Endogenous latent variable	Predictor	<i>B</i>	<i>SE(B)</i>	<i>Z</i>	<i>p</i>	<i>B*</i>	
						<i>Girls</i>	<i>Boys</i>
ER suppression	Physical activity	.110	.059	1.855	.064	.109	.156
	Physical activity	-.002	.042	-.038	.969	-.002	-.002
ER reappraisal	Physical activity	.117	.071	1.641	.101	.085	.123
	Physical activity	.185	.096	1.923	.054	.095	.137
SS- Friends	Physical activity	.181	.112	1.624	.104	.078	.113
	Physical activity	.306	.114	2.672	<.01	.133	.192
SS- Family	Physical activity	.002	.041	.042	.966	.002	.003
	Emotional SE	-.552	.108	-5.095	<.001	-.637	-.643
SS- Significant other	Physical activity	.002	.041	.042	.966	.002	.003
	Emotional SE	-.552	.108	-5.095	<.001	-.637	-.643
Depressive symptoms	Physical activity	.002	.041	.042	.966	.002	.003
	Emotional SE	-.552	.108	-5.095	<.001	-.637	-.643

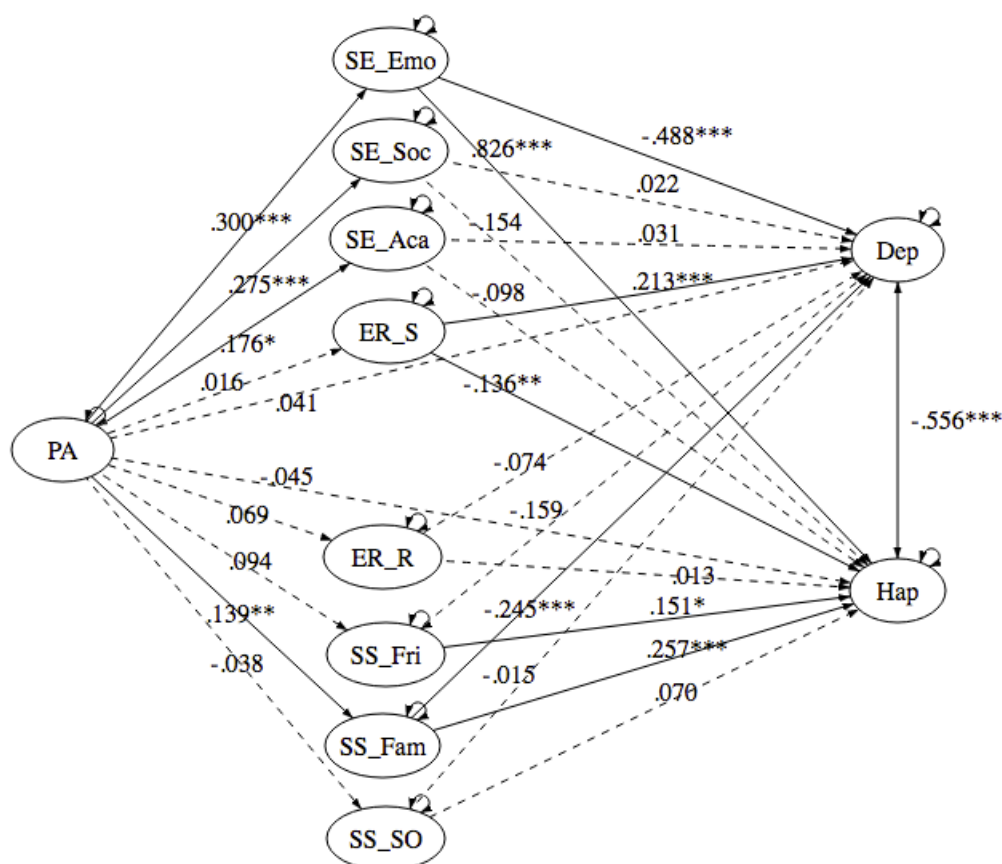
Endogenous latent variable	Predictor	<i>B</i>	<i>SE(B)</i>	<i>Z</i>	<i>p</i>	<i>B*</i>	
						<i>Girls</i>	<i>Boys</i>
	Social SE	.185	.118	1.572	.116	.182	.183
	Academic SE	-.052	.072	-.731	.465	-.061	-.061
	ER suppression	.158	.047	3.385	<.001	.175	.174
	ER reappraisal	-.100	.045	-2.215	.027	-.159	-.159
	SS- Friends	.003	.044	.064	.949	.006	.006
	SS- Family	-.108	.026	-4.198	<.001	-.291	-.290
	SS- Significant other	.027	.033	.814	.416	.072	.072
Subjective happiness							
	Physical activity	.024	.072	.328	.743	.014	.020
	Emotional SE	.805	.190	4.227	<.001	.481	.481
	Social SE	.404	.200	2.019	.044	.205	.205
	Academic SE	.033	.138	.242	.809	.020	.020
	ER- suppression	-.260	.091	-2.869	<.01	-.150	-.147
	ER- reappraisal	.290	.092	3.163	<.01	.239	.236

Endogenous latent variable	Predictor	<i>B</i>	<i>SE(B)</i>	<i>Z</i>	<i>p</i>	<i>B*</i>	
						<i>Girls</i>	<i>Boys</i>
	SS- Friends	-.064	.073	-.876	.381	-.075	-.074
	SS- Family	.123	.053	2.309	.021	.171	.169
	SS- Significant other	.054	.058	.925	.355	.074	.074

*Note.* *B\** = completely standardized regression slope estimates. SE = self-efficacy; ER = emotion regulation; SS = social support.



**EA sample.** Table 8 presents the fit indices for the multi-group invariance tests for the EA sample. Figure 4 represents the hypothesized indirect path model.



*Figure 4.* Hypothesized indirect path diagram for EAs. Standardized path coefficients were obtained from analysis based on the female participant group. Solid and dashed lines represent significant and non-significant paths, respectively. Double headed curved arrows represent error terms. PA = physical activity; SE\_Emo = emotional self-efficacy; SE\_Soc = social self-efficacy; SE\_Aca = academic self-efficacy; ER\_S = emotion regulation – suppression; ER\_R = emotion regulation – reappraisal; SS\_Fri = social support – friends; SS\_Fam = social support – family; SS\_SO = social support – significant other; Dep = depressive symptomatology; Hap = subjective happiness.

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

**Measurement model.** The measurement model produced an improper solution due to a negative estimated error variance. As such, the model was revised to constrain the error variance of Parcel1 of the physical activity latent variable and Parcel2 of the emotion regulation-suppression latent variable to zero. Invariance testing of the measurement model for the EA

sample suggests that the model parameters are invariant across male and female participants (i.e.,  $\Delta\chi^2$  non-significant for all nested models; see Table 8). Thus, configural, metric, and scalar invariance are established. As such, the scalar invariance model, where restrictions were placed on equal factor loadings and intercepts, was retained for interpretation and future testing.

The final measurement model was found to have good fit to the data, with all fit indices within the recommended range of acceptability:  $\chi^2(378) = 539.55, p < .001$ ., RMSEA = .045 with 90% CI intervals (.037, .054), CFI = .97, and TLI = .96. All items significantly and positively loaded on to their respective latent factors (all  $ps < .001$ ), suggesting that the various latent variables are psychometrically sound.

**Structural model.** Invariance of the latent means model was tested. The  $\chi^2$  change for the latent means model was significant ( $p < .001$ ), indicating that the latent means are non-invariant across groups. As such, the latent means were permitted to vary across groups. Compared to female EAs, male EAs had higher mean values for physical activity latent variable (standardized  $B = .634, p < .001$ ), the emotional self-efficacy latent variable (standardized  $B = .299, p = .021$ ), and the emotion regulation – suppression latent variable (standardized  $B = .262, p = .021$ ), and lower values for depressive symptomatology latent variable (standardized  $B = -.304, p = .011$ ) and the social support- significant other latent variable (standardized  $B = -.288, p = .025$ ). The  $\chi^2$  change for the regression model was significant ( $p < .05$ ), suggesting that path coefficients are non-invariant across groups. A partial regression model was tested in which the path between physical activity and academic self-efficacy was permitted to vary across groups. The regression slope estimate between physical activity and academic self-efficacy was positive for female participants (standardized  $B = .176$ ) and negative for male participants (standardized  $B = -.207$ ). The partial regression model was re-estimated and the  $\chi^2$  change was non-significant. This model

was retained for testing future models. The latent variable variance and covariance model was significantly different from the partial regression model ( $p < .05$ ). The covariance between the social support- friends and social support- family latent variables was set free and the partial latent variable variance and covariance model was re-estimated and compared to the partial regression model. The  $\chi^2$  change for the partial latent variable variance and covariance model was non-significant; as such, this model was retained as the final structural model for interpretation.

The final structural model was found to have good fit to the data, with all fit indices within the recommended range of acceptability:  $\chi^2(463) = 822.72$ ,  $p < .001$ , RMSEA = .061 with 90% CI intervals (.055, .068), CFI = .93, and TLI = 92. Final model parameters are presented in Table 9. For the model pictured in Figure 4, physical activity had significant direct relations with emotional self-efficacy, social self-efficacy, academic self-efficacy, and social support- family. Significant path coefficients were also found from self-efficacy, emotion regulation- suppression, and social support- family to depressive symptomatology and from emotional self-efficacy, emotion regulation- suppression, social support- family, and social support- friends to subjective happiness. Physical activity had an indirect relation with depressive symptomatology that was mediated by emotional self-efficacy (standardized effect size female participants = .146; effect size males = .148) and social support- family (standardized effect size female and male participants = .034). Physical activity also had an indirect relation with subjective happiness that was mediated by emotional self-efficacy (standardized effect size for female participants = .248; effect size male participants = .250) and social support- family (effect size for female and male participants = .036). Physical activity was no longer a direct predictor of depressive symptomatology or subjective happiness once mediators were included in the model. Overall, the

model accounted for 38.7% and 37.1% of the variance in depressive symptomatology and 63.0% and 62.5% of the variance in subjective happiness among female and male EAs, respectively.

