The Association Between Loneliness and Depressive/Eating Disorder Symptoms Among Adolescents

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Loneliness involves an individual's subjective perception of their inadequate connections to others. Due to the high loneliness rates among adolescents, as well as the health consequences associated with loneliness, it is important to examine this construct among adolescents. Prior research suggests loneliness is associated with both depressive symptoms and eating disorder symptoms, though the impact of sex/gender is unclear. Moreover, prior research has not examined which of these disorders has a stronger association with loneliness. This study, utilizing a sample of 238 high school students, examined associations between loneliness and depressive symptoms/eating disorder symptoms cross-sectionally and longitudinally with a follow up period of 14-16 weeks. The study's objectives were to assess: (1) whether there was an association between loneliness and depressive symptoms; (2) whether there was an association between loneliness and eating disorder symptoms; (3) whether the association was stronger for loneliness and depressive symptoms or loneliness and eating disorder symptoms; and (4) whether sex influenced these associations. Results indicated there were cross-sectional associations between loneliness and depressive symptoms as well as loneliness and eating disorder symptoms (all p values $\leq$ .001), but loneliness was not predictive of changes in either type of symptom (all p values > .05); findings were similar across sexes. Moreover, while the correlation between loneliness and depressive symptoms was stronger than the correlation between loneliness and eating disorder symptoms, this is likely due to the overlap in the constructs of loneliness and depression. Given the associations between loneliness and depressive/eating disorder symptoms, clinicians should consider loneliness when treating individuals with these disorders. Nevertheless, further research should expand on this study's findings.

Keywords: loneliness, eating disorder, depression, adolescents

Loneliness, or perceived social isolation, involves an individual's subjective perception of their inadequate connections to others (Erzen & Çikrikci, 2018; Laursen & Hartl, 2013; Mushtaq et al., 2014) that leads to "social pain" (Laursen & Hartl, 2013, p. 1262). Although loneliness can occur across all ages, research suggests it is particularly common among old people (Solmi et al., 2020) as well as adolescents/young adults (Laursen & Hartl, 2013; Mushtaq et al., 2014; Solmi et al., 2020). There are also gender/sex differences among loneliness rates, although results vary across studies. A recent umbrella review that examined 795 studies and nearly 750,000 individuals reported an association between loneliness and being female (Solmi et al., 2020). Additionally, although gender was found to be a large predictor for adolescent loneliness in a meta-analysis conducted by Mahon et al. (2006), results varied across individual studies. While most studies reported gender was not significantly associated with loneliness (19/31 hypotheses), the majority of those studies that did report an association between gender and loneliness (k = 12) found rates of loneliness were higher among males than females (k = 9; Mahon et al., 2006). As such, there is uncertainty regarding the gender/sex differences impacting loneliness rates.

Unfortunately, there are many adverse consequences associated with loneliness. For instance, Mushtaq et al. (2014) reported loneliness is associated with stress, increased suicidality, and physical illnesses. There has also been substantial research documenting the mental health consequences that can be associated with loneliness (e.g., Erzen & Çikrikci, 2018; Mahon et al., 2006; Richardson et al., 2017). Particularly, extensive research has been conducted examining the association between depression/depressive symptoms and loneliness.

The Association Between Loneliness and Depression

Depression is a mental disorder characterized by symptoms such as fatigue, difficulty concentrating, and a depressed mood (American Psychiatric Association, 2013). Research has highlighted a robust association between depressive symptoms and loneliness. A meta-analysis that included 95 studies looking at loneliness in adolescents (30 studies looking at depression and loneliness) found a large effect size for the association between loneliness and depression (Mahon et al., 2006). Moreover, a recent meta-analysis noted there was a moderate association between loneliness and depression across 88 studies (n = 40,068; Erzen & Çikrikci, 2018). Similarly, in a rapid review examining the association between loneliness and mental health for children and adolescents across 63 studies using cross-sectional and longitudinal designs (n = 51,576; Loades et al., 2020), a majority of the studies found associations between depression and loneliness. Contrastingly, although Lasgaard et al. (2011a) found an association between loneliness and depression at the cross-sectional level, loneliness was found to not be predictive of a difference in depressive symptoms one year later. Nevertheless, studies have generally shown a positive association between loneliness and depression for adolescents (Loades et al., 2020; Mahon et al., 2006), young adults (Lee et al., 2020; Richardson et al., 2017) and older individuals (Cacioppo et al., 2006).

