School of Psychology
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Loneliness and mental wellbeing: An empirical study of the relationship between loneliness and eating disorder-related symptoms and a meta-analysis of the relationship between depression and loneliness in a student population

Thesis submitted in partial fulfilment of the requirement for

the degree of:

Doctorate of Clinical Psychology (DClinPsy)

South Wales Doctoral Programme in Clinical Psychology

Cardiff University

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23rd May 2022

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Acknowledgements

Thank you to Marc and John, who have given endless guidance and support as research supervisors. Your feedback has been invaluable, your knowledge and enthusiasm for the research field has inspired me.

I have been incredibly lucky to be part of the most wonderful cohort of talented and caring people, who have provided laughter, joy, and memes good enough to drag us all through the tougher times. Thank you for all your support, knowledge, love, and snacks through the last three years. I couldn't have done it without you.

A thank you to my wonderful mother who inspired me to be the clinician I am today. You were unable to complete your own doctorate so I dedicate this to you so that we can share this one. Your memory is a continual driving force and a guiding light, I hope it will continue to shape me in the future.

Finally, thank you to my soon to be husband Harry. For always believing in me even when I didn't, for encouraging me to keep going when the troughs hit and for celebrating the peaks with me. I am forever grateful for the support you have given to me over the years, and I couldn't and wouldn't be Dr Marffy without you.

Preface

The need for meaningful social connections and feelings of belonging are fundamental parts of being human, with a lack or absence of these resulting in the negative experience of loneliness. The experience of loneliness is associated with numerous negative outcomes, encompassing a variety of mental health presentations. This research aims to explore constructs and experiences of loneliness alongside other mental health presentations.

The systematic review aimed to explore the current evidence base to better understand the relationship between loneliness and depression in a student population. Transitioning to university is a major life event which can entail greater independence but also a greater pressure to develop new social networks. Moving to a new and unfamiliar environment with minimal known social contacts in proximity can lead to experiences of loneliness, with findings predominantly highlighting that students can experience adverse psychological experiences during this transition. As such the purpose of this meta-analysis was to explore the association between depression and loneliness, captured by the Beck Depression Inventory (BDI) and the University of California Los Angeles Loneliness Scale (UCLA) respectively in the student population. Further research questions aimed to consider mediators of this relationship which were reported within the selected studies. Relevant databases were searched with papers being included if they reported quantitative analysis which measured factors of depression and loneliness using the BDI and UCLA respectively in a university student population. Initial research questions sought to determine the presence and nature of this relationship and considered 17 studies which reported correlation analysis between loneliness and depression. A latter research question sought to determine mediators between the primary variables and considered 18 studies. Additional analyses reported within selected papers were considered as to whether these reported additional variables were possible mediators between loneliness and depression. The meta-analyses computed a significant positive correlation between loneliness and depression. The additional research question, considering possible mediators of the relationship between loneliness and depression, highlighted anxiety, rumination hope and problem solving as potentially mediators of this relationship. Overall, the findings provide an insight into possible avenues for future exploration to better understand this link, which could be influential in developing screening procedures for students experiencing depression.

The empirical paper explores the relationship between experiences of loneliness, the frequency of the anorexic voice and its impact on eating disorder (ED) symptom severity. Many individuals with EDs report the experience of an internal 'voice', often referred to as the 'Anorexic Voice' (AV). The relationship between the anorexic voice and the sufferer is unique and has been argued to be a powerful maintaining factor in the longevity and severity of EDs. Due to its noted prevalence within this disorder, it is queried whether the AV has a social function in reducing the negative experiences of loneliness, which are often associated with EDs. The study considered data from 165 individuals who accessed online forums relating to EDs. The sample included individuals who have experienced an AV in some form (AV group) and those who have not (Non-AV group). The study utilised self-report measures via an online questionnaire to explore the predictive validity of variables of loneliness (captured via the University of Los Angeles Loneliness scale - UCLA) and frequency of the AV (captured via the Topography of Voice questionnaire - TOV) on ED symptom severity (captured via the Eating Disorder Examination Questionnaire - EDE-Q). Confirmatory analysis (AV group only) demonstrated the significance of the independent variables individually predicting ED symptom severity. From the confirmatory analysis, a significant interaction was not found between the two primary variables in predicting ED symptom severity, more significantly than the influence of either variable alone. Exploratory analysis considered the differences between the two groups (AV and Non-AV) in relation to ED symptom severity, as well as considering alternate relevant predictors within this relationship. This included other facets of the experience of the voice including objective measures of the voice such as loudness and clarity, as well as subjective measures including the 'engagingness' of the voice and the 'distressing 'ness' of the voice. The findings offer insight into possible drivers behind engagement with the AV, as well as the broader trajectory of loneliness and the AV as part of ED presentations in the community. Further research would be beneficial to consider the relational connection to the AV as well as other predictors in the relationship between loneliness, the AV and ED symptom severity.

Overall, both papers provide further insight into the impact of loneliness on mental wellbeing. As well as being deeply distressing for individuals, loneliness has wider implications for our communities and society. A better understanding of this experience, the risk factors, and how these relate, can help us to effectively reduce the negative impact of loneliness.

The relationship between depression and loneliness in a student population: a meta-analysis

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23rd May 2022

Internal Supervisors: Professor John Fox & Dr Marc Williams

Word Count: 6,963 (Main body)
235 (Abstract)

Manuscript prepared in line with the author guidelines for The British Psychological Society's – Psychology and Psychotherapy – Theory, Research and Practice Journal (Appendix A). Word count guidance for DClinPsy thesis submission in 2022.

Abstract

Purpose: This meta-analysis of 18 studies explored the association between depression and loneliness, captured by the Beck Depression Inventory (BDI) and the University of California Los Angeles Loneliness Scale (UCLA) respectively in the student population. Further research questions aimed to consider mediators of this relationship which were reported within the selected studies.

Methods: PsychInfo; Medline; APA; Scopus; Web of Science; CINAHL; ERIC; British education index were searched for research papers in November 2021. Papers were included if they included quantitative analysis which measured factors of depression and loneliness measured by the BDI and UCLA respectively in a university student population. Initial research questions sought to determine the presence and nature of this relationship and considered 17 studies which reported correlation analysis between loneliness and depression. A latter research question sought to determine mediators between the primary variables and considered 18 studies. Additional analyses reported within selected papers were considered as to whether these reported additional variables were possible mediators between loneliness and depression.

Results: The meta-analyses computed a significant positive correlation between loneliness and depression. The additional research question, considering possible mediators of the relationship between loneliness and depression, highlighted anxiety, rumination, hope and problem solving as potentially mediators of this relationship.

Conclusions: Overall, the findings provide an insight into possible avenues for future exploration to better understand this link, which could be influential in developing screening procedures for students experiencing depression.

Keywords: Loneliness, Depression, Students, Mental health, University

Introduction

Loneliness

Loneliness has been defined in a multitude of ways: as an individual's subjective perception of deficiencies in their network of social relationships (Russell et al., 2012), as a discrepancy between an individual's perceived and desired quality and quantity of social relationships (Walton et., 1991), and as perceived social isolation (Hughes et al., 2004).

What these definitions share is the subjective nature of loneliness, in contrast to objective social isolation. It is possible to have reduced social contact without experiencing loneliness and, conversely, regular social contact but report feeling lonely (Hughes et al., 2004). This discrepancy in experiences is outlined in the 'Cognitive discrepancy model of loneliness' (Russell et al., 2012), which theorized that the difference between 'desired' social engagement and 'actual' social engagement predicts loneliness. In cognisance of this, it is important to consider the environment and population in which loneliness is being considered, with regard to understanding its impact.

Loneliness and mental health in university students

There is a growing body of research demonstrating the relationship between loneliness and poor mental health outcomes (Hawkins-Elder et al., 2017; Victor & Yang, 2012). Transitioning to university is a major life event for many students as it entails changes that can be impactful on relationships and daily routines, as well as new social pressures and roles (Schlossberg & Goodman, 2005). This transitory period brings greater independence as well as greater pressure to develop new social networks (Diehl et al., 2018). Moving to a new and unfamiliar environment with minimal known social contacts in proximity can lead to experiences of loneliness (Sawir, et al., 2007). This is a well-researched phenomenon, with findings predominantly highlighting that students[1] can experience adverse psychological experiences across their university experience (Thomas, Orme & Kerrigan, 2020).

[1] For the purpose of this report the term 'Students' will be used to refer to 'University students'.

Depression in university students

Depression is an umbrella term used to describe a plethora of clinical presentations, encompassing persistent feelings of sadness and hopelessness (Karp, 2017). NICE (2009) defined its basic characteristics as *'a loss of positive affect which manifests itself in a range of symptoms, including sleep disturbance, lack of self-care, poor concentration, anxiety, and lack of interest in everyday experiences'*.

Experiences of depression occur on a spectrum (The British Psychological Society, 2022) with the causes and triggers being multifaceted (Batterham, Christensen & Mackinnon, 2009). Research has demonstrated that stressful or negative life events are a notable factor in its onset (Johnson et al., 2008; Proudfoot et al., 2012;), with the commencement of the challenges of university life being noted as a significant stressful life event for many (Adams et al., 2021).

Both psychological and psychiatric research across populations in both developed and developing countries has suggested that the prevalence of depression is greater in students than in the general population (Ibrahim et al., 2013; Mayer et al., 2016). Within the student population, depression is one of the most common health presentations, even when physical health difficulties are also considered (Ibrahim et al., 2013).

In terms of the rates of depression within this population, studies differ significantly from relatively low rates of 10% (Goebert et al., 2009; Vázquez & Blanco, 2008) to rates of 40-80% (Bayati, Beigi, & Salehi, 2009; Garlow et al., 2008). The discrepancy in these rates may be due to a multitude of influencing factors including, but not limited to, a lack of social support (Alsubaie et al., 2019) and social stressors (Ibrahim et al., 2013), with loneliness being an influential factor frequently referenced in the literature (McIntyre et al., 2018; Rahman et al., 2012; Richardson et al., 2016).