Table 8.

*Model Fit Indices for the Multi-Group Invariance Tests for Male and Female EAs (Indirect Effects Model)*

Model	Description	$\chi^2$	Df	<i>p</i>	CFI	TLI	RMSEA (95% CI)	Ref	p-value for $\Delta\chi^2$
Measurement Models									
1	Unconstrained model	307.81	177	<.001	.97	.96	.042 (.035, .050)	–	–
2	Female model	278.06	177	<.001	.97	.96	.042 (.033, .051)	–	–
3	Male model	240.78	177	<.001	.94	.92	.062 (.040, .081)	–	–
4	Configural model	520.36	354	<.001	.97	.95	.048 (.039, .056)	–	–
5	Metric model (Factor weights)	525.32	366	<.001	.97	.96	.046 (.037, .054)	4	.727
6	Scalar model (Intercepts)	539.55	378	<.001	.97	.96	.045 (.037, .054)	5	.301
Structural Models									
7	Baseline structural model	773.90	420	<.001	.93	.91	.064 (.057, .071)	–	–
8	Means model	830.87	431	<.001	.92	.90	.067 (.060, .074)	7	<.001
9	Regression model	817.05	446	<.001	.93	.91	.063 (.057, .070)	7	<.05
10	Partial regression model	806.09	445	<.001	.93	.92	.063 (.056, .069)	7	.147

Model	Description	$\chi^2$	Df	$p$	CFI	TLI	RMSEA (95% CI)	Ref	p-value for $\Delta\chi^2$
11	Invariance & covariance model	837.01	439	<.001	.93	.92	.063 (.056, .070)	10	< .05
12	Partial invariance & covariance model	822.72	463	<.001	.93	.92	.61 (.055, .068)	10	.466

*Note.* CFI = Comparative Fit index; TLI = Tucker Lewis Index; RMSEA = Root Mean Square Error Average with 95% confidence intervals; Ref= reference model used for comparison.

Table 9.

*Latent Variable Structural Regression Results for the EA Sample (Indirect Effects Model)*

Endogenous latent variable	Predictor	$B$	$SE(B)$	$Z$	$P$	$B^*$	
						<i>Women</i>	<i>Men</i>
Emotional SE							
	Physical activity	.320	.061	5.215	<.001	.300	.300
Social SE							
	Physical activity	.251	.049	5.173	<.001	.275	.275

Endogenous latent variable	Predictor	<i>B</i>	<i>SE(B)</i>	<i>Z</i>	<i>P</i>	<i>B*</i>	
						<i>Women</i>	<i>Men</i>
Academic SE	Physical activity	.163	.064	2.543	.011	.176	-.207
ER suppression	Physical activity	.019	.060	.308	.758	.016	.016
ER reappraisal	Physical activity	.103	.091	1.136	.256	.069	.069
SS- Friends	Physical activity	.199	.123	1.622	.105	.094	.094
SS- Family	Physical activity	.349	.128	2.722	<.01	.139	.139
SS- Significant other	Physical activity	-.091	.148	-.615	.538	-.038	-.038
Depressive symptoms							

Endogenous latent variable	Predictor	<i>B</i>	<i>SE(B)</i>	<i>Z</i>	<i>P</i>	<i>B*</i>	
						<i>Women</i>	<i>Men</i>
	Physical activity	.034	.048	.719	.472	.041	.042
	Emotional SE	-.379	.085	-4.471	<.001	-.488	-.495
	Social SE	.020	.104	.190	.849	.022	.022
	Academic SE	.028	.079	.352	.725	.031	.032
	ER suppression	.515	.037	4.073	<.001	.213	.216
	ER reappraisal	-.041	.038	-1.063	.288	-.074	-.075
	SS- Friends	-.062	.032	-.1920	.055	-.159	-.161
	SS- Family	-.081	.022	-3.589	<.001	-.245	-.248
	SS- Significant other	-.005	.024	-.216	.829	-.015	-.015
Subjective happiness							
	Physical activity	-.084	.095	-.888	.375	-.045	-.046
	Emotional SE	1.435	.198	7.259	<.001	.826	.832
	Social SE	-.312	.217	-1.439	.150	-.154	-.155



Endogenous latent variable	Predictor	<i>B</i>	<i>SE(B)</i>	<i>Z</i>	<i>P</i>	<i>B*</i>	
						<i>Women</i>	<i>Men</i>
	Academic SE	-.194	.169	-1.150	.250	-.098	-.099
	ER suppression	-.215	.067	-3.191	<.001	-.136	-.137
	ER reappraisal	.016	.078	.211	.833	.013	.013
	SS- Friends	.131	.060	2.181	.029	.151	.152
	SS- Family	.190	.043	4.460	<.001	.257	.259
	SS- Significant other	.054	.048	1.114	.265	.070	.071

*Note.* *B\** = completely standardized regression slope estimates. SE = self-efficacy; ER = emotion regulation; SS = social support.

## Discussion

### Summary of Findings

Although recent studies have provided empirical support for the positive influence of physical activity on mental health outcomes, the underlying mechanisms of this relationship have yet to be elucidated. As such, the current study provided the opportunity to test a theoretical model exploring the influence of physical activity on psychological well-being via the mediation of various psychosocial constructs such as self-efficacy, emotion regulation, and perceived social support, during two developmentally important periods. The utilization of a SEM approach allowed for the simultaneous estimation of associations among variables, assessment of gender differences, and comparison of various hypothesized direct and indirect relationships, ultimately yielding some preliminary support for the proposed model in a sample of adolescents and EAs.

The study findings provide further evidence for the inverse relation between physical activity and depressive symptoms in a cross-sectional sample of adolescents and EAs. Additionally, the study results offer some novel insight into the positive association between physical activity and subjective happiness among adolescents and EAs. There was also support for indirect pathways from physical activity to depressive symptoms and subjective happiness via several psychosocial mediators in both samples. For adolescent boys and girls, physical activity had indirect relations with depressive symptoms through emotional self-efficacy and indirect relations with subjective happiness through emotional self-efficacy and social self-efficacy. For EA men and women, there was an indirect path from physical activity to depressive symptoms and subjective happiness via emotional self-efficacy and perceived social support from family. Several direct paths were found from physical activity to the psychosocial

mediators, and from the psychosocial mediators to depressive symptomatology and subjective happiness; however, these noted paths did not culminate to indirect effects.

Gender differences were found for several latent means, while only one regression path (path from physical activity to academic self-efficacy in the EA sample) was found to differ between male and female participants. Compared to adolescent girls, adolescent boys had higher means for the latent variables physical activity and emotional self-efficacy and lower means for the latent variables depressive symptoms and perceived social support from significant other. In contrast to EA women, men had higher means for the latent variable physical activity, emotional self-efficacy, and emotion regulation-suppression and lower means for the latent variables depressive symptoms and perceived social support from significant other. In addition, there were observable developmental disparities with respect to mediators of the physical activity and psychological well-being relationship, along with the strength of the paths and effects in the latent path model. Social self-efficacy was a significant mediator for adolescents, while social support from family was a significant mediator for EAs. Moreover, the direct effects model accounted for a greater proportion of the variance in depressive symptoms and subjective happiness for the EA sample compared to the adolescent sample. For the indirect effects models, the adolescent model explained a greater proportion of the variance in depressive symptomatology compared with subjective happiness, while the EA sample explained a greater proportion of the variance in subjective happiness in contrast to depressed mood.

In the following sections, the results will be explained in further detail along with how they relate to current theory and research studies. First, the direct and indirect effects models will be discussed for the adolescent sample followed by the direct and indirect models for the EA

sample. Next, findings related to gender will be presented. Finally, observations related to developmental trends in the models will be highlighted.

### **Direct and Indirect Effects of Physical Activity on Psychological Well-Being During Adolescence**

In support of the current research, the direct effects model confirmed the established relationship between physical activity and psychological well-being within adolescent populations (Jerstad, et al., 2010; Moljord et al., 2011; McPhie & Rawana, 2012). More physically active adolescents reported lower levels of depressive symptoms and greater levels of subjective happiness than their less active counterparts. Thus, consistent with the existing literature (Jerstad, et al., 2010; Moljord et al., 2011; McPhie & Rawana, 2012), the current results suggest that physical activity has a direct association with psychological well-being during adolescence in the absence of intervening factors. However, once the proposed mediating factors were taken into account, the direct associations between physical activity and the indicators of psychological well-being were negligible. These results lend support to the proposition that intermediate outcomes associated with physical activity underlie psychological well-being. Specifically, in the current study, it is suggested that the physical activity effects on depressive symptoms and subjective happiness among adolescents appear to be mediated predominantly by dimensions of self-efficacy. The following paragraphs will discuss the findings related to the psychosocial mediators in further detail.

For the most part, the findings support the general notion that physical activity contributes indirectly to psychological well-being via a number of underlying mechanisms. As hypothesized, compared to less active adolescents, more physically active adolescents had higher levels of self-efficacy, which was, in turn, related with lower levels of depressive

symptomatology and greater levels of subjective happiness. More specifically, emotional self-efficacy mediated the relation between physical activity and subjective happiness and depressive symptomatology, while social self-efficacy only mediated the path from physical activity to subjective happiness. On the other hand, academic self-efficacy was unrelated to physical activity or psychological well-being.