Gender Differences Among the Association Between Loneliness and Depression

Research findings regarding the role of gender in the association between loneliness and depression remain inconclusive. Most studies have found rates of depression/depressive symptoms are higher among females than males (Cacioppo et al., 2006; Lasgaard et al., 2011a), though some studies have reported higher rates among males (Ren et al., 2021). Moreover, the influence of gender on the association between depression and loneliness remains similarly unclear. Although Cacioppo et al. (2006) found a

relationship between depressive symptoms and loneliness among a sample of older adults, this relationship was stronger for men than for women. Contrastingly, studies among adolescents (Lasgaard et al., 2011a) and young adults (Ren et al., 2021) found no gender influence on the association between loneliness and depression. Lastly, Liu et al. (2020) reported that while loneliness and social isolation were associated with depression among female university students, only social isolation was associated with depression for male students. Clearly, the influence of gender/sex requires further investigation. The association between loneliness and other mental illnesses, including eating disorders, also requires further examination.

The Association Between Eating Disorders and Loneliness

Eating disorders can encompass numerous disorders, including Anorexia Nervosa, Bulimia Nervosa, Binge Eating Disorder, and Otherwise Specified Feeding and Eating Disorders (American Psychiatric Association, 2013). Across these disorders and disordered eating symptoms generally, research suggests there is an association with loneliness (see a review of the literature by Levine, 2012). Among a sample of adolescents (n = 96), researchers found an association between bulimia symptoms and loneliness cross-sectionally; moreover, loneliness was found to mediate the relationship between low trust in others and bulimic symptoms cross-sectionally and changes in bulimic symptoms 5 months later (Rotenberg & Sangha, 2015). Moreover, eating disorder symptoms were associated with loneliness among undergraduate students (Richardson et al., 2017; Wright & Pritchard, 2009). Importantly, it appears that treating eating disorder symptoms may reduce loneliness, as research has found individuals who have recovered from an eating disorder have reduced loneliness than individuals with a current eating disorder (Harney et al., 2014). Furthermore, there is mixed evidence regarding the impact of gender/sex on the association between loneliness and eating disorders.

Gender/Sex Differences Among the Association Between Eating Disorders and Loneliness

Although eating disorders affect both men and women (Wright & Pritchard, 2009), research suggests rates of eating disorders and eating disorder symptoms are higher among women than men (Abebe et al., 2014; Mond et al., 2014; Rotenberg & Sangha, 2015; Wright & Pritchard, 2009). However, there are mixed findings with regards to the impact of gender/sex on the association between loneliness and eating disorders. Across a longitudinal study (n = 5,679 at time 1), the association between loneliness and eating disorder symptoms in adolescence was found to be stronger among boys than girls (the association for girls was not significant; Abebe et al., 2014). Moreover, among a sample of adolescent psychiatric patients, social-emotional isolation was associated with eating disorder symptoms (e.g., binge eating) for both males and females; researchers noted that the relationship between interpersonal difficulties and disordered eating was similar across genders/sexes[1] (if not stronger for men; Zaitsoff et al., 2009). Contrastingly, researchers found gender did not influence the association between loneliness and bulimic symptoms among a sample of high school students (n = 96; Rotenberg & Sangha, 2015). As noted by Abebe et al. (2014), it is difficult to draw firm conclusions because of the limited research examining the association between loneliness and eating disorder symptoms, as well as the influence of gender/sex on this association.

Comparing the Association between Loneliness Across Various Mental Disorders

Few studies have compared associations with loneliness across various mental disorders, and among the studies that have, eating disorders are generally excluded. While Loades

[1] Researchers used both terms (i.e., gender and sex) in the paper so it is unclear which variable they used.

et al. (2020) found a stronger association with loneliness for depression than anxiety, their review only included one study that examined eating disorders. Similarly, Meltzer et al. (2013) determined that depression, phobias, and obsessive-compulsive disorder had the strongest association to loneliness in comparison to generalized anxiety, panic disorder, etc.; however, they did not include eating disorders and their sample consisted of adults. Moreover, Papagavriel et al. (2020) examined associations between loneliness and various mental disorders (e.g., depression, anxiety, panic disorder); however, eating disorders were not included and the primary focus of their study was on adults with intellectual impairments. Lastly, Lasgaard et al. (2011b) examined the impact of different types of loneliness on various mental disorders among a sample of high school students. Interestingly, while depression was associated with peer-related loneliness and family-related loneliness, eating disorders were only associated with family-related loneliness (Lasgaard et al., 2011b), highlighting potential differences across these disorders.