Depression and loneliness amongst students

Richardson, Elliott & Roberts (2017) reported loneliness to be significantly predictive of depression in students in a longitudinal study controlling for demographics and baseline mental health. Greater loneliness was linked to greater severity of depression, with causality analysis suggesting that loneliness induces or exacerbates symptoms of depression. One of the limitations cited within this research is the small sample size as well as a high dropout rate, which is a problem as this may have introduced attrition bias, which was not considered within the study. As such further research would benefit from a broader sample size, as well as expanding this to sample across cultures, to assess if this association is universal.

The presence and severity of depression and loneliness can be clinically classified by standardised diagnostic interviews, but in most studies as well as within clinical practice it is typically identified through the administration of validated, self-report screening measures (Ibrahim et al., 2013). In terms of standardized measures for both constructs, there is a vast number that aim to quantitatively capture these experiences.

Concerning loneliness, the most widely used assessment in the adult literature (Weeks & Asher, 2012) is the University of California, Los Angele Loneliness scale (UCLA) (Russell, 1996). This measure is argued to be preferred by both researchers and clinical practitioners (Elphinstone, 2018) with an internal consistency of α = .89–.94 as well as a test-retest reliability over a 1-year period (r = .73) (Russell, 1996). Convergent validity has also been demonstrated by significant positive correlations with other measures of loneliness and construct validity by significant relations with measures of 'satisfactoriness with interpersonal relationships' (Russell, 1996). Since its development, it has been used across a broad range of cohorts (Shevlin, Murphy & Murphy, 2014) and translated and adapted to be used across a vast number of dialects (Anjum, & Batool, 2016). It has been shown to retain good levels of reliability and validity making it a favourable measure for comparing outcomes between studies.

Regarding depression, there are even more measures that seek to quantitatively capture this construct. The Beck Depression Inventory (BDI) (Beck, Steer, & Brown, 1987) is one of the most widely used instruments for capturing the severity of depressive symptoms in both psychiatric patients and normal populations (Whisman, Perez & Ramel, 2000). Analysis has suggested that the measure has a good level of internal consistency in a depressed population

(α = .91 (Schotte et al., 1997)). It comprises two underlying factors which assess cognitive affect and the somatic symptoms of depression (Whisman, Perez & Ramel, 2000). Richter et al. (1998) argued that the inventory has 'high internal consistency, high content validity and validity in differentiating between depressed and nondepressed subjects, sensitivity to change, and international propagation'. It has also been shown to be positively correlated with other validated measures of depression such as the Centre for Epidemiological Studies-Depression scale (CES-D) (Radloff, 1977) (r = .70) within a student population (Roberts, Lewinsohn & Seeley, 1991). Like the UCLA it has been used across a broad range of cohorts (Canel-Çınarbaş, Cui & Lauridsen, 2011) and adapted to be used across several dialects (Wiebe & Penley, 2005) making it also a favourable measure for comparing outcomes between studies with regards to its reliability and validity.

Previous reviews

Erzen & Çikrikci (2018) completed a meta-analysis of 88 studies (N=531) which aimed to determine the effect of loneliness on depression. Using a random-effects model, they demonstrated that loneliness had a moderately significant positive effect on depression scores. The population of this study was broad, including 'patients', 'carers', 'elderly' and 'other' as well as 'students'. A moderator analysis demonstrated that the population sample used did not moderate the role between the effects of loneliness on depression. Although 'students' were considered, in-depth evaluation of mediators and moderator variables relevant to this population were not considered, using more broadly literary factors such as year of publication and type of publication. As such this meta-analysis offers little insight into the unique factors relevant to the experiences of students. Furthermore, within this meta-analysis, various measures of loneliness and depression were used. Post hoc analysis suggested that the effect of different measures of depression between studies was not statistically significant, however, this was not reported regarding measures of loneliness used. In line with meta-analysis guidance (Thompson, 1994), the use of the same measures or a robust assessment of heterogeneity between all measures and variables used would have improved the validity and reliability of the above works.

Achterbergh et al. (2020) completed a qualitative meta-synthesis of 14 studies (N = 388) concerning the experience of loneliness among young people with depression (Age ranges

11-30). Their findings identified how non-disclosure of depression, and the debilitating nature of the depressive symptomatology, can act as factors perpetuating a cycle of loneliness and depression. In line with the exploratory nature of meta-synthesis (Grant & Booth, 2009), these thematic summaries offer powerful insights. However, it is not possible to infer statistical causation or prediction from the findings, the intention was to draw together knowledge on a topic area to provide a broader understanding. Their findings support the development of clearer hypotheses about the nature of the relationships between these variables which can then be statistically considered via meta-analysis, mitigating inconsistencies in research, and identifying potential predictors or mediating variables (Stone & Rosopa, 2017).

Research questions

This study aimed to quantitatively assess the nature of the relationship between depression and loneliness in students, as measured by the BDI & UCLA. The following research questions (Table 1) were addressed via a systematic literature review and meta-analysis.

Table 1

Research questions

1	Is there an association between depression and loneliness, captured by the BDI and UCLA respectively?
2	What is the nature of any association?

Regarding the above literature exploration, it is acknowledged that the relationship between experiences of loneliness and depression does not occur in isolation from other variables. As such, if a statistically significant association is found between loneliness and depression then further exploratory analysis of findings in selected studies will aim to explore whether there are any further variables reported that may be influential in mediating this relationship. As such the 3rd research question to be explored:

Table 1 (continued)

Research questions continued

3.	If there is an association between loneliness and depression, what are the mediators of this relationship?

Method

A systematic review method was employed to capture all material that documents the relationship between depression and loneliness as captured by the BDI & UCLA respectively. The search protocol was registered on Prospero (CRD42020196033) and followed recommendations given in the PRISMA statement (Page et al., 2021).

A meta-analysis methodology was used to critically evaluate, statistically analyse, and combine the results of comparable studies exploring the discussed variables to assess the nature of the association (Fagard, Staessen & Thijs, 1996). Research considering the presence of levels of loneliness and or depression is vast (Hawkley & Cacioppo, 2010). The methodology of a meta-analysis was deemed most suitable to answer the first two research questions, as its main purpose is to increase the number of observations and statistical power to improve calculated estimates of statistical significance, correlational association and/or effect size. This study is written in line with the meta-analysis guidelines described by Forero et al. (2019).

Search strategy

Pilot searches were conducted to scope the complexity of the topic area and identify terms for the formal searches. These searches identified terms related to depression and loneliness, such as ‘isolated’, ‘sadness’ and ‘hopeless’. This is consistent with synonyms and language utilised within the BDI and UCLA, which aim to quantify the severity of both depression and loneliness. Search terms were developed collaboratively with an information specialist using term finding and thesaurus facilities within five electronic databases (Table 2). The search terms were initially intentionally broad given the breadth of research within the topic area. The databases were then systematically searched on 4th November 2021.

Table 2

Databases and search terms - Initial searches returned 1,927 originals before de-duplication

Database	Search terms
PsychInfo, Medline and APA	Terms relating to depression/mental health AND terms relating to loneliness AND terms relating to university students (See Appendix B for a list of specific search terms)
Scopus	(TITLE-ABS-KEY (lonel* OR isolated OR isolation OR seclusion OR secluded OR remoteness OR solitude) AND TITLE-ABS-KEY (undergraduate* OR postgraduate* OR "higher education" OR university* W/2 student* OR freshman* OR fresher*) AND TITLE-ABS-KEY ("mental health" OR anxiety OR depress* OR "mental wellbeing" OR "mental wellbeing"))
Web of Science	TOPIC: ((lonel* OR isolated OR isolation OR seclusion OR secluded OR remoteness OR solitude)) ANDTOPIC: ((undergraduate* OR postgraduate* OR "higher education" OR university* NEAR/2 student* OR freshman* OR fresher*)) AND TOPIC: (("mental health" OR anxiety OR depress* OR "mental wellbeing" OR "mental wellbeing"))
CINAHL	((lonel* OR isolated OR isolation OR seclusion OR secluded OR remoteness OR solitude)) AND ((undergraduate* OR postgraduate* OR "higher education" OR university* N2 student* OR freshman* OR fresher*)) AND (("mental health" OR anxiety OR depress* OR "mental wellbeing" OR "mental well being"))
ERIC	((lonel* OR isolated OR isolation OR seclusion OR secluded OR remoteness OR solitude)) AND ((undergraduate* OR postgraduate* OR "higher education" OR university* N2 student* OR freshman* OR fresher*)) AND (("mental health" OR anxiety OR depress* OR "mental wellbeing" OR "mental well being"))
British education index	((lonel* OR isolated OR isolation OR seclusion OR secluded OR remoteness OR solitude)) AND ((undergraduate* OR postgraduate* OR "higher education" OR university* N2 student* OR freshman* OR fresher*)) AND (("mental health" OR anxiety OR depress* OR "mental wellbeing" OR "mental well being"))

Inclusion and exclusion criteria

The inclusion criteria were intentionally broad as all study methodologies and constructs of depression and loneliness were eligible (Table 3).