The general finding that aspects of self-efficacy are significant mediators is in agreement with the self-efficacy theory. Bandura's (1977) seminal work on self-efficacy purports that mastery of a task that is perceived to be challenging can lead to positive changes in psychological functioning, such as self-confidence. In this way, participating in physical activity can be viewed as a difficult task, with successful engagement leading to increased self-confidence, self-efficacy, and ability to cope with personal problems, leading to improvements in mental health (Monteiro-Peluso & Guerra de Andrade, 2005). This general sense of mastery and confidence may translate to an efficacious outlook in other domains, such as efficacy beliefs related to academics, social relationships, and emotional control, viewing difficult tasks in these areas as challenges to be mastered rather than threats to be avoided.

Although no known research has specifically considered emotional, social, and academic self-efficacy as intervening mechanisms, the results suggest that physical activity may contribute to well-being via specific aspects of self-efficacy. Social self-efficacy pertains to one's perceived ability for peer relationships and assertiveness, while emotional self-efficacy relates to one's perceived ability to cope with negative emotions (Muris, 2001). Academic self-efficacy pertains to one's perceived ability to master academic content, meet academic requirements, and manage one's own learning activities (Muris, 2001). Interestingly, academic self-efficacy was unrelated to either depressive symptomatology or subjective happiness in the adolescent model, while

other research has demonstrated that academic self-efficacy plays an important role in depression (Muris, 2001). Specifically, it has been suggested that youth with high academic self-efficacy may perceive academic setbacks or obstacles as manageable, therefore promoting greater effort rather than discouragement and hopelessness. It may be that other areas of self-efficacy represented in the model better accounted for feelings of happiness and low mood in the adolescent sample.

Consistent with the findings of the current study, Muris (2001) found that social self-efficacy appears to play a less important role in adolescent depression. As such, social self-efficacy may be a more salient factor in promoting positive affect during adolescence, rather than protecting against depressed mood. Through interpersonal contact, physical activity may foster confidence in one's communication skills and subsequently lead to improved mental health. Moreover, it is plausible that physical activity increases an individual's perceived self-efficacy in their ability to cope with symptoms mental illness. That is, individuals may use physical activity as a means to enhance their ability to cope with and manage negative emotions, or develop a sense of mastery regarding their ability to utilize social support to maintain a particular behaviour, leading to improvements in well-being. Studies examining the mediating role of coping self-efficacy in the adult literature have yielded mixed findings (Craft, 2005; Pickett, Yardley, & Kendrick, 2012). Thus, the current study results provide some novel insight into the mediating role of emotional and social self-efficacy in the physical activity and psychological well-being relationship, most notably in promoting subjective happiness among adolescents.

Contrary to what was hypothesized, among adolescents, emotion regulation did not serve as a mediator of the physical activity and psychological well-being relationship. Further, neither type of emotion regulation strategy (i.e., suppression and reappraisal) was predicted by physical

activity. Only one known study has considered the mediating role of emotion regulation in a youth population. The authors found support for the idea that physical activity may be regarded as an adaptive strategy for managing emotions among normative youth; however, it may serve as a mechanism in which to avoid negative affect among youth with symptoms of disordered eating (Goodwin, Haycraft, & Meyer, 2012). Further, it is possible that the two indices of emotion regulation used in the present study (i.e., suppression and reappraisal) are not influenced by participation in physical activity. As such, future research should consider the mediating role of other types of emotion regulation, such as distraction and rumination. For example, the distraction hypothesis (Sachs, 1982) proposes that engagement in physical activity may serve as distraction from daily worries or psychological stress, possibly interrupting rumination, and leading to improved psychological well-being. However, little empirical support has been found for this hypothesis, especially among younger and normative populations (Craft, 2005; North, McCullagh, & Tran, 1990). Thus it is possible that other psychosocial mechanisms, such as increased self-efficacy and a strong social network, buffer the effects of maladaptive emotion regulation on psychological well-being.

On the other hand, both reappraisal and suppression significantly predicted subjective happiness and depressive symptoms. Increased use of reappraisal was associated with lower levels of depressive symptoms and greater levels of happiness, while greater use of the maladaptive emotion regulation strategy, suppression, was associated with higher levels of depressive symptoms and lower levels of happiness among adolescents. These findings are in line with existing research on emotion regulation and depression (Aldao, Nolen-Hoeksema, & Schweizer, 2010); however, to a much lesser extent, research has considered the influence of emotion regulation on subjective happiness among adolescents (Fry, Guivernau, Kim, Newton,

Gano-Overway, & Magyar, 2012). Thus, the idea that more adaptive emotion regulation strategies among adolescents are related to greater levels of subjective happiness is a relatively novel finding.

Perceived social support did not function as an intervening factor in the adolescent model. This finding is contrary to the original study hypothesis and the general social interaction theory of physical activity. Broadly, this hypothesis proposes that there is a social benefit to exercise. The research is mixed, with some studies offering support for the role of social benefit (e.g., Babiss & Gangwisch, 2009; Harvey et al., 2010), others similarly neglecting to find empirical support for this hypothesis (e.g., North, McCullagh, & Tran, 1990), and some even finding a greater reduction in depressive symptoms among adults who exercise alone at home (Brown, Ramirez, & Taub, 1978). It is possible that the social interaction benefits of exercise are more important when first participating in physical activity, as they may serve as an extrinsic motivator, while over time, the rewards of physical activity become more intrinsic (North, McCullagh, & Tran, 1990). Moreover, other research suggests that older adults with low levels of physical activity and social support are more susceptible to depression, while those with higher levels of physical activity are less susceptible to the effects of low social support on depression (McHugh & Lawlor, 2012). This implies that social support may be more important for those with low levels of physical activity. It may also be the case that social support plays a larger role in promoting engagement in physical activity, rather than physical activity fostering perceptions of increased social support (Dishman, Saunders, Motl, Dowda, & Pate, 2009). Future studies should take into account length of participation in physical activity, the type of activity (individual vs. group), and temporal relations among the variables within a younger population.



Despite the lack of significant indirect effects of social support, there was evidence for several direct pathways involving perceived support. Compared with less active adolescents, more active adolescents reported greater levels of perceived social support from significant others. Further, perceived social support from family was an important predictor for psychological well-being with increased support from family relating to lower levels of depressive symptoms and higher levels of subjective happiness. Surprisingly, perceived social support from friends was unrelated to physical activity or psychological well-being among adolescents. Cross-sectional and longitudinal research on social support for physical activity in adolescents has consistently found a positive effect for support from peers and family on participation in physical activity among adolescents (Mendonça et al., 2014). Indeed, the current findings may be explained on the basis of the variation in forms of physical activity among youth. For example, participation in organized sport is very different from more unstructured and independent forms of physical activity, such as going on a walk. Interestingly, in the current study, greater levels of physical activity were associated with greater perceptions of support from a significant other. Provided that the “significant other” subscale of the MSPSS is open to interpretation, it is possible that the support came from any number of individuals deemed to be a special person in the adolescent’s life. For example, this person could be a teammate, coach, teacher, romantic partner, or simply the most important person, whether it is also a parent, sibling or friend. As such, the results suggest that physical activity may be particularly relevant to increasing perceptions of social support from an important person. Forthcoming studies should clarify who respondents consider as constitutive of a “special person.” Furthermore, past studies have demonstrated the protective role of social support and connectedness with family and friends for depression (Li et al., 2014; Van Voorhees et al., 2008; Vaughan et al., 2010), while

the research on happiness is more limited, with some empirical support for the positive association between social support, broadly, and happiness during adolescence (Mahon & Yarcheski, 2002).

### **Direct and Indirect Effects of Physical Activity on Psychological Well-Being During Emerging Adulthood**

For the sample of EAs, engagement in physical activity was found to have a direct effect on psychological well-being. As hypothesized, greater levels of physical activity were associated with lower levels of depressive symptoms and higher levels of subjective happiness. This finding is corroborated by existing research on physical activity and depression during emerging adulthood (Elliot, Kennedy, Morgan, Anderson, & Morris, 2012; Taliaferro et al., 2009). Similarly, the finding that physical activity is positively related with subjective happiness during emerging adulthood is supported by the relatively scant literature on this topic, especially within younger populations (Maher et al., 2013; Martinez, 2005). These results further support the general notion that physical activity is a health behaviour with important implications for psychological well-being and underscore the particular relevance in EA populations. Further, the direct effects of physical activity on depressive symptoms and subjective happiness in emerging adulthood were no longer significant once mediators were incorporated into the model. This finding suggests that the effects of physical activity on psychological well-being are largely indirect, accounted for, in part, by various underlying psychosocial mediators. Specifically, in the current sample of EAs, it appears that this relation is predominately explained by aspects of self-efficacy and perceived social support. The subsequent paragraphs will delve further into the findings pertaining to the hypothesized psychosocial mediators.

Among EAs, the results support the hypothesis that self-efficacy provides an indirect association between physical activity and psychological well-being. Specifically, higher levels of physical activity were associated with greater levels of emotional self-efficacy, which, in turn, were related to lower levels of depressive symptoms and greater levels of perceived happiness. On the other hand, social and academic self-efficacy did not significantly mediate the link between physical activity and psychological well-being; however, there was a direct link between greater levels of physical activity and improved social and academic self-efficacy among EAs. Unlike emotional self-efficacy, social and academic self-efficacy was not significantly related to depressed mood or subjective happiness.