Current Study

Given the potential loneliness-related differences among depression and eating disorders (Lasgaard et al., 2011b), their association with loneliness may vary. Moreover, there is inconclusiveness regarding the role of sex/gender in influencing the associations between loneliness and depressive/eating disorder symptoms. Importantly, this study will help fill a gap in the literature by directly comparing the association between loneliness and depressive symptoms as well as loneliness and eating disorder symptoms to determine if the type of symptoms influences the strength of the association with loneliness. In addition, sex differences are explored; this is important due to the current mixed research results as well as the fact that if there are sex differences present in the associations between loneliness and depressive symptoms/eating disorder symptoms, it could alter the treatment a clinician provides to a client based on the client's sex.

In conducting this study, we aimed to answer the following research questions:

1. Is there an association between loneliness and depressive symptoms among adolescents at time 1, and will loneliness be predictive of changes in depressive symptoms? We hypothesized that given prior findings (e.g., Loades et al., 2020; Mahon et al., 2006), there would be a positive association between loneliness and depressive symptoms and that loneliness would be predictive of increases in depressive symptoms.
2. Is there an association between loneliness and eating disorder symptoms among adolescents at time 1, and will loneliness be predictive of changes in eating disorder symptoms? Given prior findings (e.g., Abebe et al., 2014; Levine, 2012; Rotenberg & Sangha, 2015), we hypothesized there would be a positive association between loneliness and eating disorder symptoms and that loneliness would be predictive of increases in eating disorder symptoms.
3. Is the association stronger for loneliness and depressive symptoms or loneliness and eating disorder symptoms? Given the lack of research directly comparing these disorders/symptoms, we had no formal hypothesis.
4. Does sex influence the: (1) association between loneliness and depressive symptoms or (2) the association between loneliness and eating disorder symptoms? Given the inconclusiveness of prior research findings, we had no formal hypothesis.

Methods

Sample

Of the 504 students recruited from local Canadian school districts, 311 consented to participate at time 1 (T1) and 238 (76.53%) also participated at time 2 (T2). Importantly, there were no statistically significant differences on the main variables of the study: age; BMI; and mean

scores on measures of depressive symptoms, eating disorder symptoms, and loneliness between those who completed T1 versus T2 (all *p* values > .15). The final sample (*n* = 238) was roughly equivalent across females (*n* = 134) and males (*n* =104). Participants were between the ages of 13 and 18 years (*M* = 16.49, *SD* = 1.23). Information on participant ethnicity, as well as other demographics, is presented in Table 1.

Measures

Participant Characteristics

A questionnaire designed for this study captured various participant characteristics (e.g., age, gender, sex, ethnicity). In this questionnaire, participants were also asked about previous diagnoses/treatment they had received for eating disorders. For the purposes of our analyses, the variable "sex at birth" was used. Given the inconclusiveness of previous findings regarding gender/sex differences, we decided to compare sex differences as Johnson et al. (2009) note that once sex differences have been confirmed, further research can disentangle whether these differences are caused by sex, gender, or both.

Anthropometric Measurements

Participant's height and weight to the closest 0.1 kg/0.1 cm were measured at T1 and T2 in a private room with participants wearing light clothing and removing their shoes; participants were not given the value of these measurements. These measurements were used to obtain each participant's body mass index (BMI; kg/m^2) and the World Health Organization reference values were used to obtain the 50^{th} percentile for BMI (de Onis et al., 2007). Percent median BMI was also calculated.

UCLA Loneliness Scale – 8 (ULS-8; Hays & DiMatteo, 1987).