Table 3

Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
Quantitative studies with a focus on the factors of depression and loneliness, captured using the BDI and UCLA respectively	Studies that explore the construct of measures of loneliness or depression on any other relevant measure
Published in peer-review journal articles	Studies that utilise only one of the two required assessment tools (BDI & UCLA)
Participants who would class themselves as students in either part-time or full-time study	Qualitative analysis or thematic reviews of literature
Participants between the ages of 18 - 69 years of age	Non-English publications
Participants of any gender	Participants who have a recognised intellectual disability
Participants of any ethnicity	
Participants who have been involved in research related to their experiences of mental health during their period of study	

Study selection

Initial searches returned 1,927 records. Duplicate papers were removed before titles and abstracts were reviewed independently by two researchers to assess their eligibility; the lead researcher, a trainee Clinical Psychologist, reviewed 100% of the papers and a second researcher (a qualified Clinical Psychologist) reviewed 20%, as recommended by McDonagh et al. (2013). Dual reviewing is argued to be superior to single reviewing and can reduce bias in study selection (Stoll et al., 2019). Any disagreements were discussed until a consensus was reached for papers to be included for full-text review. Full texts were then reviewed, again, 100% by the lead researcher and 20% by the second researcher. Cohen's Kappa (Cohen, 1992) was used to assess inter-rater reliability between the researchers. The reference lists of the final eligible papers were searched for further titles and abstracts that met the inclusion criteria and the process was repeated for these papers.

Data extraction

The publication standards' Wong et al. (2013) recommend data extraction includes background theoretical assumptions, research aims, study methodology and significant findings. Informed by these recommendations, a pre-specified data extraction form (Table 4) was constructed including the extraction of 1) theoretical underpinnings 2) year of publication 3) sample characteristics, 4) methodological implementations and designs, 5) methods of data collection and outcome measures 6) data analysis 7) primary outcomes 8) secondary outcomes. Mapping the extracted data onto the three research questions (Table 1) allowed for immersion in the data and evaluation of how each new data item fits with quantitative findings regarding the relationship between loneliness and depression, alongside other variables.

The Quality Appraisal for Diverse Studies (QuADS) (Harrison et al., 2021) was used to critically appraise each study's ability to make a valid contribution to this review. This quality assessment tool was selected to ensure the review had a flexible inclusion criterion to include correlational papers and cases control design. Using this tool, each paper reviewed was assigned a quality score.

Synthesis and analysis of literature

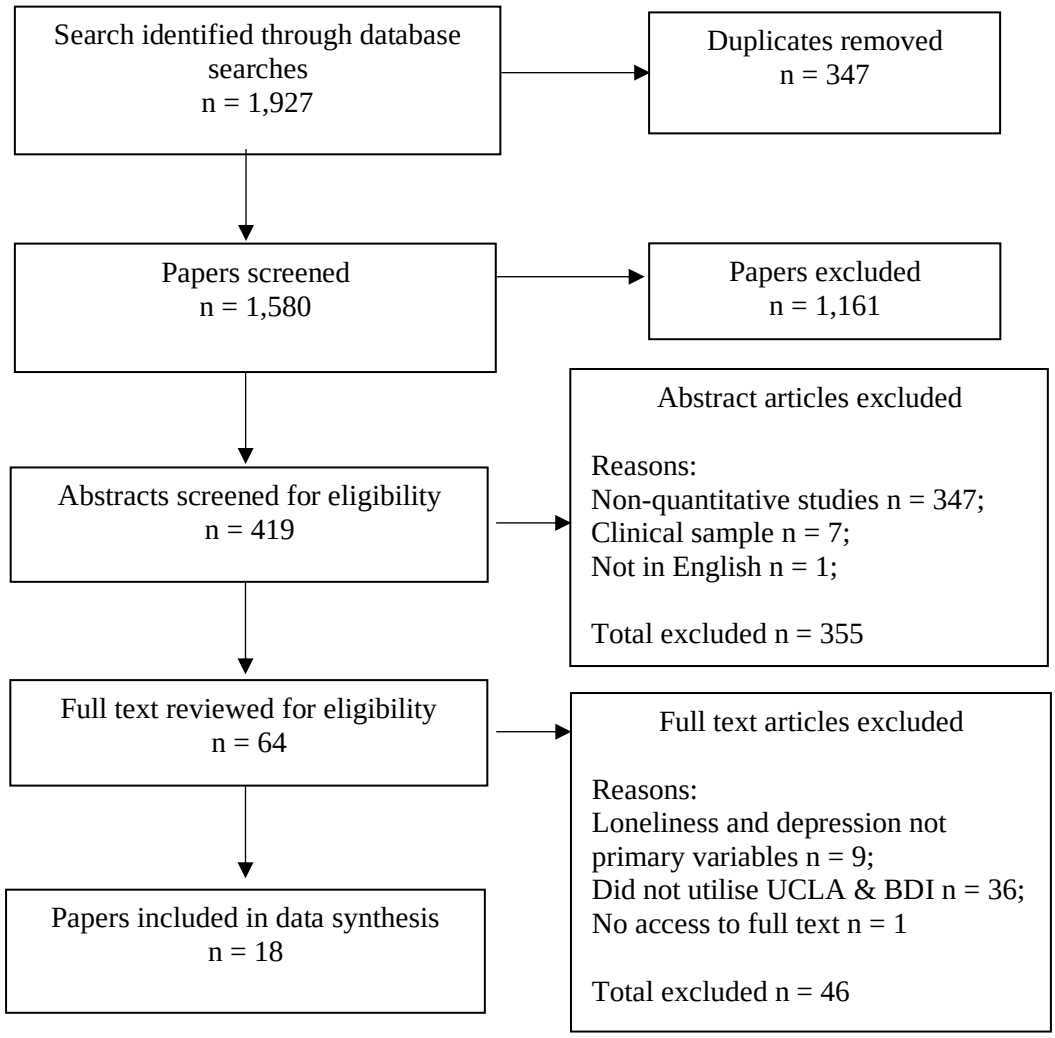
Meta-analysis methodology allowed for the synthesis of quantitative and consequent identification of statical findings (Wong et al., 2013). For research questions 1 and 2, as the study level data was already synthesized into two single measures (UCLA & BDI) no transformation procedures were required. The meta-analysis integrated the quantitative findings from the selected studies and provided a numerical estimate of the overall effect of interest (Petrie et al., 2003). Different weights were assigned to the different studies in relation to the specific studies' sample size, and this weighting was used to calculate the summary/pooled effect. Med Calc (MedCalc Statistical Software; version 19.2.6) statistical software was used to calculate the total fixed and random effects alongside the effect size and precision of the estimate (95% CI[2]) of the Pearson's correlation coefficients using the Hedges-Olkin method (Hedges & Olkin, 2002). Tests for heterogeneity (Cochran's Q and I^2 statistic) were completed also well as statistical tests for publication bias (Egger's Test and Begg's Test).

[2] Confidence Intervals

Results

Figure 1

Flow chart of the systematic review process



Selection and inclusion of studies

The search generated 1,927 papers resulting in 1,580 being retained following the removal of duplicates. Following a review of titles, 1,161 papers were excluded, and a further review of abstracts excluded 355 papers, retaining 64 papers for full-text review. The full-text review resulted in excluding a further 47 papers, leaving 18 retained (Figure 1). Cohen's Kappa (Cohen, 1992) revealed substantial inter-rater reliability between the two researchers at both the reviewing titles and abstracts ($k=0.742$, $p=<0.05$) and full text ($k=0.783$, $p=<0.05$) stage.

Study characteristics

Methods

Study characteristics are described in Table 4. All included papers were quantitative and cross-sectional in their design (N=18). Aims were heterogeneous across studies. Of the studies, three examined the specificity of a measure (Either UCLA or BDI), and the remaining fifteen examined the relationship between loneliness, depression, and other variables.

Of the 18 studies, 17 reported a Pearson's correlation between loneliness (UCLA) and depression (BDI). One study (Wilson & Lavelle, 1990) did not calculate the correlation coefficient between these variables. As such this study could not be included in the meta-analysis. One study (Zawadzki, Graha & Gerin, 2013) did not report the correlation analysis in the main report, authors were contacted and provided this information for this meta-analysis (Appendix C).

With regards to the analysis used to assess predictability from models as well as mediators within the relationship, the following statistical analyses were reported by papers. Eight reported regression analyses (linear, multiple, and hierarchical), two reported factor analyses, two reported t-tests, two reported structural equation modelling, one reported a principal component analysis, one reported a functional analysis, one reported a path model, one reported a two-way MANOVA, one reported an unspecified prediction model, one reported a validity analysis, and two completed no further statical analysis beyond a correlation.

All studies used the UCLA and BDI to measure constructs of loneliness and depression, respectively. Twelve studies used the 1980 version of the UCLA, two used the 1996 version, two used the 1978 version, one did not specify which version was used and one utilised a version translated into Turkish, which was shown to be comparable with the UCLA-R English version (Hisli, 1989). The use of different versions of the UCLA was deemed appropriate as scales have shown to demonstrate good levels of internal consistency (Shevlin, Murphy & Murphy, 2014). Seventeen studies used the 21-item version of the BDI and one used the 13-item short version. The use of differing versions of the BDI was deemed appropriate as scales have been demonstrated to show good levels of internal consistency (Beck et al., 1996). All 18 studies utilised self-report questionnaire methods, with one study (Westefeld et al., 2001), using a self-report questionnaire and structured interview methods.

Samples

Papers were published between 1980 - 2019 with sample sizes ranging from 50 to 1004 participants. The total sample size across the 18 included studies was 5848 (mean = 324.8). Studies included in the meta-analysis (N = 17) had a total sample size of 5,771 (mean = 339.5). Only sixteen studies reported age ranges, and these were from 18-40 years. Of the thirteen mean ages reported, the median was 21.4 years (IQR=19.91). Seventeen studies included both males and females; across these, there was a total of 1975 males and 3,517 females, with 23 individuals not stating their sex. One study did not report the sex of the sample (Weeks et al., 1980)

Ethnicity was reported within 16 of the studies, these included, Zimbabwean (N = 1), Jamaican (N = 1), Turkish (N = 2), American (N = 3), Hungarian (N = 1), Spanish (N = 1), Latin Americans (N = 1), Hispanic (N = 1), French-Canadian (N = 1), and 'Mixed/Various ethnicity' (N = 4).