The results broadly support the mastery theory of physical activity on psychological well-being. Several studies have provided evidence for the mediating role of self-efficacy within adult samples; albeit, the studies tend to employ measures of physical self-efficacy (Ryan, 2008; White et al., 2009). As suggested previously, physical activity may serve to increase an individual's confidence in their ability to cope with and manage negative emotions; thereby, buffering against negative psychological outcomes during emerging adulthood. Moreover, the findings suggest that physical activity may promote beliefs about one's ability to initiate social contact and develop new friendships, and beliefs in one's capacity to fulfill academic requirements and master academic material. Contrary to previous research, in the current study, social self-efficacy was unrelated to psychological well-being during emerging adulthood (Wei, Russell, & Zakalik, 2005). Further, no known studies have examined the relation between academic self-efficacy and mood among EAs attending university. Thus, it is possible other psychosocial factors play a more salient role in promoting psychological well-being during emerging adulthood.

With respect to emotion regulation, the data does not support the hypothesis that suppression and reappraisal strategies mediate the physical activity and psychological well-being relation among EAs. Moreover, reappraisal was neither directly related to physical activity or psychological well-being. Conversely, compared to lower levels, higher levels of suppression were associated with increased depressive symptomatology and decreased subjective happiness, but not with physical activity. No known studies have considered the mediating role of suppression and reappraisal among EAs. Craft (2005) found some limited support for the mediating role of the emotion regulation strategy, distraction, in the association between exercise and depressive symptoms in a sample of adult women with diagnoses of clinical depression; however, the emotion regulation strategy, rumination, was not a particularly important mechanism. Thus, it is possible that the emotion regulation strategies examined in the current study are not the most important strategies for explaining the link between physical activity and psychological well-being. Moreover, it is also possible that other mediating factors in the model play a more significant role.

Existing research supports the finding that maladaptive emotion regulation, as measured by suppression, is associated with psychological well-being among EAs (Haga, Kraft, & Corby, 2009; Soto, Perez, Kim, Lee, & Minnick, 2011). Specifically, Soto and colleagues (2011) found that expressive suppression was associated with negative psychological functioning, namely depressed mood and life satisfaction. On the other hand, the negligible relationship between the adaptive emotion regulation strategy, reappraisal, and psychological well-being runs contrary to past study findings. Past research suggests that among EAs, cognitive reappraisal is positively associated with life satisfaction and positive affect, and negatively associated with depressive symptoms and negative affect (Haga et al., 2009). No previous studies have examined whether

physical activity is associated with suppression and reappraisal strategies. However, Craft (2005) found some preliminary support for the association between exercise and decreased use of rumination and increased use of distraction in a sample of clinically depressed adult women.

Recently, research has considered cross-cultural differences in emotion regulation. Indeed, culture may play a key role in determining which emotions are appropriate and valued, and consequently, the way in which they should be regulated (Campos, Frankel, & Camras, 2004). For example, one study found expressive suppression to be associated with poorer psychological outcomes among European American students, while no adverse outcomes in psychological functioning were found for Chinese students from Hong Kong utilizing expressive suppression (Soto et al., 2011). Accordingly, given that both the adolescent and EA sample used in the current study were ethnically diverse, with a substantial proportion of students born outside of Canada, it is possible that cultural factors related to emotion regulation could account for the negligible results. Thus, future research is needed to determine whether a link exists between various emotion regulation strategies, physical activity, and psychological well-being among EAs, and to further elucidate the potential role of culture.

The results suggest that aspects of perceived social support significantly mediate the physical activity- psychological well-being link among EAs. Interestingly, there was an indirect effect from physical activity to both depressive symptoms and subjective happiness via perceived social support from family. Perceptions of social support from friends or significant others were not significant mediators in the EA model. Moreover, physical activity was not significantly associated with perceptions of social support from friends or significant others. Greater perceptions of social support from friends was associated with greater subjective happiness, but

not significantly associated with depressive symptoms. Social support from significant others was not related to depressive symptoms or subjective happiness among EAs.

The finding that social support is a significant mediator of the physical activity and psychological well-being relationship among EAs is supported by past research. In a sample of EAs and adults, researchers found that social support and social engagement were important factors in explaining the relationship between physical activity and psychological well-being (Harvey et al., 2010). Research suggests that the transition to emerging adulthood is marked by a general decline in support from friends and romantic partners, and an increase in the saliency of social support from family (Larose & Boivin, 1998). Further, the sample of EAs used in the current study are somewhat unique in that over half of the EA sample still lived at home with their families. As such, it is possible that living in the family home during university enhances the saliency of social support from family compared to other forms of social support. Further, students living at home may have more limited opportunities to for peer connections. For example, going to the gym with friends from campus residence, joining university sports teams, or other on-campus activities, may prove more challenging for off-campus dwellers to become involved with. In addition to remaining in the family home, the majority of the sample was also in their first year of studies. This marks a pivotal transition period into a large university, perhaps increasing their reliance on support from their families compared with adolescents, who are more settled in with their peer groups. Thus, these findings suggest that social support from family, and not necessarily support from friends or significant others, is particularly important for explaining the positive relationship between physical activity and psychological well-being during emerging adulthood. Future research is needed to determine whether this relationship holds in a sample of university students predominantly living away from their family.

The finding that social support from friends was unassociated with either physical activity or depressive symptoms, but significantly associated with happiness, was somewhat unexpected, but can be understood in relation to the above explanation regarding fewer opportunities for peer connections when living at home and emerging adulthood representing a transitional period influencing peer relations. Interestingly, research has demonstrated that higher support from family predicts better psychological adjustment during emerging adulthood (Holahan, Valentiner, & Moos, 1994), and that friend support is not predictive of depressive symptoms during this period (Pettit et al., 2011). Indeed, friend support was important for subjective happiness in the current study, which is in line with other research demonstrating that support received from friends is associated with happiness among EAs (Demir, Özen, Doğan, Bilyk, & Tyrell, 2011). Moreover, in contrast to expectations, support from a significant other was not associated with happiness or depressed mood among EAs. Generally emerging adulthood is also characterized by an ascendance of romantic partners as sources of support (Furman & Buhrmester, 1992). However, the “significant other” referenced in the current study may not necessarily be a romantic partner, as it is left to the respondent to define. Thus, it is possible that the contributions of peer and significant other support to psychological adjustment may be overshadowed by the increasing importance of relying on family members when navigating the transition to adulthood (Pettit et al., 2011).

### **Gender Differences**

The present study explored gender differences among latent variable means and regression coefficients in the latent path model for adolescents and EAs. For the most part, the gender effects reported in this study are in line with previous research. Below, several

noteworthy findings pertaining to gender in the adolescent and EA samples will be discussed in further detail.

Significant gender differences were observed in the means of several of the latent constructs. Consistent with previous research (Kjønniksen, Torsheim, & Wold, 2008; Kwan et al., 2012; McPhie & Rawana 2012, 2015), differences were found between male and female participants with respect to participation in physical activity. Specifically, adolescent boys and EA men appear to be, on average, more physically active than girls and women. Moreover, male EAs tended to endorse the use of suppression to regulate emotions to a greater extent than female EAs; however no gender differences were found in the adolescent sample. This finding is consistent with other studies (Zimmermann & Iwanski, 2014), which report a greater use of the maladaptive emotion regulation strategy, suppression, among young males. Gender differences were not found for reappraisal, which is also in line with other research (John & Gross, 2004; Zimmermann & Iwanski, 2014). In explaining these gender differences in emotion regulation, researchers have hypothesized that gender differences may reflect differences in socialization, or possible differences in emotional reactivity and regulation based on brain processes (Domes, Schulze, Böttger, Grossmann, Hauenstein, Wirtz et al., 2010; Zimmerman & Iwanski, 2014). Further, adolescent boys and EA men demonstrated higher levels of emotional self-efficacy compared with their female counterparts. Only one known study has specifically examined gender differences in global self-efficacy in a normative sample of adolescents (Grubbs, Hardin, Weinrich, Weinrich, Garrison, Peasut, & Hardin, 1992); however, contrary to Grubbs and colleagues' expectations, no significant gender differences were noted. Thus, the gender differences observed in the present study suggest that adolescent boys and EA men possess



stronger beliefs in their ability to manage and cope with negative emotions, which may reflect societal differences in the experiences of girls and boys.

With respect to gender differences in depressive symptoms, the study findings support a large body of research that repeatedly demonstrates higher rates of depression among adolescent girls (Hankin, Abramson, Moffitt, Silva, McGee, & Angell, 1998; Hyde, Mezulis, & Abramson, 2008; Merikangas, He, Brody, Fisher, Bourdon, & Koretz, 2010; Nolen-Hoeksema & Girgus, 1994). Interestingly, significant gender differences in depressive symptomatology were not observed for the EA sample. Research using university samples of EAs have produced mixed findings, with some studies reporting gender differences (Gladstone & Koenig, 1994) and others neglecting to find any noteworthy differences in depressed mood (Boggiano & Barrett, 1991). However, studies utilizing samples of the broader EA population more consistently demonstrate such gender differences (Galambos, Barker, & Krahn, 2006; McPhie & Rawana, 2014). Hankin and colleagues (1998) hypothesize that such discrepancies may be due to methodological differences among studies.