The ULS-8 assesses loneliness using 8 items (e.g., I lack companionship, I feel isolated from others; Hays & DiMatteo, 1987). Items are scored on a 4-point scale with options from *never* to *always* (Wu & Yao, 2008), with higher scores indicating higher levels of loneliness (Yildiz & Duy, 2014); the total score given is between 8 to 32 points (Xu et al., 2018). Research suggests this scale has good psychometric properties when used with university students (Hays & DiMatteo, 1987; Wu & Yao, 2008). Among a sample of Chinese adolescents, researchers found that the psychometric properties of the ULS-8 were improved by excluding two of the items (items 3 and 6); however, they hypothesized this may be due to cultural factors (Xu et al., 2018). Moreover, the ULS-8 was found to assess loneliness reliably and validly among Turkish adolescents, though a 7-item measure excluding item 3 had a better factor structure (Yildiz & Duy, 2014). The 8-item measure was used for this study due to its strong psychometric properties; moreover, it has been used by this study's second author previously and thus would allow for a more direct comparison of findings across studies.

Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977)

The CES-D is a 20-item measure of depressive symptoms that is intended for use within the general population (Radloff, 1977). Items are scored based on symptoms experienced recently (in the last week) on a scale of 0 (*rarely or none of the time; less than 1 day*), 1 (*some or a little of the time; 1-2 days*), 2 (*occasionally or a moderate amount of time; 3-4 days*), and 3 (*most or all of the time; 5-7 days*); higher scores indicate higher levels of depressive symptoms (Radloff, 1977, 1991). Research supports the use of the CES-D with adolescents (Radloff, 1991; Roberts et al., 1990) and has found the Dutch version of the CES-D to be reliable and valid in screening Dutch adolescents for depression (Cuijpers et al., 2008). Moreover, a recent systematic review and meta-analysis found that the measure had good internal consistency for use with children and adolescents (Stockings et al., 2015). Research has suggested various factor models are adequate, including one that just considers total score (Phillips et al., 2006). In this study, the total score of the CES-D

was used, which can range from 0 to 60 (Radloff, 1977).

Eating Disorder Examination Questionnaire (EDE-Q; Mond et al., 2014)

The EDE-Q is a self-report measure that assesses eating disorder symptoms across 36 items. Of the 36 items, 22 of them fall across four subscales (restraint, weight concerns, shape concerns, eating concerns); these items are rated on a scale from 0 to 6 across a 28-day period, with higher scores representing higher levels of eating disorder symptoms (Mond et al., 2014). The remaining 14 questions examine the frequency of behaviours over the last 28 days, though a global score is calculated by obtaining subscale scores for each subscale and then summing and averaging the subscale scores (Aardoom et al., 2012). Research has utilized the EDE-Q among adolescent females (Carter et al., 2001) and adolescent males (Mond et al., 2014). We used a version of the EDE-Q that was used by Mond et al. (2014); this version was modified to be used with an adolescent population (e.g., changing the wording of some questions; see Mond et al., 2014 for details). Moreover, a systematic review examining the psychometric properties of the EDE-Q found evidence of its reliability and validity; however, few studies examined psychometric properties among adolescents or males (Berg et al., 2012).

Procedure

Ethics approval was obtained from Simon Fraser University, the University of British Columbia, and BC Children's Hospital. Data were collected as a part of a larger project on well-being and health behaviour in adolescents (see Pullmer et al., 2019; Zaitsoff et al., 2020). Recruitment occurred at three Canadian high schools. Before data collection occurred, all prospective participants listened to a lecture about research methodology and the concept of informed consent was explained. After this lecture, students were provided with a consent form; they had a week to decide if they wanted to participate. Students were also given a letter describing the research to provide their parents, and they were encouraged to discuss their decision to consent with their parents/guardians.

Data collection occurred at two time periods. At T1, data collection took place over a class period (questionnaires took about 30 minutes to complete); 14-16 weeks later, data was collected at T2 (questionnaires took about 15 minutes to complete). At T1, participants filled out a demographic questionnaire as well as key measures of interest described above (ULS-8; CES-D, EDE-Q). Depressive symptoms (CES-D) and eating disorder symptoms (EDE-Q) were re-assessed at T2. As described above, participants were weighed and measured at both time periods. When participants were taken out of class to be measured, non-participants were also taken to a separate room so participant confidentiality was protected. As laid out in the consent form, the high school counsellor was informed if any participants reported engaged in potentially dangerous disordered eating behaviours (e.g., engaging in restricted eating behaviours and having a body mass index of less than 15.5).