Students were enrolled on various classes with many studying within the social sciences faculty. Students were reported to be either undergraduate (N = 1,828), college student (N = 2,134) or the student status was not stated (N = 1,886). It is acknowledged that due to translation that 'Undergraduate' and 'College student' are likely to represent the same age of the learner. There was little discussion with regards to any clinical diagnosis of conditions across studies, and all studies focussed on non-clinical samples.

Table 4:

Characteristics of selected studies

Study No.	Authors/ study location	Primary study aim	Design	Sample characteristics	Other variables assessed	Data collection	Additional data analysis
1	Zawadzki (2013) †	To report the relationships between loneliness, depressed mood & sleep in college students	Cross-sectional quantitative	N= 300; 84 Males, 216 Females, Mean age 20.3; Course studied Biobehavioural Health classes; Undergraduate Students; Ethnicity American	The Spielberger Trait Anxiety Scale (Spielberger, Gorsuch, & Lushene, 1971), Smoking behaviours (2 questions, cigarettes per day and years smoking), The Cook-Medley Hostility Scale (Cook & Medley, 1954), The Ruminative Response Scale (Nolen-Hoeksema & Morrow, 1991), Big Five Inventory (BFI; John, Donahue & Kentle, 1991)	Self-report questionnaires	Factor analysis; Structural equation modelling
2	Yavuzer (2019)	To examine the relationships amongst aggression, self-theory, loneliness, and depression	Cross-sectional quantitative	N = 904; 309 Males, 595 Females; Mean age 25.22; Age Range 22-29; Various courses studied; Undergraduate students; Ethnicity Not stated	Self-Theory Scale (Berg & Snyder, 2010) KAR-YA Aggression Scale (Karatas¸ & Yavuzer, 2016)	Self-report questionnaires	Simple and hierarchical multiple linear regression analyses, T-tests

3	Wilson (1990) ǂ	To examine the specificity of the UCLA among Zimbabwean students	Cross-sectional quantitative	N = 77; 44 Males, 33 Females; Mean age 22.13; Courses studied student status Not stated; Undergraduate students; Ethnicity Zimbabwean	Rosenberg's Self-Esteem Scale (Rosenberg, 1965) State-Trait Anxiety Inventory (Spielberger, Gorsuch, & Luschene, 1971), Social Support Questionnaire (Sarason, Levine, Basham, & Sarason, 1983)	Self-report questionnaires	Principal component analysis, Scale intercorrelations
4	Wilbert (1986)	To explore the role of dysfunctional attitudes in loneliness among college students	Cross-sectional quantitative	N = 50; 20 Males, 30 Females; Mean age 18.9; Age Range 18-22; Courses studied Psychology; Undergraduate students; Ethnicity Not stated	Young Loneliness Diagnostic Scale (YLD; Young, 1981), Dysfunctional Attitudes Scale (Form A) (DAS; Weissman, 1980)	Self-report questionnaires	Multiple regression analysis, Functional analysis
5	Lipps (2007)	To explore the concurrent and discriminant validity of the Brief Screen for Depression (BSD)	Cross-sectional quantitative	N = 244; 32 Males, 200 Females, 12 Not stated; Mean age 22.7; Age Range 17-49; Various courses Faculty of Social Sciences; Undergraduate students; Ethnicity Jamaican	The Brief Screen for Depression (BSD; Hakstian & McLean, 1989), The Centre for Epidemiologic Studies Depression scale (CES-D; Radloff, 1977), The Responding Desirably on Attitudes and Opinions Scale (Schuessler, Hittle & Cardascia, 1978)	Self-report questionnaires	Internal consistency reliability of the BSD was examined using Chron- Bach's α coefficient

6	Kılınç (2019)	To determine the relationship between the loneliness and depression levels of students studying at Inonu University, Faculty of Health Sciences	Cross-sectional quantitative	N = 1004; 317 Males, 687 Females; Age 18-19 (N= 144), 20-21 (N= 499), 22+ (N = 361); Courses studied Faculty of Health Sciences; Student status NS; Ethnicity Turkish	Bespoke questionnaire (11 questions) inc age, sex, marital status, family type, sibling situation, economic situation, mother's education, father's education, department, class year, and place of residence). Economic status, Residence, Class, Family type, Mothers education, Economic situation	Self-report questionnaires	Regression analysis
7	Joiner (1997)	To test interpersonal-personality view on vulnerability to depressive symptoms	Cross-sectional quantitative	N = 172; 90 Males, 82 Females; Age NS; Course studied Psychology classes; Undergraduate students; Ethnicity American	Shyness (Cheek & Buss 1981), Social support Questionnaire (Sarason, Levine, Basham, & Sarason, 1983), Positive Negative affect schedule (Watson, Clark, & Tellegen, 1988)	Self-report questionnaires	Multiple regression
8	Chang (2017)	To examine loneliness and family support as predictors of suicide risk	Cross-sectional quantitative	N = 456; 225 Males, 231 Females; Mean age 21.52; Age Range 18-35; Courses NHS; College students; Ethnicity Hungarian	Frequency of Suicidal Ideation Inventory (FSII; Chang & Chang, 2016), Family Support Scale (FSS; Julkunen & Greenglass, 1989)	Self-report questionnaires	Hierarchical regression analyses

9	Westefeld (2001)	To explore the relationship between sexual orientation and depression, loneliness, and suicide in Gay, Lesbian, and Bisexual college students:	Cross-sectional quantitative	N = 70; 47 Males, 23 Females; Age Range 18-29; Course NS; College students; Ethnicity American	The College Student Reasons for Living Inventory (CSRLI; Westefeld, Cardin, & Deaton, 1992), A series of open-ended questions was also posed to the lesbigay respondents.	Self-report questionnaires, Structured interview	Between control and sample group T-tests
10	Fuente (2018)	To examine coping strategies as a mediator of the association between loneliness and depressive symptoms	Cross-sectional quantitative	N = 364; 80 Males, 275 Females, 9 NS; Mean age 21.6; Age Range 18-57; Courses & Student status NS, Ethnicity Spanish	Coping Strategies Inventory (CSI; Tobin et al., 1989)	Self-report questionnaires	Prediction model with multiple mediators
11	Muyan (2016)	To examine the role of hope in understanding the link between loneliness and negative affective conditions	Cross-sectional quantitative	N = 318; 101 Males, 215 Females; Mean age 21.69; Age Range 18-58; Course NS; College students; Ethnicity Various	Hope Scale (HS; Snyder et al., 1991), Beck Anxiety Inventory (BAI; Beck, Epstein, Brown, & Steer, 1988)	Self-report questionnaires	Hierarchical regression analyses
12	Hermann (2006)	To test the predictive models of depressive symptoms and loneliness in college students	Cross-sectional quantitative	N = 696; 346 Males, 350 Females; Mean age 18.8; Course NS; College students; Ethnicity 'Mixed'	The Scale of perceived Social Efficacy (Smith & Betz, 2000), Bem sex Role Inventory (Bem, 1974), Unconditional Self Regard scale (Betz et al., 1995)	Self-report questionnaires	Two-way MANOVA, Path Models
13	Weeks (1980)	To assess the relationship between loneliness and depression	Cross-sectional quantitative	N = 333; Age NS; Course & Student status NS; Ethnicity American	The Profile of Mood States (POMS; McNair, Lorr, & Droppleman, 1971)	Self-report questionnaires	Four structural equation models

14	Weber (1997)	To examine the relation- ship between suicide ideation and depression, loneliness, stress, and hopelessness in college student	Cross-sectional quantitative	N = 185; 91 Males, 94 Females; 93% of Respondents Aged 18-25; 54% College Freshman; Ethnicity 58% 'Predominantly White'	The Social Readjustment Rating Scale (SRRS, Holmes & Rahe, 1967), The Beck Hopelessness Scale (Beck, Weissman, Lester & Trex-Ier, 1974), The Suicide Ideation Questionnaire (SIQ, Reynolds, 1987),	Self-report questionnaires	None
15	Chang (2011)	To assess perfectionism and loneliness as predictors of depressive and anxious symptoms in Latinas	Cross-sectional quantitative	N = 121; 121 Females, Mean age 19.78; Various courses studies, College students; Ethnicity Latin Americans	Frost Multidimensional Perfectionism Scale (Frost et al., 1990), Beck Anxiety Inventory (BAI; Beck, Epstein, Brown, & Steer, 1988)	Self-report questionnaires	hierarchical regression analyses
16	Muyan (2015)	To examine perfectionism and loneliness as predictors of suicidal risk	Cross-sectional quantitative	N = 288; 118 Males, 170 Females; Mean age 21.33; Age Range 18-40; Various courses studied; College students; Ethnicity Turkish	Frost Multidimensional Perfectionism Scale (Frost et al., 1990), Frequency of Suicide Ideation Inventory (FSII; Chang and Chang 2016)	Self-report questionnaires	Hierarchical regression analyses
17	Ouellet (1986)	To assess the relationship between loneliness and depression	Cross-sectional quantitative	N = 81; 29 Males, 52 Females; Mean age 21.4; Age Range 19-26; Course NS; Undergraduate students; Ethnicity French-Canadian	Social self-esteem inventory (Lawson, Marshall & McGrath, 1979)	Self-report questionnaires	None
18	Gould (1982)	To investigate the standard and short form BDI	Cross-sectional quantitative	N = 185; 42 Males, 143 Females; Mean age 20.85; Course & Student status NS; Ethnicity 96% White, 1% Black & 3% Hispanic	Rosenberg Self-esteem Scale (Rosenberg, 1965), Zung Self-Rating Depression Scale (Zung, 1965)	Self-report questionnaires	Factor analysis

† Correlations were not reported within the paper, but the author was contacted and provided this post hoc (Appendix C)
‡ Study did not report the exact correlation between variables. Considered within 'Research question 3' analysis only
For simplicity and clarity only lead authors have been referenced in tables and figures. Full references available in the reference list

Risk of bias

The QuADS checklist (Harrison et al., 2021) was used to critically appraise the quality of papers (Table 5). This review followed a process described by Dixon-Woods et al. (2007) whereby papers are categorised as 'key papers' (KP), 'satisfactory papers' (SP), and papers where the researcher was 'unsure whether the paper should be included' (unsure). A scoring system described by Pluye et al. (2009) was used to support categorisation. Papers meeting 75% of the appraisal criterion were classified as KP (n=6), meeting 37.5% were classified as SP (n=9) and below 37.5% were classified as unsure (n=3).