Lower levels of perceived support from significant others was observed for adolescent boys and EA men. This finding is supported by past research demonstrating that, for the most part, female participants tend to report greater levels of perceived social support compared to their male counterparts (Bruwer, Emsley, Kidd, Lochner, & Seedat, 2008). Further, past studies have found that female adolescents and undergraduates report higher levels of social support from significant others compared to their male peers (Canty-Mitchell & Zimet, 2000; Zimet et al., 1988). However, given that the “significant other” is largely defined by the respondent, it is not clear exactly how this support differs across male and female participants. Thus, in general, it

appears as though girls and women perceive a greater amount of support from a “special person” (e.g., teacher, coach, specific family member, etc.) in their life compared to boys and men.

It was speculated that gender differences would be observed in the regression coefficients across the adolescent and EA models. Surprisingly, only one pathway was found to vary across gender. For the most part, regression parameters (size and direction) were found to be similar across adolescent boys and girls and EA men and women. However, in the EA sample, the path between physical activity and academic self-efficacy was observed to vary across gender. For EA women, higher levels of physical activity were related to higher endorsements of academic self-efficacy, while for EA men, higher levels of physical activity were associated with lower levels of academic self-efficacy. Thus, it appears as though physical activity has a negative influence on men’s sense of academic self-efficacy during emerging adulthood. A plausible explanation for this finding is that undergraduate men involved in higher levels of physical activity feel less supported in their ability to succeed academically. For instance, perhaps men find it more challenging to balance exercise and sport with the increasing academic demands of university, or perhaps they experience less of a sense of mastery and accomplishment from engaging in greater levels of physical activity compared to women.

It was expected that a greater number of pathways would differ across gender given the tendency of the constructs to demonstrate gender differences during adolescence and emerging adulthood; however, the data does not support this hypothesis. Thus, it may be that although there are differences in the means of various constructs, the pattern in which the variables relate to one another does not differ by gender. That is, for instance, despite the fact that women and girls tend to have lower levels of physical activity and greater levels of depressed mood compared to boys and men, engaging in physical activity remains an important predictor of

mood across gender. Future studies should replicate the models in a sample with a more balanced sample of male and female participants.

### **Developmental Trends in the Relation between Physical Activity and Psychological Well-Being**

Although developmental differences between the adolescent and EA model were not tested statistically in the current study, the following section will comment informally on some noteworthy group differences and similarities. That being said, several similarities and differences were observed between the adolescent and EA models. In terms of similarities, physical activity had a direct and positive effect on psychological-wellbeing for both developmental periods. Further, physical activity had a slightly stronger effect on depressed mood and happiness for EAs relative to adolescents, suggesting that other explanatory variables may play a more salient role in promoting mental wellness during adolescence. For the most part, these findings corroborate past research demonstrating a beneficial influence of physical activity on mental health across the life-span (Jerstad et al., 2010; Martinez, 2005; Moljord et al., 2011; Taliaferro et al., 2009).

In terms of indirect pathways to mental health from physical activity, emotional self-efficacy similarly served as a mediator for both adolescents and EAs. This finding underscores the importance of emotional self-efficacy as a salient mediator of the physical activity effect on well-being across developmental stages. Interestingly, the indirect effect via emotional self-efficacy was strongest for depressed mood in the adolescent sample, while emotional self-efficacy was a stronger mediator for happiness in the EA sample. This may reflect the general trend towards improvements in psychological well-being during emerging adulthood (Galambos et al., 2006; McPhie & Rawana, 2014); thus, various predictors may then become more

important for promoting happiness opposed to diminishing risk for low mood during this life stage.

For adolescents and EAs, the models accounted for a greater amount of the variance in subjective happiness compared with depressive symptoms. Furthermore, when considering the direct effect of physical activity on psychological well-being, stronger effects were found for subjective happiness compared with depressed mood. Together, these results suggest that for both adolescents and EAs, physical activity and psychosocial factors appear to have a more important role in promoting positive affect compared with reducing risk for depressed mood. No known studies have simultaneously considered both depressed mood and subjective happiness as outcomes of participation in physical activity while accounting for multiple mediators; as such, it will be important for forthcoming research to verify whether physical activity has a larger influence on enhancing subjective happiness compared with diminishing risk for depressive symptoms.

Several differences were observed in the indirect models between adolescents and EAs. Social self-efficacy was a significant explanatory factor for the path between physical activity and subjective happiness in the adolescent model, but not in the EA model. Perhaps feelings of social competence play a more central role for psychological well-being during adolescence, when their social world is undergoing rapid changes and they are faced with a growing number of social pressures and demands (Obradović, van Dulmen, Yates, Carlson, & Egeland, 2006). For EAs, family support significantly mediated the path from physical activity to depressive symptoms and subjective happiness. This indirect path was not significant in the adolescent model. It may be that social support is particularly important for psychological adjustment

during the transition into emerging adulthood, while other factors play a more central role during adolescence.

Consistent with existing research, EAs reported higher levels of self-efficacy, perceived social support, adaptive emotion regulation, subjective happiness, and lower levels of depressed mood relative to adolescents (Galambos & Krahn, 2008; Goldbeck et al., 2007; McPhie & Rawana, 2015; Schulenberg, O'Malley, Bachman, & Johnston, 2005; Uusitalo-Malmivaara, 2014; Zimmermann & Iwanski, 2014). Interestingly, the mean scores on the physical activity measure were remarkably consistent across the samples. Generally, research reports a decline in physical activity during adolescence (Center for Disease Control and Prevention, 1997), with further reductions during emerging adulthood (Bray & Born, 2004), particularly among those transitioning to university (Kwan, Cairney, Guy, & Pullenayegum, 2012). Further, Canadian national data suggests that 42.3% of young adults aged 20 to 29 still live in their family home, either because they never left, or they returned after living elsewhere (Statistics Canada, 2011). The current finding may be due, in part, to the characteristics of the current sample, most notably, the fact that well over half of the EAs sampled still lived at home. Thus, compared to EAs living at home, EAs who live outside the home may have greater opportunities to experience different ways of living, which may include changes in health behaviours, such as physical activity, that were formerly imposed by parents.

### **Limitations and Future Directions**

The results of the current study should be interpreted in light of the following limitations. For one, the cross-sectional design of the study precludes the ability to draw cause-and-effect inferences, as reciprocal and reverse effects are possible (Cerin, 2010). For example, one cannot conclude from the study results that physical activity causes lower levels of depressive

symptoms and greater levels of happiness. Related, due to the cross-sectional design, it is equally possible that some of the mediators, such as social support, lead to increased physical and not necessarily the other way around. Additionally, despite the fact that the study included a sample of adolescents and EAs, with a range of ages within each developmental stage, conclusions about developmental changes over time cannot be formally made. That is, the cross-sectional nature limited the study to investigations between individuals opposed to within individuals across development. Mechanisms responsible for between individual differences in physical activity and psychological well-being may indeed vary from those underlying within individual variations in psychological well-being (Cerin, 2010). Additionally, caution is warranted when interpreting the developmental comparisons made in the current study, as the mode and context of data collection differed between the two samples, possibly influencing any apparent differences noted. Additionally, given the two separate cross-sectional age-based samples, it is not possible to rule out the possibility of cohort or period effects influencing any apparent differences between samples. Forthcoming research would benefit from a longitudinal design, which would allow for the examination of temporal relations among the study variables and the investigation of continuous developmental trajectories from adolescent into emerging adulthood.

Several sample selection factors limit the generalizability of the study results to the broader population of adolescents and EAs. The adolescent sample consisted of high school students who self-selected to attend a university faculty of health information day. These students likely have a particular interest in health related disciplines, which may make them unique in some way from the broader high school student population. The EA sample used in the present study consisted of those currently attending university. Although the majority of Canadian EAs pursue a post-secondary education after high school (Statistics Canada, 2005),

many also go directly into the work force, enroll at some later point, or are unsuccessful at matriculating; thus, leaving a proportion of individuals in this age range that do not attend a post-secondary institution. Additionally, the university from which the EA sample was drawn is regarded as a “commuter” school, with the majority of students still living at home. Moreover, in both samples, girls and women were overrepresented compared to boys and men, highlighting the need for subsequent studies to obtain more balanced samples. A relatively narrow age range was examined within each developmental period, with older adolescents and younger EAs being overrepresented. Provided these selection factors, future research should strive for a more representative sample by surveying a broader sample of high school students that more accurately reflect the general adolescent population. Further, future research with EAs not pursuing post-secondary education, as well those attending non-commuter schools, is warranted.

Data was collected via self-report instruments, which may have introduced subjective bias. The accuracy of self-report measures can be influenced by degree of insight and social desirability (Furnham, 1986). As such, future studies might implement additional methods of assessment to measure psychopathology and psychosocial constructs (e.g., clinical interviews, parent/teacher report, etc.). Further, to reduce some of the subjectivity inherent in survey methods of physical activity, objective assessment tools for assessing physical activity (i.e., pedometers, accelerometers, heart rate monitors, direct observation, etc.) may be used in conjunction with the self-report measures (Sirard & Pate, 2001); however, traditional survey and recall methods of physical activity have demonstrated a high degree of agreement with more objective measures, such as direct observation (Sirard & Pate, 2001). Using objective measures may preclude researchers from tapping into contextual or environmental factors surrounding physical activity, such as the type of activity (e.g., walking for exercise vs. playing on a soccer

team). Further, the straightforward and efficient manner of administering self-report physical activity tools allows for the study of such a construct in larger samples. These tools can also be easily integrated into lengthier research protocols where they may not serve as the central purpose. Lastly, this study considered more general aspects of self-efficacy. Forthcoming research may wish to examine how physical activity self-efficacy influences psychological well-being in adolescents and EAs.