Results

All analyses were conducted using SPSS version 27. Due to the interest in comparing differences across sexes, analyses have all been run separately for males and females.

Descriptive Analyses

At T1, males had a mean Percent Median Body Mass Index (%mBMI) of 103% (*SD* = 0.16); their %mBMI was also 103% at T2 (*SD* = 0.17). Similarly, females had a mean %mBMI of 105% at T1 and 104% at T2 (*SD*s = 0.19). Most participants (*n* = 234, 98.32%) reported they had not been previously diagnosed with an eating disorder. Moreover, males had a mean score of 12.59 (*SD* = 8.36) on the CES-D total score at T1 and a mean score of 12.37 (*SD* = 7.79) at T2. Females had higher scores than males (T1: *M* = 19.31, *SD* = 12.15; T2: *M* = 18.84, *SD* = 11.97). Similarly, males had a mean score of 0.95 (*SD* = 1.00) on the EDE-Q global score at T1 and a mean score of 0.80 (*SD* = 0.82) at T2. Females

had slightly higher scores than males (T1: M = 1.91, SD = 1.40; T2: M = 1.72, SD = 1.28). Lastly, on the ULS-8 Loneliness scale, males had a mean score of 1.99 (SD = 0.51) at T1, whereas females had a mean score of 2.33 (SD = 0.58).

The Association Between Loneliness and Depressive Symptoms

For the correlations assessing the association between depressive symptoms and loneliness for females and males, the assumption of linearity was met as assessed using a scatterplot and there were no outliers. Although the assumption of bivariate normality was not met as assessed by Shapiro-Wilk's tests with $p < .05$, we proceeded with running Pearson's correlations as this analysis is somewhat robust to deviations against normality (Laerd Statistics, n.d.a).

There was a large positive association (Laerd Statistics, n.d.b, as cited in Cohen, 1988) between loneliness and depressive symptoms at T1 for both females and males, as indicated by significant Pearson correlation values (see table 2). This association was similar in strength across sexes, though the correlation value was larger for females (.70) than males (.60).

Next, to see if loneliness (ULS-8 score) at T1 was predictive of changes in depressive symptoms (T2 CES-D score), we ran two hierarchical linear regressions. To assess sex differences, regressions were run separately for males and females. In step 1, we entered T1 CES-D scores to control for baseline levels of depressive symptoms. Then, in step 2 we entered T1 ULS-8 scores. By entering CES-D score at T1 in step 1, we controlled for baseline levels of depressive symptoms to assess the impact of loneliness (T1 ULS-8 score) in predicting changes in depressive symptoms (CES-D score at T2). Outliers were detected via casewise diagnostics and studentized deleted residuals (> 3 SDs); 3 outliers were detected, and the regressions were re-run once removing these 3 cases. All other assumptions required to run hierarchical linear regressions (independence of observations, linear relationship between the dependent variable and each independent variable/between the dependent variable and each independent variable collectively, homoscedasticity of residuals, no multicollinearity, no leverage points/influential points, and normally distributed residuals) were met.

Hierarchical linear regressions indicated that loneliness at T1 (mean ULS-8 score) was not predictive of changes in depressive symptoms (CES-D total score) at T2 (see table 3) as indicated by the minimal and non-significant increase in R^2 for both males (R^2 change of .01, $F(1, 95) = 0.76$, $p = .39$) and females (R^2 change of .00, $F(1, 123) = 0.24$, $p = .63$). The full model of T1 CES-D total score and T1 ULS-8 mean score to predict changes in CES-D score at T2 (Model 2) was significant for both males ($R^2 = .32$, $F(2, 95) = 21.82$, $p < .0005$; adjusted $R^2 = .30$) and females ($R^2 = .56$, $F(2, 123) = 78.50$, $p < .0005$; adjusted $R^2 = .55$).

The Association Between Loneliness and Eating Disorder Symptoms

For the correlations assessing the association between eating disorder symptoms and loneliness for females and males, the scatterplot indicated there may be deviations from linearity, there were no outliers, and the assumption of bivariate normality was not met as assessed by Shapiro-Wilk's tests with $p < .05$. To ensure our results were not impacted by these violations, we also ran Spearman's rank-order correlations. Given the similarity of findings, only Pearson correlation values are reported below.