Table 5

Quality assessment scores for selected studies using The Quality Appraisal for Diverse Studies (QuADS)

QuADS Item	Zawadzki (2013)	Yavuzer (2019)	Wilson (1990)	Wilbert (1986)	Lipps (2007)	Kılınç (2019)	Joiner (1997)	Chang (2017)	Westefeld (2001)	Fuente (2018)	Muyan (2016)	Hermann (2006)	Weeks (1980)	Weber (1997)	Chang (2011)	Muyan (2015)	Ouellet (1986)	Gould (1982)	Item % score
Theoretical or conceptual underpinning to the research	2	3	0	3	3	3	3	3	3	3	3	3	2	3	3	3	1	0	81%
Statement of research aim/s	3	3	1	3	2	3	1	3	3	3	3	1	2	2	3	3	1	0	74%
Clear description of research setting and target population	1	3	1	2	3	3	1	3	3	3	2	2	2	3	3	3	0	0	70%
The study design is appropriate to address the stated research aim/s	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	1	2	93%
Appropriate sampling to address the research aim/s	1	2	0	1	3	3	1	3	3	3	1	3	2	2	2	3	1	1	65%
Rationale for choice of data collection tool/s	1	3	1	3	3	3	3	3	2	2	3	2	1	3	2	3	0	2	74%
The format and content of data collection tool/s is appropriate to address the research aim/s	3	3	2	3	3	3	3	3	3	3	3	3	2	3	3	3	2	3	94%
Description of data collection procedure	2	0	1	2	3	3	3	2	1	2	2	3	3	2	3	2	1	0	65%
Recruitment data provided	1	0	0	1	3	1	1	1	1	3	2	3	2	2	3	1	1	0	48%
Justification for analytic method selected	2	2	1	2	2	3	3	3	1	2	2	2	3	2	2	3	0	1	67%
The method of analysis was appropriate to answer the research aim/s	3	3	1	3	3	3	3	3	3	3	3	3	3	3	3	3	1	2	91%
Evidence that the research stakeholders have been considered in the design or conduct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
Strength and limitations discussed critically	2	3	1	1	3	1	2	3	1	2	3	3	2	1	3	3	0	1	65%
Percentage score %	61.54	71.79	28.21	69.23	87.18	82.05	69.23	84.62	69.23	82.05	76.92	79.49	69.23	74.36	84.62	84.62	23.08	30.77	
Classification of paper	SP	SP	Unsure	SP	KP	KP	SP	KP	SP	KP	SP	SP	SP	SP	KP	KP	Unsure	Unsure	

Meta-analysis

A meta-analysis of the relationship between loneliness and depression in the student population was conducted (Table 6) to address the first two research questions (Table 1). In seeking patterns that span the literature, the analysis explores these constructs captured by the UCLA and BDI respectively to quantitively compare findings across the current field.

Research questions 1 and 2

All studies that were included in the primary analysis (Research questions 1 and 2) (N=17) demonstrated a significant positive correlation between variables of loneliness and depression (captured via the UCLA and BDI respectively), with significance ranging from $p < .05$ – $p < .001$. Correlation coefficients between the variables ranged from .24 - .69. These were plotted via a forest plot (Figure 2).

The Hedges-Olkin method (Hedges & Olkin, 2002) method was used to calculate the (1) total fixed effects (2) total random effects (3) effect size (4) precision of the estimate (95% CI) of the combined Pearson's correlation coefficients of all studies (N=17), weighted by sample size. The total random-effects model was selected as a large sample size was achieved and studies within the analysis varied in terms of their methods and participants (Higgins & Thompson, 2002). The total random-effects model analysis showed that there was a significant positive correlation between variables of loneliness and depression across the primary studies ($g = .533$, (CI 0.469 to 0.591) $p < .001$) (Table 6).

Tests for heterogeneity between studies were also completed (Table 7) which demonstrated that despite heterogeneity being present between the studies the main finding (significant positive correlation between the two variables) was still reliable (See below). Statistical tests for publication bias (Egger's Test and Begg's Test) (Table 8) were also completed which indicated that publication bias was not present (see below).

In answer to research questions 1 and 2: a significant positive correlation was demonstrated between the two variables. This pooled correlation was deemed to be of a large effect size (Cohen, 1992).

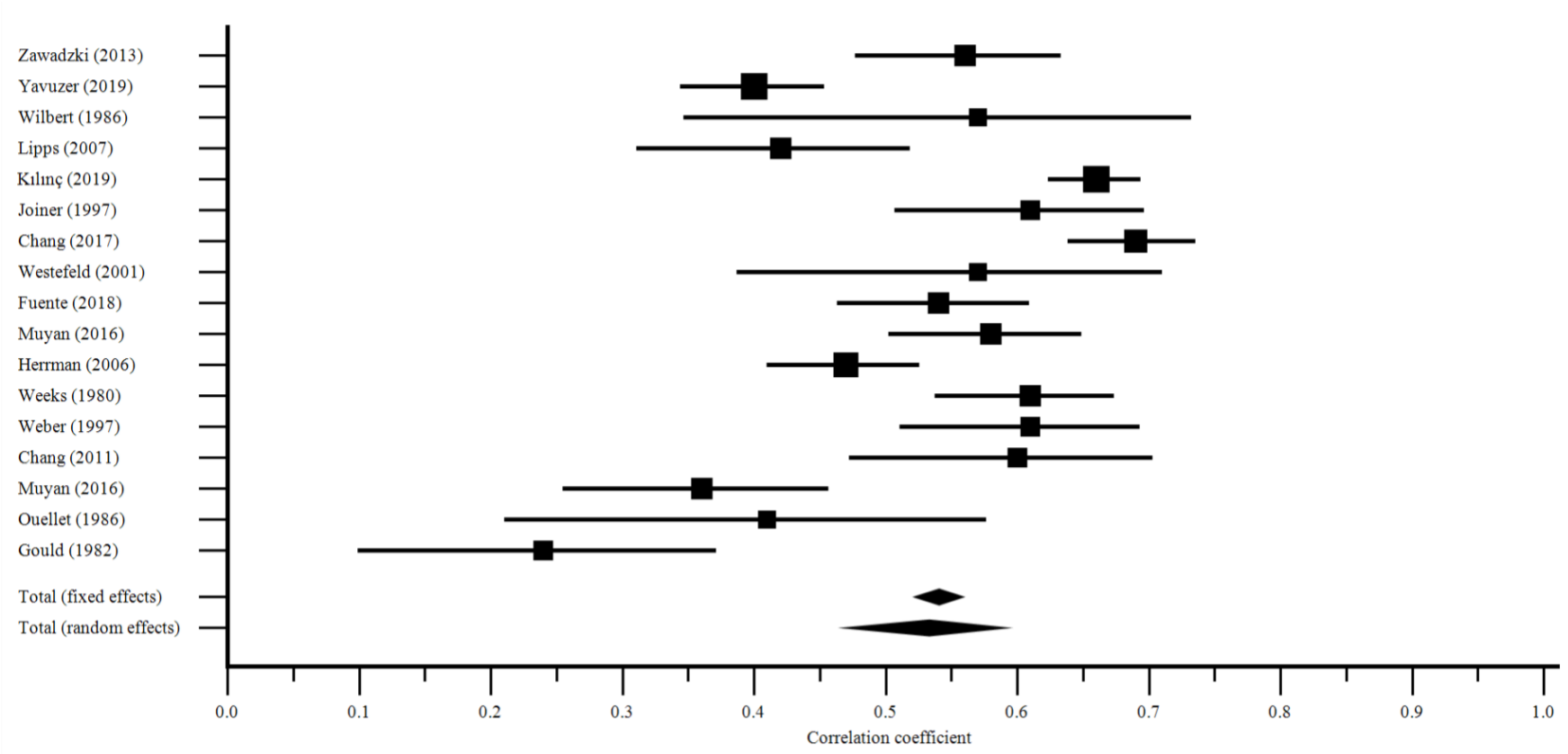
Table 6

Meta-analysis of primary variables

Study	Sample size	Correlation coefficient BDI & UCLA	95% CI	z	P	Weight (%)	
						Fixed	Random
Zawadzki (2013)	300	0.560	0.477 to 0.633			5.10	6.23
Yavuzer (2019)	904	0.400	0.344 to 0.453			15.48	6.74
Wilbert (1986)	50	0.570	0.347 to 0.732			0.81	3.90
Lipps (2007)	244	0.420	0.311 to 0.518			4.14	6.08
Kılınç (2019)	1004	0.660	0.624 to 0.694			17.20	6.77
Joiner (1997)	172	0.610	0.507 to 0.696			2.90	5.74
Chang (2017)	456	0.690	0.639 to 0.735			7.78	6.49
Westefeld (2001)	70	0.570	0.387 to 0.710			1.15	4.50
Fuente (2018)	364	0.540	0.463 to 0.609			6.20	6.36
Muyan (2016)	318	0.580	0.502 to 0.649			5.41	6.27
Hermann (2006)	696	0.470	0.410 to 0.526			13.63	6.71
Weeks (1980)	333	0.610	0.538 to 0.673			5.67	6.31
Weber (1997)	185	0.610	0.511 to 0.693			3.13	5.82
Chang (2011)	121	0.600	0.472 to 0.703			2.03	5.32
Muyan (2015)	288	0.360	0.255 to 0.457			4.90	6.20
Ouellet (1986)	81	0.410	0.210 to 0.577			1.34	4.74
Gould (1982)	185	0.240	0.0992 to 0.371			3.13	5.82
Total (random effects)	5771	0.533	0.469 to 0.591	13.706	<0.001	100.00	100.00

Figure 2

A forest plot to demonstrate the correlation coefficients of the included studies, with 95% CI and the overall effect (Under the fixed and random effect model) with 95% CI.