The current study examined multiple psychosocial mediators of the physical activity-psychological well-being link. Despite finding evidence for full mediation, this does not preclude the possibility of other important explanatory mechanisms or direct relationships. It is likely that other equally important complementary and parallel processes exist. For example, biological mechanisms, such as brain derived neurotrophic factor (BDNF), may also contribute to the therapeutic effect of physical activity on mood (Salmon, 2001). As such, physical activity has an important role in fostering these beneficial intervening processes, which in turn promote positive psychological outcomes. Clearly more work should be done to examine more complex models that consider other potential mechanisms and take into account more specific aspects of physical activity (i.e., frequency, intensity, duration, type), which may influence these mediational relationships.

### **Study Implications**

The current study has made a unique contribution to the extant literature by exploring the role of multiple psychosocial mediators of the physical activity – psychological well-being link in two distinct developmental periods. Other noteworthy contributions include the investigation gender-specific hypotheses; focus on positive mental health outcomes; and utilization of latent variables in the path models. Further, existing theoretical frameworks or conceptual models of



depression pathways among young people may be advanced by the addition of physical activity, which represents a relatively novel promotive factor in the extant adolescent and emerging adult depression literature.

Most notably, the study has important prevention and intervention implications for clinicians, educators, and mental health service providers working with adolescents and EAs. Likewise, the results are also of importance to policymakers in the area of mental-health promotion and intervention for young people. By incorporating physical activity as a core component, prevention and intervention initiatives can target the promotion of positive mental health outcomes and the reductions of negative psychological outcomes. In particular, physical activity may be beneficial for fostering happiness and reducing depressive symptomatology among adolescents and EAs, while also facilitating the development of other psychosocial factors, such as self-efficacy and perceived social support. Knowledge regarding these underlying mechanism may aid practitioners in developing interventions or making recommendations regarding the clinical utilization of physical activity. That is, if the psychological well-being response to physical activity is dependent on an individual's psychosocial experiences of physical activity, such as increased self-efficacy or social support, then programs could be tailored in a manner that includes sources of these psychosocial constructs (Pickett et al., 2012). For instance, initiatives could incorporate mastery experiences by setting attainable goals in order to promote feelings of self-efficacy. Moreover, exercising with a friend or developing physical activity programs with ample opportunities to build connections with peers, coaches, and others may facilitate improved social support. In addition, compared to boys and men, girls and women tended to have lower levels of physical activity and higher levels of depressive symptoms, suggesting that it may be particularly beneficial to target

prevention and intervention efforts towards young females, with a focus on increasing engagement in physical activity.

Several global health initiatives have already been developed, such as “Exercise is Medicine,” which aims to have healthcare providers monitor patients physical activity levels and provide counseling and resources. This organization has also developed the “Exercise is Medicine on Campus” initiative, which has four main goals: (1) to develop physical activity opportunities; (2) organize educational events; (3) consult with health professionals within Student Health Services or local family medicine teams; and (4) consult with medical or other health professional educators regarding curriculum redesign to promote the integration of physical activity (American College of Sports Medicine, 2007). These initiatives focus on physical activity as a vital part of prevention and treatment of chronic disease in the population; however, evidence from the current study, along with other existing studies, suggests that this initiative may also extend to the promotion of psychological wellness in the broader population.

The study results provide additional empirical support for the importance of promotion and early intervention to prevent mental health problems across development. Specifically, adolescence and EA represent a key developmental periods during which to direct prevention efforts, as they mark a time when enduring habits, values, and lifestyles associated with health are shaped (Maggs et al., 1997). As such, prevention and promotion initiatives aimed at increasing physical activity in order to foster adaptive psychological functioning may be disseminated more broadly, targeting the entire population of adolescents and EAs, regardless of their risk status. Specifically, this may be accomplished via school-based mental health promotion and intervention programs aimed at increasing prospects for positive development and reducing risk for future problems in the entire student body in addition to more targeted

programs for youth at greatest risk. Because students often spend a large proportion of their day at school, the school setting represents a key venue in which to deliver universal mental health promotion programs to the majority of young people (National Research Council and Institute of Medicine, 2009).

The results also suggest that mental health and mental illness are highly correlated. However, extant evidence suggests that they represent distinct constructs on separate continuums (Keyes, 2002). As such, the treatment and prevention of mental illness may not necessarily promote more mentally healthy youth (Keyes, 2002). Traditionally, school-based and community programs and services have focused on remediating problems and addressing risk factors for psychopathology (Morrison & Kirby, 2010). However, more recently, there has been an emphasis on programs stemming from the areas of positive psychology and health promotion, among others, which incorporate prevention and intervention programs aimed at promoting adaptive psychological functioning in the larger student population (Fowler & Lebel, 2013). The findings from the current study further underscore the importance of also targeting and fostering a positive sense of emotional and psychological well-being and enjoyment in life (i.e., subjective happiness) as a complementary strategy to the identification, prevention, and treatment of psychopathology. In light of the study results, clinicians and policymakers are encouraged to take a broader framework to the promotion and treatment of mental health issues among adolescents and EAs, incorporating frameworks that promote positive outcomes, rather than strictly deficit focused-models.

## **Conclusion**

In summary, this study explored psychosocial mechanisms underlying the physical activity and psychological well-being relationship in a sample of male and female adolescents

and EAs. Results support the association between participation in physical activity and lower levels of depressive symptoms and higher levels of subjective happiness among adolescents and EAs. Further, physical activity also promoted adaptive psychological outcomes predominantly via increased self-efficacy and perceived social support. The results contribute to the growing literature on the positive psychological outcomes associated with physical activity across the lifespan and facilitate a better understanding of the underlying process. This research informs the development of prevention and intervention programming utilizing physical activity to foster positive psychological health among youth. Future research is required to corroborate these results and to build on the current findings by examining the proposed associations longitudinally.

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## Appendix A.

## Consent and Assent Forms

## Parent/ Legal Guardian Information and Consent Form

**PARENT INFORMATION FORM****Emotion Regulation, Dating Relationships, and Psychological Strengths in Adolescence: A Survey Study**

**Dr. Jennine Rawana**  
**Department of Psychology, York University**

**Dr. Jennifer Connolly**  
**Department of Psychology, York University**

**Introduction:** We are professors at York University and we are conducting a research project studying adolescents' ability to handle their emotions (i.e., emotional regulation) and how these relate to their past and present dating experiences. The project is also interested in exploring whether strengths in various life areas and mood are related to dating experiences in youth. Results will be used to understand different dating experiences in youth and what might lead young individuals to more positive well-being and health.

**Procedure:** We are asking that guardians give permission for their adolescent to complete the questionnaires, which will take 20 minutes, and be completed during a Mental Health Seminar at York University during your adolescent's visit to the campus in the Fall of 2013. The questionnaires inquire about past and present dating experiences (if any), handling of emotions, strengths, and mood. We are interested in group patterns only and will not be looking at a particular student's results.

There are no known physical or social risks of participating in this research. Questions about feelings and behaviors might upset some youth; however, we believe the chance of this is minimal given the measures that we have used. We are collecting information about mood but will not have appropriate information to address any clinical or diagnostic concerns about a particular child and will not be following up with guardians about individual results. We will be giving all youth the phone number for KIDS HELPLINE in the case they would like to talk to someone about upset feelings. However, in our experience, young people have enjoyed participating in similar projects. Your child may benefit from this study by gaining first-hand experience about participating in a university level research study. Students may also learn about mental health issues in adolescence, including common symptoms and treatments, and stress reduction techniques. Your child will be told that he or she has a choice whether or not to participate and will also be told that he or she may withdraw from the study or choose not to answer a particular question at any time, without penalty. Withdrawal or refusal to answer questions will not influence any privileges or resources that your child receives from the school. **If your child does not wish to participate in the study, their refusal will be respected and will not affect the relationship with the researchers, York University, or any other group associated with this project.** If students withdraw, their data will be destroyed.

**Confidentiality:** We will be collecting identifying information on the youth, but such information will not be attached to the other measures completed. All measures completed by youth are identified by ID number only. All information provided is strictly confidential and will be used for research purposes. Information will be electronically stored for 7 years and then destroyed. Confidentiality will be provided to the fullest extent possible by law. Schools will not have access to any information we collect. Like you, we are interested in the wellbeing of youth and helping them to succeed personally, socially, and academically.

This project has been reviewed and received ethics clearance York University's Ethics Review Board. If you have any questions or concerns regarding your family's rights or treatment as participant(s) in the project, you may contact the Office of Research Ethics at York University (telephone 416-736-5914 or e-mail [ore@yorku.ca](mailto:ore@yorku.ca)). Moreover you can also contact Dr. Jennine Rawana or Dr. Jennifer Connolly, whose contact information is listed above.



**YOUTH INFORMATION FORM**  
**Emotion Regulation, Dating Relationships, and**  
**Psychological Strengths in Adolescence:**  
**A Survey Study**

**Dr. Jennine Rawana**  
**Department of Psychology, York University**

**Dr. Jennifer Connolly**  
**Department of Psychology, York University**

We are professors at York University and we are conducting a research project studying adolescents' emotions and how these relate to their dating experiences. The project is also interested in exploring how strengths in various life areas and how one handles emotions are related to dating experiences. Results will be used to understand different dating experiences in youth and what leads individuals to positive well-being and health. The study will take place at York University during the Mental Health Seminar of your campus visit, when you will be given questionnaires that will take approximately 20 minutes to complete. In order to participate in the study, if you are 18 years old or younger, your parents will have to give permission, but it is ultimately your choice whether or not you would like to. If there is any question in the study that you do not feel comfortable answering, you will be able to skip it. You can also stop participating at any time without telling us why. In the event you withdraw from the study, all associated data collected will be immediately destroyed wherever possible. If you do not wish to participate in the study, your refusal will be respected and will not affect the relationship with the researchers, your teachers, York University or any other group associated with this project.