There was a moderate positive association (Laerd Statistics, n.d.b, as cited in Cohen, 1988) between loneliness and eating disorder symptoms at T1 for both females and males, as indicated by significant Pearson correlation values (see table 2). This association was similar in strength across sexes (.32 for males vs. .34 for females).

Second, to see if loneliness was predictive of changes in eating disorder symptoms (T2 EDE-Q score), we ran two hierarchical linear regressions. To assess sex differences, regressions were run separately for males and females. In step 1, we entered EDE-Q score at T1 to control for baseline levels of eating disorder symptoms. Then, in step 2 we entered ULS-8 score at T1. By entering EDE-Q score at T1 in step 1, we controlled for baseline levels of eating disorder symptoms to assess the impact of loneliness (ULS-8 score at T1) in predicting changes in eating disorder symptoms (EDE-Q score at T2). Outliers were detected via casewise diagnostics and studentized deleted residuals (> 3 *SD*s); 4 outliers were detected, and the regressions were re-run once removing these 4 cases. All other assumptions required to run a hierarchical linear regression (independence of observations, linear relationship between the dependent variable and each independent variable/between the dependent variable and each independent variable collectively, homoscedasticity of residuals, no multicollinearity, no leverage points/influential points, and normally distributed residuals) were met.

Hierarchical linear regressions indicated that loneliness at T1 (mean ULS-8 score) was not predictive of changes in eating disorder symptoms (EDE-Q global score) at T2 (see table 4) as indicated by the minimal and non-significant increase in R^2 for both males (R^2 change of .00, $F(1, 96) = 0.10$, $p = .76$) and females (R^2 change of .01, $F(1, 122) = 3.58$, $p = .06$). The full model of T1 EDE-Q global score and T1 ULS-8 mean score to predict changes in EDE-Q global score at T2 (Model 2) was significant for both males ($R^2 = .71$, $F(2, 96) = 116.51$, $p < .0005$; adjusted $R^2 = .70$) and females ($R^2 = .68$, $F(2, 122) = 129.89$, $p < .0005$; adjusted $R^2 = .68$).

Discussion

The results indicated there was a large, positive association between depressive symptoms and loneliness at T1, as found in previous studies (e.g., Loades et al., 2020). However, unlike the findings of most prior studies (12/15 studies in Loades et al., 2020), loneliness did not predict changes in depressive symptoms from T1 to T2. Interestingly, another study conducted among a sample of high school students similarly found that loneliness was not predictive of changes in depressive symptoms over one year once controlling for initial depressive symptoms, demographic characteristics, and subsequent loneliness (Lasgaard et al., 2011a). One of their potential explanations for this finding was that loneliness may fluctuate quickly in adolescence, thus making it a poor predictor of depressive symptoms over time; they also suggested more than two time points may be needed to examine the longitudinal nature of this relationship (Lasgaard et al., 2011a). These explanations may explain the lack of significant findings in this study as well. Moreover, the studies included in Loades et al. (2020) had follow-up periods ranging from several months to several years; compared to these, our study had a shorter follow-up period and this may have influenced our results. A three-month period was chosen as this is typically what is used as the timeframe for diagnostic criteria, though a longer follow up may have allowed for more change across symptoms to have been observed. Based on our findings, it appears that loneliness and depressive symptoms are correlated, although further research is needed to confirm if loneliness is predictive of changes in depressive symptoms over time among adolescents.

Similarly, results indicated there was a moderate, positive association between eating disorder symptoms and loneliness at T1, but that loneliness was not predictive of changes in eating disorder symptoms from T1 to T2. This partially contrasts findings from Abebe et al. (2014), as their study indicated loneliness predicted changes in eating disorder symptoms for adolescent males (but not for females). It is unclear why there was no longitudinal association between these constructs in this study. Although it may be due to the non-clinical sample (and thus low base rates of eating disorder symptoms in the sample), prior research has shown longitudinal

associations with non-clinical samples (e.g., Abebe et al., 2014; Rotenberg & Sangha, 2015). Although Rotenberg and Sangha (2015) found a longitudinal relationship between these associations, this was through loneliness mediating the association between low trust beliefs in others and changes in bulimic symptoms over a follow-up period of 5 months. As such, there may be other factors influencing the longitudinal association between loneliness and eating disorder symptoms that were unexplored in this study. Moreover, the follow-up period in our study is shorter than prior studies (e.g., 14-16 weeks vs. 5 months for Rotenberg & Sangha, 2015; 2 years for Abebe et al., 2014) which may have impacted results as discussed above. Nevertheless, given the correlation found between eating disorder symptoms and loneliness, loneliness should be something clinicians consider when treating individuals with eating disorders.