Note. The marker sizes vary in size in accordance with the weights assigned to the different studies (N). The location of the diamonds (Total Fixed and Random effects) represents the estimated effect size, and the width of the diamond represents the precision of the estimate (95% CI)

Heterogeneity

Table 7

Tests for heterogeneity

Cochran's Q	154.323
DF	16
Significance level	P < 0.0001
I^2 Statistic (inconsistency)	89.63%
95% CI for I^2	84.99.08 to 92.84
τ	0.164
τ^2	0.027
Prediction interval	0.205 to 0.861

The Cochran's Q value (154.323) with 16 degrees of freedom and $p < 0.0001$ (Table 7), demonstrated that the true effect size was significantly different across all studies. The I^2 value demonstrated that 89.63% of the variance in the observed effects reflected the variance in the true effects, while the remaining 10.37% reflected variation due to sampling error. The results of the Cochran's Q and I^2 tests implied considerable heterogeneity between studies (I-squared=89.63%, $P<0.0001$) (Higgins & Thomas, 2019; Higgins & Thompson, 2002), even when the confidence intervals of I^2 were considered.

The variance of the true effects (τ^2) is 0.027 and the standard deviation of true effects (τ) is 0.164, with a prediction interval of 0.205 to 0.861. As such, it is expected that in some 95% of all populations comparable to those in this analysis, the true effect size of the correlation coefficients between loneliness and depression would fall within the range r = 0.205 to 0.861. Based on the context outlined above, there will be some populations where the correlational relationship between loneliness and depression is small (r = 0.1 to 0. 3) and some where it is large (r = 0.5 to 1.0), as well as some where it will range between these (r = 0. 3 to 0.5) (Cohen, 1992).

The prediction interval implies the variation in effect sizes between studies is considerably diverse, implying although significant, the pooled correlation must be interpreted with caution. From the data retrieved for this meta-analysis alone, it is not possible to either assess or determine the factors or sources causing the heterogeneity between the studies.

However, despite this, when considering the prediction interval, this still represents a positive correlation between the variables of loneliness and depression. Due to the heterogeneity of the studies in this meta-analysis, it is not possible to confirm a 'large correlational effect' between these two variables. However, it still demonstrates that a positive correlation is present in a minimum of 95% of a similar population.

Publication bias

Table 8

Tests for publication bias

Egger's test	
Intercept	-0.7032
95% CI	-5.0579 to 3.6516
Significance level	P = 0.7355
Begg's test	
Kendall's Tau	-0.1107
Significance level	P = 0.5351

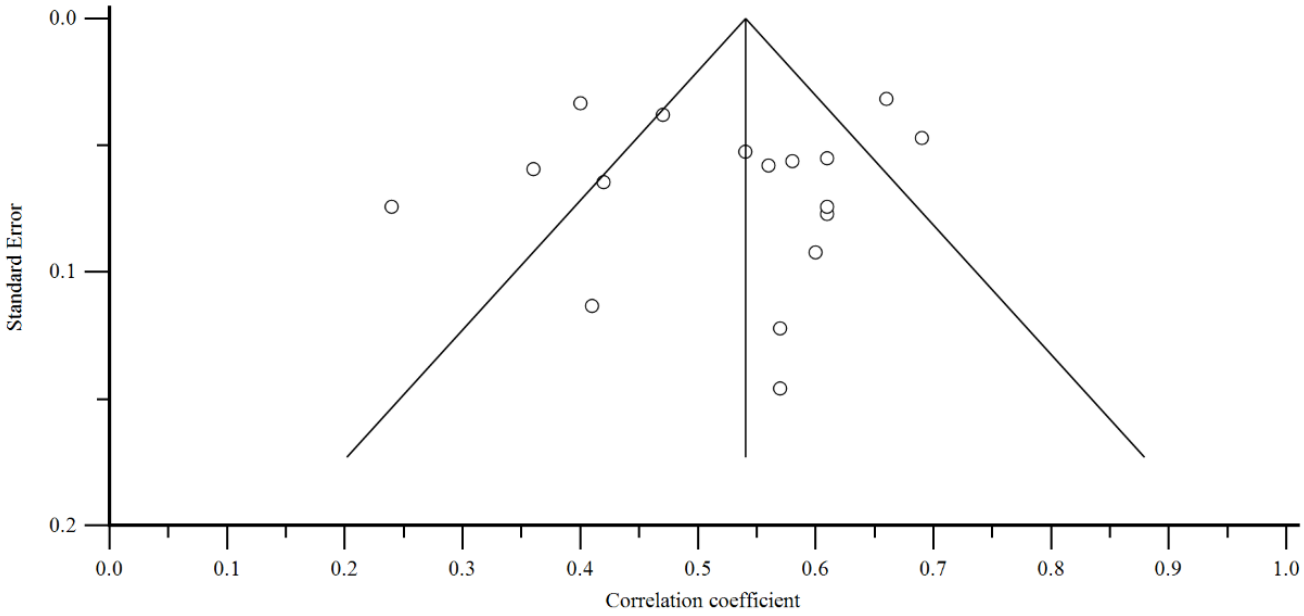
Egger's linear regression (Egger, Smith, Schneider & Minder, 1997) assessed the skewness of the standardized deviations of each study to highlight whether a publication bias was likely to be present. Egger's test for a regression intercept gave a p-value of 0.7355, indicating that there was no evidence of publication bias. It is acknowledged that the power of this test to detect publication bias within this meta-analysis is low due to the small number of studies assessed (Egger et al., 1997), however, the number of studies is still above the recommended cut-off for the use of this analysis (N<10) (Sterne et al., 2011).

Begg's test (Begg & Mazumdar, 1994) assessed if there is a significant correlation between the ranks of the standardized effect sizes and the ranks of their variances. Begg's test for rank correlation gave a p-value of 0.5351, also indicating no evidence of publication bias.

Cumulatively *p* values from Eggers's test and Begg's test indicated that there was not a publication bias within the papers analysed (Table 8). When plotted the distributions of the effect sizes exhibited a symmetrical shape, again typical of a nonbiased publication sample (Figure 3).

Figure 3

A funnel plot to demonstrate the absence of any publication bias in the reported effect sizes of the correlation coefficients of scores loneliness and depression across studies



*Note. The vertical line represents the pooled correlation coefficient using a random-effects meta-analysis. The two diagonal lines represent the 95% prediction interval (effect ± 2*SD (0.164)) around the summary effect (g = .533)*

Research question 3

To address research question 3, a preliminary inspection of other variables captured within the selected studies was completed. In line with the assumptions required for mediation analysis, linear relationships between the dependant variable and both independent variables must be confirmed to establish the presence of a mediation. These linear relationships were confirmed via the extraction of correlational analyses of other variables captured within the studies, to consider their relationships individually to the variables of interest (UCLA & BDI) (Table 9). It is acknowledged that these correlations alone do not offer direct insight into the mechanisms between the relationship of loneliness and depression, however as discussed, it is necessary to consider whether other variables are associated in order to explore the possible mediators of the primary relationship of interest (discussed below).

Table 9

Exploratory Correlation matrix of other variables captured within studies with the BDI & UCLA

Construct measured	Measurement tool	Studies used in	Correlation	
			BDI	UCLA
Depression	BSD	(Lipps, 2007)	.64	.62
	CESD	(Lipps, 2007)	.65	.51
	Zung Self-rating depression scale – 21 items	(Gould, 1982)	.42	NR
	Zung Self-rating depression scale – 13 items	(Gould, 1982)	.41	NR
Loneliness	YLD	(Wilbert, 1986)	.46	.65
Anxiety	The Spiel-berger Trait Anxiety Scale	(Wilson, 1990)	NR	NR
		(Zawadzki, 2013)	NR	NR
	BAI	(Chang, 2011)	.55	.33
		(Muyan, 2016)	.64	.47
	RSS	(Zawadzki, 2013)	NR	NR
Self-esteem and self-theory	Self-Theory Scale	(Yavuzer, 2019)	.39	.42
	Rosenberg's Self-Esteem Scale	(Wilson, 1990)	NR	NR
		(Gould, 1982)	.24	NR
	Unconditional Self Regard scale	(Hermann, 2006)	-.60	-.61
	The Scale of perceived Social Efficacy	(Hermann, 2006)	-.49	-.24

	Social self-esteem inventory	(Ouellet, 1986)	.28	.72
Suicidality	Frequency of Suicidal Ideation Inventory	(Muyan, 2015)	.49	.29
		(Chang, 2017)	.66	.59
	The Suicide Ideation Questionnaire	(Weber,1997)	.62	.52
	The College Student Reasons for Living Inventory	(Westefeld, 2001)	-.34	-.39
Aggression	KAR-YA Aggression Scale	(Yavuzer, 2019)	.36	.43
	The Cook-Medley Hostility Scale	(Zawadzki, 2013)	.43	NR
Support	Social Support Questionnaire	(Wilson, 1990)	NR	NR
		(Joiner, 1997)	-.29	-.43
	Family Support Scale	(Chang, 2017)	-.44	-.54
Mood	Positive affect schedule	(Joiner, 1997)	-.52	-.57
	Negative affect schedule		.65	.44
	The Profile of Mood States	(Weeks, 1980)	NR	NR
	The Beck Hopelessness Scale	(Weber,1997)	.70	.52
	Hope Scale	(Muyan, 2016)	-.58	-.48
	The Social Readjustment Rating Scale	(Weber,1997)	.40	.20