You will be asked questions about your past and present dating experiences, including brief questions about your partner(s) and yourself. You will also be asked questions about how you handle your positive and negative emotions, as well as your strengths, including questions about yourself (e.g., "I am happy about life."), your home (e.g., "I like to do things with my family."), and your friends (e.g., "I get along well with my friends."). In addition to this, you will be asked questions about your view of yourself and your feelings. Your answers are used for research only and are completely private. Information that identifies you will be kept for 7 years at York University and then destroyed. Your anonymous answers will be kept indefinitely at York University in a secure location. We are interested in studying groups overall and do not look carefully at one student's answers. We are asking questions about your feelings, but we won't be looking for individual answers or following up with you. It is possible that questions about your feelings could upset you. We are giving all students information about KIDS HELPLINE in case they need to talk to somebody or need some help with how they are feeling. We are interested in research that helps us know how to help young people have more positive dating experiences. We find most young people enjoy participating in similar studies. This project has been reviewed and has received ethics clearance by York University. If you have any questions or concerns you can contact the manager of the Office of Research Ethics of York University, 309 York Lanes, 416-736-5914, e-mail ore@yorku.ca. You may also contact Dr. Jennine Rawana or Dr. Jennifer Connolly, whose contact information is listed above.

**CONSENT FORM****Emotion Regulation, Dating Relationships, and Psychological Strengths in Adolescence:  
A Survey Study****PLEASE RETURN THIS FORM TO THE CLASSROOM TEACHER**

- I (the parent/guardian) consent to my child's participating in the *Emotion Regulation, Dating Relationships, and Psychological Strengths in Adolescence: A Survey Study*.

Child's School: \_\_\_\_\_ Child's teacher: \_\_\_\_\_

Child's Name: \_\_\_\_\_

Child's Date of Birth: \_\_\_\_\_

Parent/Guardian Name \_\_\_\_\_

Parent/Guardian Signature \_\_\_\_\_

Date \_\_\_\_\_

- I (the youth) consent to my participating in the *Emotion Regulation, Dating Relationships, and Psychological Strengths in Adolescence: A Survey Study*

Child's Name: \_\_\_\_\_

Child's Signature \_\_\_\_\_ Date: \_\_\_\_\_

**PLEASE RETURN THIS FORM TO THE CLASSROOM TEACHER****THANK YOU!**



### Consent Form

- A. For this study, you will complete an online survey about a broad range of behaviours and emotions encountered in university. For example, the survey will ask questions about your engagement in physical activity, any feelings of low mood, and coping. Some demographic information is collected too. It will take about 30 minutes to complete the survey.
- B. **This is a voluntary study.** You are free to not answer any questions, and to stop participating at any time without any academic penalty in Psyc 1010 (i.e., no impact on your marks). Further, refusal to participate, refusal to answer any particular questions, or withdrawal from the study will not affect your relationship with the researchers, York University, or any group associated with this research project. All responses to these questions will be kept anonymous and confidential by the researchers. **Confidentiality will be provided to the fullest extent possible by law.** Your name will not be linked with your answers. The information you provide will help us understand better our research on young adults attending university. In the event, that you withdraw from the study, all associated data collected will be immediately destroyed wherever possible.
- C. There are no serious anticipated risks involved with completing the survey. Some people may become uncomfortable or distressed while completing some questions related to feelings of sadness or issues in relationships. If you do become distressed, please contact the Counselling & Development Centre at York University (Ph: 416-736-5297; Location: N110 Bennett Centre for Student Services). At the end of the survey, you will also be given a list of other local counselling resources. Benefits of participating in the study are an added percentage to your Psyc 1010 grade and experience in psychology research.
- D. If you have any questions about the survey or the study in general, please contact the REACH Lab - URPP Study or Dr. J. Rawana.
- E. Should If you have any questions about this process, or about your rights as a participant in the study, please contact the Sr. Manager & Policy Advisor for the Office of Research Ethics, 5<sup>th</sup> Floor, Kaneff Tower, York University (telephone [416-736-5914](tel:416-736-5914) or e-mail [ore@yorku.ca](mailto:ore@yorku.ca))
- F. **This research has received ethics review and approval by the Human Participants Review Sub-Committee, York University's Ethics Review Board and conforms to the standards of the Canadian Tri-Council Research Ethics guidelines.**
- G. Please select below that you “agree” or “disagree” to participate in this study. By selecting “agree” and continuing to complete this survey online, you are providing your consent to participate in this study and indicating you have read this Consent Form. Thank you.

#### Response Options:

I agree  or disagree  to participate in the study.

## Appendix B

### Debriefing Information for Research Participants

We would like to thank you for completing our **Survey** study on feelings and behaviours experienced while attending university. The questions that you have answered pertaining to physical activity, feelings, and coping will help us identify some common problems and strengths experienced in undergraduates. Some of the questions in this survey may have made you feel uncomfortable or distressed. If you are or anyone you know is feeling depressed or psychologically distressed, there is help available. Below is contact information for some helpful services if you are feeling psychologically depressed or distressed.

Before we end this study, we would like to please not talk about this study with anyone. There are many other people who have not participated in this study yet. If they hear from you or others about what the study is about, it may influence their responses. Our results may not be accurate. We hope that you will cooperate with us in this regard. Questions related to this study can be sent to [rch\\_urpp@yorku.ca](mailto:rch_urpp@yorku.ca).

Thank you.

#### Other Counselling Services in the GTA:

1. Toronto Psychological Services 416-531-0727 [www.toronto-ps.com](http://www.toronto-ps.com)
2. Distress Centre of Toronto 416-408-4357 (HELP)
3. Help Line for All Youth HEYY 416-423-4399 (HEYY)
4. Good 2 Talk (for post-secondary students) 1-866-925-5454 <http://www.good2talk.ca/>
5. York University - Personal Counselling Services (PCS). Located in Counselling & Disability Services (CDS) in N110 Bennett Centre for Student Services, and can also be reached by phone at 416-736-5297 or <http://pcs.info.yorku.ca/in-case-of-crisis/>
6. The Freedom from Fear Foundation in Toronto is an organization established to help people with anxiety disorders. They have a network of support groups set up throughout Ontario 416-761-6006
7. Drug & Alcohol Registry of Treatment (DART)/Treatment info-line 1-800-565-8603
8. The National Eating Disorder Information Centre has a national register of private therapists, medical programs, and information 416-340-4156
9. Mood Disorders Association of Ontario 416-486-8046 OR call TOLL-FREE at 1-888-486-8236
10. A.C.C.E.S. (Accessible Community Counselling and Employment Services)  
Toronto: 416-921-1800 Scarborough: 416-431-5326 Mississauga: 905-361-2522
11. Family Services Association of Toronto 416-595-9230
12. For a list of more health, social, community, and/or government community resources/services, you can access it via [www.211toronto.ca](http://www.211toronto.ca) or you can dial 2-1-1 in Toronto 24 hours a day. This phone number is free, confidential, and the trained staff is multilingual.

## Appendix C

## Physical Activity Questionnaire for Adolescents (PAQ-A; Kowalski, Crocker, &amp; Donen, 2004)

We are trying to find out about your level of physical activity from the **last 7 days** (in the last week). This includes sports or dance that make you sweat or make your legs feel tired, or games that make you breathe hard, like tag, skipping, running, climbing, and others.

<b>1. Physical activity in your spare time: Have you done any of the following activities in the past 7 days (last week)? If yes, how many times? (Mark only one box per row.)</b>					
	<b>No</b>	<b>1-2</b>	<b>3-4</b>	<b>5-6</b>	<b>7 times or more</b>
Skipping					
Rowing/canoeing					
In-line skating					
Tag					
Walking for exercise					
Bicycling					
Jogging or running					
Aerobics					
Swimming					
Baseball, softball					
Dance					
Football					
Badminton					
Skateboarding					
Soccer					
Street Hockey					
Volleyball					
Floor hockey					
Basketball					
Ice skating					
Cross-country skiing					
Ice hockey/ringette					
Other					
Other					

2. In the **last 7 days**, during your **physical education (PE) classes**, how often were you very active (playing hard, running, jumping, throwing)? (Check one only.)

- I don't do PE .....
- Hardly ever .....
- Sometimes .....
- Quite often .....
- Always .....

3. In the **last 7 days**, what did you normally do at **lunch** (besides eating lunch)? (Check one only.)

- Sat down (talking, reading, doing schoolwork).....
- Stood around or walked around .....
- Ran or played a little bit .....
- Ran around and played quite a bit .....
- Ran and played hard most of the time .....

4. In the **last 7 days**, on how many days **right after school**, did you do sports, dance, or play games in which you were very active? (Check one only.)

- None .....
- 1 time last week .....
- 2 or 3 times last week .....
- 4 times last week .....
- 5 times last week .....

5. In the **last 7 days**, on how many **evenings** did you do sports, dance, or play games in which you were very active? (Check one only.)

- None .....
- 1 time last week .....
- 2 or 3 times last week .....
- 4 or 5 last week .....
- 6 or 7 times last week .....

6. On the **last weekend**, how many times did you do sports, dance, or play games in which you were very active? (Check one only.)

- None .....
- 1 time .....
- 2 — 3 times .....
- 4 — 5 times .....
- 6 or more times .....

7. Which **one** of the following describes you **best** for the **last 7 days**? Read all five statements before deciding on the one answer that describes you.