Associations with loneliness were similar across symptoms of both disorders such that both depressive symptoms and eating disorder symptoms were correlated with loneliness at T1, but loneliness was not correlated with changes in those symptoms at T2 14-16 weeks later. At the cross-sectional level, there were larger correlations between loneliness and depressive symptoms than loneliness and eating disorder symptoms. However, this is not surprising, given the nature of symptoms associated with depression (e.g., feelings of worthlessness; American Psychiatric Association, 2013). Moreover, the measure of depression used in this study included items about loneliness (e.g., Item 14: I felt lonely; Radloff, 1977). Given the overlap of these two constructs, the large correlation between them makes sense. However, as loneliness is not included in the diagnostic criteria/symptoms of eating disorders, it is notable that there was still a moderate correlation between these constructs. In summary, the cross-sectional association between depressive symptoms and loneliness is stronger than the cross-sectional association between eating disorder symptoms and loneliness, likely due to the substantial overlap between loneliness and depressive symptoms.

Findings were similar across sexes, such that there were associations between depressive symptoms/eating disorder symptoms and loneliness at baseline but not associations for changes in these symptoms 14-16 weeks later for both males and females. Moreover, the strength of correlations was similar for both males and females, suggesting associations are equivalent across sexes. This is in line with some prior findings that examined gender differences for the association between depressive symptoms and loneliness (e.g., Lasgaard et al., 2011a & Ren et al., 2021) and between bulimic symptoms and loneliness (Rotenberg & Sangha, 2015). However, this contrasts with findings from other studies that have found gender differences in both the association between depressive symptoms and loneliness (Cacioppo et al., 2006; Liu et al., 2020) and the association between eating disorder symptoms and loneliness (Abebe et al., 2014). Further research is needed to determine whether gender/sex influences these associations, given the mixed findings evident in prior research.

Strengths and Limitations

Limitations of this study must be noted. Firstly, as a non-clinical sample was used, there were low base rates of symptoms among the sample, particularly eating disorder symptoms. As such, it is difficult to determine if the same findings would have been found had a clinical sample been used. Moreover, only self-report measures were used to measure loneliness, depressive symptoms, and eating disorder symptoms. Although it is unlikely that participants felt uncomfortable answering honestly given the confidentiality/privacy measures put in place (e.g., privacy shields on their desks, reporting answers via questionnaires), there is still a potential that participants were not honest in their answers. Moreover, the sample consisted primarily of Caucasian (35.71%) and East Asian (28.57%) adolescents, so results may not be generalizable to individuals of other ethnicities.

Lastly, we examined differences in these associations based on an individual's assigned sex at birth, which prohibited an examination of these associations based on gender and failed to consider individuals outside of the gender binary. This was done due to the uncertainty in prior research on the influence of sex/gender for these associations, in line with recommendations from Johnson et al. (2009). However, as a result our findings may not be generalizable to gender diverse youth.

Several strengths of the study should also be noted. Firstly, this study explored an under-researched area by directly examining differences in the strength of the associations between: (1) loneliness and depressive symptoms and (2) loneliness and eating disorder symptoms. Moreover, given the inconclusiveness regarding gender/sex differences found in prior studies, a strength of this study lies in using a sample of males and females, thus allowing for a further examination of sex differences across these associations. Lastly, by assessing associations cross-sectionally and longitudinally, this study allowed for a thorough examination of the relationship between these constructs.