Attitudes	Dysfunctional Attitudes Scale	(Wilbert, 1986)	.38	.47
Gender role	Bem sex Role Inventory – Instrumentality	(Hermann, 2006)	-.23	-.28
	Bem sex Role Inventory – Expressiveness		-.24	-.39
Personality	Shyness	(Joiner, 1997)	.34	.49
	Frost Multidimensional Perfectionism Scale	(Chang, 2011)	NOR	NOR
		(Muyan, 2015)	NOR	NOR
	Big Five Inventory (Neuroticism only)	(Zawadzki, 2013)	.52	NR
Coping	Coping Strategies Inventory	(Fuente, 2018)	NOR	NOR
Smoking	Smoking behaviours	(Zawadzki, 2013)	.06 (NS)	NR

Note. All correlation significant to p<.05 unless otherwise stated
NS – Not significant
NR – Not reported in the study
NOR – No overall score from the measure reported within the study. See exploratory analysis for relevant subscales from measures discussed in relation to whether the variable was explored as a mediator of the relationship of interest (BDI & UCLA)

Mediators of the relationship between loneliness and depression

Of the papers analysed only three considered possible mediators of the relationship between loneliness and depression (Fuente et al., 2018; Muyan et al., 2016; Zawadzki, Graha & Gerin, 2013). These are discussed with regards to general constructs measured and were only referenced when papers reported them to be mediators of the relationship between loneliness and depression.

Anxiety and rumination

Zawadzki, Graha & Gerin (2013) considered rumination (The Ruminative Response Scale; Nolen-Hoeksema & Morrow, 1991) and anxiety (State-Trait Anxiety Inventory; Spielberg, Gorsuch, & Luschene, 1971) as mediators in the relationship between loneliness and depression via structural equation modelling. Entering loneliness as a predictor of rumination and anxiety, allowed these two mediators to covary, and tested the effects of rumination and anxiety on depressed mood. This model accounted for 54% of the variance in depressed mood. With (1) Loneliness predicting rumination and anxiety. (2) Rumination co-varying with anxiety, and (3) rumination and anxiety predicting depressed mood. Finally, the direct path between loneliness and depressed mood (ß = .56, $p < .001$) was reduced to non-significance when rumination and anxiety were included (ß =.09, $p < .10$) i.e., that rumination and anxiety are mediators of the relationship between loneliness and depression.

Aggression

Concerning aggression, Zawadzki, Graha & Gerin (2013) in a bivariate analysis demonstrated that hostility (The Cook-Medley Hostility Scale; Cook & Medley, 1954) was related to depressed mood ($r = .43$, $p< .001$) (correlation with loneliness not reported within the paper). Modelling hostility and another variable (smoking) as mediating the relationship between loneliness and depressed mood along with rumination and anxiety, allowing hostility to covary with rumination and anxiety (discussed previously). However, hostility did not account for any further variance in depressed mood above that of rumination and anxiety, i.e., hostility is not a mediator of the relationship between loneliness and depression.

Hope

Regarding the role of hope within the relationship between loneliness and depression, Muyan et al., (2016) completed a hierarchical regression. In predicting depressive symptoms, loneliness was found to account for a large (f^2 = .52) 34% of variance in depressive symptoms, F (1, 316) D 162.16, p < .001. Additionally, after controlling for loneliness, when hope was entered, it was found to account for a small (f^2 = .03), but significant 3% of additional variance in depressive symptoms, F (1, 315) D 15.68, p < .001, suggesting that hope may be a mediator in this relationship.

Neuroticism

Zawadzki, Graha & Gerin (2013) completed a bivariate analysis, reporting that neuroticism (captured by the Big Five Inventory (BFI; John, Donahue & Kentle, 1991) was related to depressed mood (r = .52, p< .001) (correlation with loneliness not reported within the paper). Modelling neuroticism as a mediating variable between loneliness and depression as well as other variables (rumination, anxiety, smoking and hostility). They reported that the overall model accounted for 54% of the variance in depressed mood, however when neuroticism was removed as a mediator, the variance accounted for did not decrease, implying that neuroticism is not a mediator of the relationship between loneliness and depression.

Coping style

Fuente, Chang, Cardeñoso & Chang (2018) examined coping strategies as a mediator of the association between loneliness and depression. Utilising a multiple mediation model involving loneliness and coping style accounted for (f^2 = .68) 40.5% of the variance in depressive symptoms, F (10, 353) = 23.69, p < .001. However, when the direct path between loneliness and depression was assessed (ß = .70, p < .05) loneliness alone actually explained greater variance in depression scores. Only ‘problem solving’ was found to mediate the association between loneliness and depression (ß = .20, p < .05), however again this accounts for less variance than the direct path between loneliness and depression. Suggesting that overall coping style is not a mediator of the relationship between loneliness and depression.

Discussion

Main findings

In line with the three research questions, the analyses found that:

1. There is an association between depression and loneliness in the student population, captured by the BDI and UCLA, respectively.
2. The nature of this relationship is a significant positive correlation between the two variables. i.e., students who score higher on the UCLA also score higher on the BDI.
3. Across all the studies variables of rumination, anxiety, hope and problem solving were reported within three of the studies as possible mediators of the relationship between loneliness and depression.

The association between depression and loneliness – Research questions 1 and 2

The meta-analysis demonstrated that there was a significant positive correlation between loneliness and depression across the analysed studies. Due to the heterogeneity between the studies, it is not possible to report the effect size, however, it is likely to consistently fall within the small to large range. These findings are in line with previous research (Richardson, Elliott & Roberts, 2017) and previous meta-analyses (Erzen & Çikrikci, 2018) which also reported positive correlations between loneliness and depressive symptoms in students of a similar effect size. Various regression analyses reported within the studies analysed also demonstrated the predictive validity of the UCLA on the BDI and vice versa, reporting varying percentages of variance being accounted for. Within the studies analysed, two studies (Gould, 1982 & Lipps, Lowe, & Young, 2007) considered other measures of depression including the CES-D, BSD, and Zung Self report depression scale. All the measures were shown to be significantly positively correlated with the BDI and UCLA, giving further evidence for the reliability of these findings.

Cumulatively the use of meta-analytic methodology allowed for the objective appraisal of evidence concerning the relationship between loneliness and depression. Furthermore, the use of robust and well-validated measures of the considered constructs advances the validity and reliability of this relationship beyond that of previous reviews. It is further advantageous as it captures a broad population sample which included a breadth of ethnicities and cultures which is advantageous in considering the generalisability of these findings to students more globally and as such the understanding of experiences of mental wellbeing during university.

Mediators of this relationship – Research question 3

By examining the selected studies, several other variables were highlighted as possible mediators of the relationship between loneliness and depression. The statistical analysis reported within studies was reviewed to consider the strengths of these relationships. It is acknowledged that this exploration is not a conclusive list of all possible mediators, nor is it a statistical comparison of potential mediators from which meaningful predictions can be drawn. It is advantageous, as this explorative methodology allowed for consideration of the influence of other possible variables captured within the studies selected, which may mediate the primary interaction.

Concerning anxiety four studies considered the relationship between anxiety and 'loneliness and depression' (Wilson & Lavelle, 1990; Chang et al., 2011; Zawadzki, Graha & Gerin, 2013; Muyan et al., 2016). It is a well-researched phenomenon that concepts of depression and anxiety often occur synchronously (Tracy, 2022), as is the case with loneliness and depression (Erzen & Çikrikci, 2018). As such it is theoretically sound that these three constructs would be statistically related to each other, which was demonstrated across these four studies analysed, with correlational analysis confirming positive significant correlations (Table 9). Analysis completed by Zawadzki, Graha & Gerin (2013) reported that rumination and anxiety mediated the relationship between loneliness and depression, i.e., those who were lonely, were only depressed when they experienced anxiety. These findings are in opposition to the tripartite model (Clark & Watson, 1991) cited by Ebesutani et al. (2015), which suggests that anxiety leads to depression through the pathway of loneliness.

Four studies considered mood states (Joiner, 1997; Weber, Metha, & Nelsen, 1997; Muyan et al., 2016; Weeks et al., 1980). In line with theory (Kılınç et al., 2019) mood states were shown to be significantly correlated with loneliness and depression (Table 9). Levels of hope were reported by Weber, Metha, & Nelsen (1997) to mediate the relationship between loneliness and depression with those who hold greater hope being less lonely. However, it is acknowledged that the construct of 'Mood states' is vast and likely to encompass depression and anxiety. Hence from this analysis alone, it is not possible to draw any conclusions from these findings alone, except for those from where studies have reported single variables i.e., hope.

One study (Fuente et al., 2018) considered the mediating effect of students coping styles, reporting that 'problem solving' mediated the relationship between loneliness and depressive symptoms i.e., those who are better able to problem solve, when lonely were less likely to become depressed. Fuente et al. (2018) cited Tobin et al.'s (1989) hierarchical model of engaged and disengaged coping, and suggested that those with disengaged coping strategies i.e., problem avoidance, when lonely would inadequately address this, leading to feelings of failure and further social isolation, resulting in increases in depressive symptoms. This model and this study are advantageous in considering why loneliness and depression are not homogenous, however, it is important to note that this only demonstrated a mediation, on only the variable of 'problem solving', with all other subscales of 'coping style' being non-significant in relation to their role as mediators. This suggests that overall, coping style does not explain the mechanism linking loneliness to depression.

Four studies (Chang et al., 2011; Joiner, 1997; Muyan & Chang, 2015; Zawadzki, Graha & Gerin; 2013) explored the effect of personality types on the primary relationship. Zawadzki, Graha & Gerin (2013) considered the influence of neuroticism as a mediator on the relationship between loneliness and depression but found that this did not account for any further variance implying was not a relevant factor in mediating this relationship.