- F. All or most of my free time was spent doing things that involve little physical effort .....
- G. I sometimes (1 — 2 times last week) did physical things in my free time (e.g. played sports, went running, swimming, bike riding, did aerobics) .....
- H. I often (3 — 4 times last week) did physical things in my free time .....
- I. I quite often (5 — 6 times last week) did physical things in my free time .....
- J. I very often (7 or more times last week) did physical things in my free time .....

8. Mark how often you did physical activity (like playing sports, games, doing dance, or any other physical activity) for **each day last week**.

	None	Little bit	Medium	Often	Very often
Monday					
Tuesday					
Wednesday					
Thursday					
Friday					
Saturday					
Sunday					

9. Were you **sick last week**, or did anything prevent you from doing your normal physical activities? (Check one.)

Yes .....

No .....

If Yes, what prevented you? \_\_\_\_\_

## Appendix D

## Physical Activity Questionnaire for Adults (PAQ-AD; Copeland, Kowalski, Donen, &amp; Tremblay, 2005)

We are trying to find out about your level of physical activity from the **last 7 days** (in the last week). This includes activities that make you sweat, make your legs feel tired, or make you breathe hard, such as team sports, running, strenuous occupational activities, and others

1. Physical activity in your <b>spare time</b> : Have you done any of the following activities in the past <b>7 days (last week)</b> ? If yes, how many times? (Mark only one box per row.)					
	No	1-2	3-4	5-6	7 times or more
Rock climbing					
Rowing/canoeing					
Tennis/Squash					
Stair climber (or other similar equipment)					
Walking for exercise					
Heavy yard work					
Jogging or running					
Bicycling					
Aerobics (or other exercise class)					
Swimming					
Baseball, softball					
Dance					
Football					
Badminton					
Soccer					
Street/floor hockey					
Volleyball					
Basketball					
Skating (in-line/ice)					
Cross-country skiing					
Ice hockey/ringette					
Martial arts					
Weight training					
Other _____					
Other _____					

2. In the **last 7 days**, during the **morning**, how often were you very active (for example: playing sports, exercise classes, strenuous occupational activity)? (Check one only.)

None .....

1 time last week .....

2 or 3 times last week .....

4 or 5 last week .....

6 or 7 times last week .....

3. In the **last 7 days**, after **lunch and before supper**, how often were you very active (for example: playing sports, exercise classes, strenuous occupational activity)? (Check one only.)

None .....

1 time last week .....

2 or 3 times last week .....

4 or 5 last week .....

6 or 7 times last week .....

1. In the **last 7 days**, during the **evening**, how often were you very active (for example: playing sports, exercise classes, strenuous occupational activity)? (Check one only.)

None .....

1 time last week .....

2 or 3 times last week .....

4 or 5 last week .....

6 or 7 times last week .....

2. On the **last weekend**, how often were you very active (for example: playing sports, exercise classes, strenuous occupational activity)? (Check one only.)

None .....

1 time last week .....

2 or 3 times last week .....

4 or 5 last week .....

6 or 7 times last week .....

6. Which **one** of the following describes you **best** for the **last 7 days**? Read all five statements before deciding on the one answer that describes you.

F. All or most of my free time was spent doing things that involve little physical effort .....

G. I sometimes (1 — 2 times last week) did physical things in my free time (e.g. played sports, went running, swimming, bike riding, did aerobics) .....

H. I often (3 — 4 times last week) did physical things in my free time .....

I. I quite often (5 — 6 times last week) did physical things in my free time .....

J. I very often (7 or more times last week) did physical things in my free time .....

7. Mark how often you did physical activity (for example: playing sports, exercise classes, strenuous occupational activity) for **each day last week**.

	None	Little bit	Medium	Often	Very often
Monday					
Tuesday					
Wednesday					
Thursday					
Friday					
Saturday					
Sunday					

8. Were you **sick last week**, or did anything prevent you from doing your normal physical activities? (Check one.)

Yes .....

No .....

If Yes, what prevented you? \_\_\_\_\_



## Appendix E

## Multidimensional Scale of Perceived Social Support (MSPSS; Zimet, Dahlem, Zimet, &amp; Farley, 1988)

Instructions: We are interested in how you feel about the following statements. Read each statement carefully. Indicate how you feel about each statement.

	<b>Very Strongly Disagree</b>	<b>Strongly Disagree</b>	<b>Mildly Disagree</b>	<b>Neutral</b>	<b>Mildly Agree</b>	<b>Strongly Agree</b>	<b>Very Strongly Agree</b>
1. There is a special person who is around when I am in need.	1	2	3	4	5	6	7
2. There is a special person with whom I can share my joys and sorrows.	1	2	3	4	5	6	7
3. My family really tries to help me.	1	2	3	4	5	6	7
4. I get the emotional help and support I need from my family.	1	2	3	4	5	6	7
5. I have a special person who is a real source of comfort to me.	1	2	3	4	5	6	7
6. My friends really try to help me.	1	2	3	4	5	6	7
7. I can count on my friends when things go wrong.	1	2	3	4	5	6	7
8. I can talk about my problems with my family.	1	2	3	4	5	6	7
9. I have friends with whom I can share my joys and sorrows.	1	2	3	4	5	6	7
10. There is a special person in my life who cares about my feelings.	1	2	3	4	5	6	7
11. My family is willing to help me make decisions.	1	2	3	4	5	6	7
12. I can talk about my problems with my friends.	1	2	3	4	5	6	7

Appendix F  
Self-efficacy Questionnaire for Children (SEQ-C; Muris, 2001)

	<b>1 Not at all</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5 Very Well</b>
<b>1.</b> How well can you get teachers to help you when you get stuck on schoolwork?	1	2	3	4	5
<b>2.</b> How well can you express your opinions when other classmates disagree with you?	1	2	3	4	5
<b>3.</b> How well do you succeed in cheering yourself up when an unpleasant event has happened?	1	2	3	4	5
<b>4.</b> How well can you study when there are other interesting things to do?	1	2	3	4	5
<b>5.</b> How well do you succeed in becoming calm again when you are very scared?	1	2	3	4	5
<b>6.</b> How well can you become friends with other children?	1	2	3	4	5
<b>7.</b> How well can you study a chapter for a test?					
<b>8.</b> How well can you have a chat with an unfamiliar person?	1	2	3	4	5
<b>9.</b> How well can you prevent to become nervous?	1	2	3	4	5
<b>10.</b> How well do you succeed in finishing all your homework every day?	1	2	3	4	5
<b>11.</b> How well can you work in harmony with your classmates?	1	2	3	4	5
<b>12.</b> How well can you control your feelings?	1	2	3	4	5
<b>13.</b> How well can you pay attention during every class?	1	2	3	4	5
<b>14.</b> How well can you tell other children that they are doing something that you don't like?	1	2	3	4	5
<b>15.</b> How well can you give yourself a pep-talk when you feel low?	1	2	3	4	5
<b>16.</b> How well do you succeed in understanding all subjects in school?	1	2	3	4	5
<b>17.</b> How well can you tell a funny event to a group of children?	1	2	3	4	5
<b>18.</b> How well can you tell a friend that you don't feel well?	1	2	3	4	5

<b>19.</b> How well do you succeed in satisfying your parents with your schoolwork?	1	2	3	4	5
<b>20.</b> How well do you succeed in staying friends with other children?	1	2	3	4	5
<b>21.</b> How well do you succeed in suppressing unpleasant thoughts?	1	2	3	4	5
<b>22.</b> How well do you succeed in passing a test?	1	2	3	4	5
<b>23.</b> How well do you succeed in preventing quarrels with other children?	1	2	3	4	5
<b>24.</b> How well do you succeed in not worrying about things that might happen?	1	2	3	4	5



## Appendix H

Center for Epidemiologic Studies Depression Scale, 12-item National Longitudinal Study of Children and Youth version (CES-D-12-NLSCY; Puolin Hand, Boudreau, & Santor, 2005)

Below is a list of the ways you might have felt or behaved.

Based on **the last week** please circle the number in the column that describes you best:

	Rarely or None of the Time (less than 1 day)	Some or a Little of the Time (1-2 days)	Occasionally or a Moderate Amount of Time (3-4 days)	Most of or All of the Time (5-7 days)
1. I did not feel like eating; my appetite was poor.	1	2	3	4
2. I felt like I could not shake off the blues even with help from my family or friends.	1	2	3	4
3. I had trouble keeping my mind on what I was doing.	1	2	3	4
4. I felt depressed.	1	2	3	4
5. I felt like I was too tired to do things.	1	2	3	4
6. I felt hopeful about the future.	1	2	3	4
7. My sleep was restless.	1	2	3	4
8. I was happy.	1	2	3	4
9. I felt lonely.	1	2	3	4
10. I enjoyed life.	1	2	3	4
11. I had crying spells.	1	2	3	4
12. I felt that people disliked me.	1	2	3	4

Appendix I  
Subjective Happiness Scale (Lyubomirsky & Lepper, 1999)

For each of the following statements and/or questions, please circle the point on the scale that you feel is most appropriate in describing you.

1. In general, I consider myself:

1	2	3	4	5	6	7
Not a very happy person						A very happy person

2. Compared to most of my peers, I consider myself:

1	2	3	4	5	6	7
Less happy						More happy

3. Some people are generally very happy. They enjoy life regardless of what is going on, getting the most out of everything. To what extent does this characterization describe you?

1	2	3	4	5	6	7
Not at all						A great deal

4. Some people are generally not very happy. Although they are not depressed, they never seem as happy as they might be. To what extent does this characterization describe you?

1	2	3	4	5	6	7
Not at all						A great deal