Given the potential limitation of examining these associations using a non-clinical sample, this study should be replicated using a clinical sample to determine if findings are similar. Moreover, as loneliness was found to not predict changes in depressive symptoms or eating disorder symptoms from T1 to T2, studies could assess the association between depressive/eating disorder symptoms and loneliness over a longer duration of time to determine if this impacts findings. As suggested by other researchers (e.g., Lasgaard et al., 2011a; Zaitsoff et al., 2020), perhaps more than two time points are needed to examine longitudinal associations. Future research should also be done examining these associations among gender diverse youth. Research suggests that gender minority youth report higher loneliness levels than cisgender youth and that among a sample of adolescents, the association between sexual/gender minority status and loneliness significantly predict depression/anxiety levels (McDanal et al., 2021). As such, associations may differ for gender-diverse youth. Lastly, given the diversity across eating disorder symptoms, future studies should examine associations between loneliness and specific eating disorder symptoms rather than examining eating disorders as a broad category. Some research has examined associations with loneliness for specific eating disorders/symptoms (e.g., bulimic symptoms; Rotenberg & Sangha, 2015), whereas other studies have focused on disordered eating more generally (e.g., Abebe et al., 2014). Examining specific eating disorder symptoms may provide more insight into whether the association between loneliness and eating disorder symptoms is stronger for certain eating disorders/symptoms than others.

Conclusion

Results indicated there were cross-sectional, but not longitudinal, associations between loneliness and depressive symptoms as well as loneliness and eating disorder symptoms. As such, loneliness is an important construct for clinicians to consider when treating individuals with these disorders, though more research should be done with clinical samples to confirm these findings. The consequences associated with loneliness (Mushtaq et al., 2014), and the fact that loneliness is particularly common among adolescents (Laursen & Hartl, 2013; Mushtaq et al., 2014; Solmi et al., 2020), makes it necessary to study this construct among this age group. Moreover, it has become an especially relevant topic to consider due to the spikes in loneliness associated with the COVID-19 pandemic (Lee et al., 2020). Thus, further research should continue to examine loneliness and its association with other constructs/mental disorders among adolescents.

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Table 1

Sample and Demographic Information

Demographic Information	N	%
Ethnicity		
Caucasian	85	35.71
East Asian	68	28.57
South East Asian	17	7.14
South Asian	13	5.46
FN[a]/Hispanic/African	12	5.04
More than 1 ethnicity	26	10.92
Other ethnicity	12	5.04
Not reported	5	2.10
Sex at Birth		
Male	104	43.70
Female	134	56.30

[a] *Note.* FN = First Nations (included other Indigenous identities as well such as Inuit & Metis)

Table 2

Pearson's Correlations: Associations Between Depressive Symptoms/Eating Disorder Symptoms and Loneliness

	Males		Females	
	ULS-8	**N**	**ULS-8**	**N**
CES-D	.60***	100	.70***	127
EDE-Q	.32**	101	.34***	127

Note. ** = $p \leq .001$; *** = $p < .0005$

Table 3

Hierarchical Linear Regression Predicting Change in Depressive Symptoms from T1-T2

	Males			Females		
X (predictor)	**B**	**SE B**	**β**	**B**	**SE B**	**β**
Step 1						
T1 CES-D	0.48	0.07	.56***	0.76	0.06	.75***
Step 2						
T1 CES-D	0.43	0.09	.50***	0.73	0.08	.72***
T1 ULS-8	1.30	1.49	.09	0.84	1.72	.04
	Step 1: R^2 = .31; Step 2: R^2 change = 0.01 (p = .39)			Step 1: R^2 = .56; Step 2: R^2 change = 0.00 (p = .63)		

Note. n = 98 for males; n = 126 for females

** = $p \leq .001$; *** = $p < .0005$

Table 4

Hierarchical Linear Regression Predicting Change in Eating Disorder Symptoms from T1-T2

	Males			Females		
X (predictor)	**B**	**SE B**	**β**	**B**	**SE B**	**B**
Step 1						
T1 EDE-Q	0.70	0.05	.84***	0.76	0.05	.82***
Step 2						
T1 EDE-Q	0.70	0.05	.85***	0.73	0.05	.79***
T1 ULS-8	-0.03	0.09	-.02	0.22	0.12	.10
	Step 1: R^2 = .71; Step 2: R^2 change = .00 (p = .76)			Step 1: R^2 = .67; Step 2: R^2 change = .01 (p = .06)		

Note. n = 99 for males; n = 125 for females

** = $p \leq .001$; *** = $p < .0005$