Two studies (Zawadzki, Graha & Gerin, 2013; Yavuzer, Albayrak, & Kılıçarslan, 2019) considered the variable of aggression. However, in terms of its validity as a mediator, this was only considered by Zawadzki, Graha & Gerin (2013), who found hostility had no further impact on scores of depression and loneliness.

Cumulatively within the analyses reviewed only variables of anxiety and rumination were reported within one study (Zawadzki, Graha & Gerin, 2013) to fully mediate the relationship between loneliness and depression. Variables of hope and problem solving were reported as mediators for this relationship but did not fully account for all variance observed. In relation to mediators of 'rumination and anxiety', this finding is in opposition to the tripartite model (Clark & Watson, 1991) cited by Ebesutani et al. (2015). These findings instead suggested that loneliness initiates experiences of anxiety and rumination, which subsequently lead to depressive symptoms. However, within this study, no further analysis was reported in relation to the impact of either of the variables singularly as mediators and as such, it is not possible to confirm whether they are both mediators in this relationship.

Limitations

It is important to consider the limitations of this meta-analysis in relation to the validity, generalisability, and implication of these findings.

Firstly, the main analysis within this meta-analysis is a statistical comparison of correlational studies. Correlational analyses only offer insight with regards to whether a relationship is present, rather than offering information regarding causation, i.e., whether loneliness increases experiences of depression, whether depression increases experiences of loneliness, or whether their statistical association is due to an unmeasured variable affecting both. However, the advantages of this analysis were that utilising this method meant that a broad range of studies could be compared as correlational analyses are a common preliminary analysis for research in this area, and as such a large sample size was attainable which increased the validity of the meta-analysis. The disadvantage of this approach was that the inclusiveness of the criteria meant that significant heterogeneity was demonstrated between the effect sizes of the studies analysed. However, the prediction interval still demonstrated that most scores would still fall within a positive correlation between the two variables, in keeping with the study's findings. Furthermore, several regression and path models demonstrated predictive validity in this relationship. Although it was not possible to statistically compare these due to inconsistencies in methods used and limited information reported regarding the process of the analysis, it still demonstrates valuable insight into the nature of this relationship.

Another limitation of this analysis is that within the scope of this research and due to discrepancies in measures and research methods utilised it was not possible to statistically compare any mediators of the primary relationship (i.e., whether another variable mediates the relationship between loneliness and depression). It is emphasised that the mediators discussed are not an exhaustive or conclusive list of factors which are relevant to the relationship between loneliness and depression. Concerning research into the experiences of loneliness and depression, the mediators of this relationship are likely to be broad and multifaceted. However, the exploratory analysis does highlight constructs which may be significantly influential within this such as anxiety and rumination.

It is also important to acknowledge that of the papers studied six (a third of the entire sample) represented the 'student' cohort by recruiting participants from courses relating to

‘social sciences and/or healthcare’. It is important to recognise that findings such as this may not be generalisable to the full student cohort as there are likely to be several factors which potentially differentiate why some students chose to study such courses.

Finally, quality reviews of the papers highlighted two papers used within the meta-analysis (Ouellette & Joshi, 1986; Gould 1982) which fell under the lower threshold in terms of the reliability of the quality of the findings. These papers fell in this domain mostly due to a lack of clearly reported methodology and theoretical underpinnings. As such findings from these papers must be interpreted with caution. However, post hoc analysis removing these papers from the meta-analyses did not significantly change the primary findings of this study, implying that despite their lack of quality their findings are in line with the general trend (Appendix D).

Future directions and recommendations

It is a well-researched phenomenon that attending university is a transitional period which can influence individuals’ experiences of loneliness (Thomas, Orme & Kerrigan, 2020) and depression (Ibrahim et al., 2013). Findings from this meta-analysis support previous research that these two experiences are positively associated (McIntyre et al., 2018; Rahman et al., 2012; Richardson et al., 2016). However, it is acknowledged that both experiences are unlikely to be static phenomena. With regards to loneliness, it is acknowledged that many university students do go on to create new social bonds and expand and develop new relationships and networks (Maunder, 2017) which may mitigate experiences of loneliness. In terms of depression, academic, social, and financial pressures (Ashraful Islam et al., 2018) may also influence feelings of despair and distress across academic life. These findings do not offer any insight with regards to causation between these variables across a period of study, as the studies reviewed all utilised cross-sectional methodology. Furthermore, research question 3, which considered the impact of mediators on the relationship between loneliness and depression was only a surface-level exploration. As such, future meta-analytic research reviewing studies which utilised longitudinal methodology would be beneficial to consider the causation between these variables captured via robust measures as utilised here as well as the statistical predictive validity of the mediators highlighted within this review (anxiety and rumination individually). Confirming both the causational factors in this relationship as well as the influence of other possible mediators on the primary relationship would be beneficial.

Findings such as these have the potential to be influential with regards to making recommendations to university's mental health provisions. From an assessment stance, they would provide insight into improving assessment procedures within clinical practice and could provide insight into whether experiences of loneliness should be more regularly captured within assessment screenings relating to presentations of depression. Furthermore, it could also provide insight with regards to possible treatment targets for this population which could in turn have a positive impact on university outcomes such as grades, dropout rates and future job prospects.

Finally, it was beyond the scope of this meta-analysis to explore any differences between the experiences of students transitioning to university and other groups experiencing transitional life periods. Although beneficial in developing the understanding of the experiences within the student population, future analysis would be beneficial to consider whether these findings can be generalised to other populations. For example, it would be beneficial to consider whether this is also the case in other transitional periods across the lifespan, such as transitioning through roles at work (Fletcher & French, 2021), or emigrating (Ivlevs, 2014) which have both shown to be associated with possible changes in mental health.

Conclusion

This meta-analysis of 18 studies demonstrates that there is a significant, positive correlation between depression and loneliness in the student population, captured by the BDI and UCLA, respectively, i.e., students who score higher on the UCLA also tend to score higher on the BDI. The exploratory analysis highlighted several other variables across the studies that could be full mediators of the relationship between loneliness and depression or themselves may be influenced by levels of loneliness and depression. From this analysis alone is not possible to infer any predictive validity of these mediators but it provides insight into possible avenues for future exploration to better understand the link between loneliness and depression, which could be influential in developing screening procedures for students experiencing these phenomena.

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An exploration of the relationship between loneliness, the severity of eating disorder-related symptoms and the experience of the 'Anorexic voice'

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23rd May 2022

Internal Supervisors: Professor John Fox & Dr Marc Williams

Word Count: 5,940 (Main body)
249 (Abstract)

Manuscript prepared in line with the author guidelines for The British Psychological Society's – Psychology and Psychotherapy – Theory, Research and Practice Journal (Appendix A). Word count guidance for DClinPsy thesis submission in 2022.

Abstract

Objectives: Many individuals with eating disorders (EDs) report the experience of an internal 'voice', often referred to in the literature as the 'Anorexic voice' (AV). Negative experiences of loneliness are also often associated with EDs. Due to the noted prevalence of both phenomena within this disorder, this study sought to explore the relationship between experiences of loneliness, the frequency of the anorexic voice and the impact of this on eating disorder (ED) symptom severity.

Design: One hundred and sixty-five individuals (mean age 27.54 years) who accessed online forums relating to EDs participated in this study. The sample included individuals who have experienced an AV (AV group) and those who have not (Non-AV group).

Methods: The study utilised self-report measures via an online questionnaire to explore the predictive validity of loneliness (University of Los Angeles Loneliness scale) and frequency of the AV (Topography of Voice questionnaire) on ED symptom severity (Eating Disorder Examination Questionnaire).

Results: Confirmatory analysis (AV group only) demonstrated the significance of the independent variables individually predicting ED symptom severity. However, a significant interaction was not found between the two primary variables in predicting ED symptom severity, more significantly than the influence of either variable alone. Exploratory analysis considered the differences between the two groups (AV and Non-AV) in relation to ED symptom severity, as well as considering alternate predictors within this relationship.

Conclusions: The findings offer insight into possible drivers behind engagement with the AV, as well as the broader trajectory of loneliness and the AV as part of ED presentations in the community. Further research would be beneficial to consider the relational connection to the AV as well as other predictors in the relationship between loneliness, the AV and ED symptom severity.

Key words: Loneliness, Eating disorders, Anorexic Voice, Mental health

Introduction

Eating disorders

Eating disorders (ED) are behavioural conditions that are characterized by severe and persistent disturbances in eating behaviours that are deemed as abnormal from cultural norms (Miller & Pumariega, 2001; Schmidt et al., 2016). In terms of their incidence, a recent systematic literature review has suggested a mean prevalence globally of 8.4% (CI[3] 3.3–18.6%) for women and 2.2% (CI 0.8–6.5%) for men across individuals' lifespans (Galmiche et al., 2019).

The presence of an ED is associated with significant psychological distress as well as being detrimental to quality of life (Bamford et al., 2014). EDs have also been argued to be one of the most high-risk psychiatric presentations, with sufferers having significantly higher mortality rates (Arcelus et al., 2011).

Eating disorders in the community

Galmiche et al., (2019) have argued that current prevalence rates of EDs are an underestimate of the full spectrum of this disorder. Cross-sectional surveys have demonstrated that levels of body dissatisfaction in the community are high (Quittkat et al., 2019) which has been demonstrated to be a crucial predictor and feature of eating problems (Mustapic, Marcinko & Vargek, 2015). Galmiche et al. (2019) suggested that many of these individuals do not present to psychiatric or health services and hence do not receive a formal clinical diagnosis. It is therefore considered whether some of the current research into EDs are a misrepresentation of the population, as many studies are only inclusive of those who have received this formal diagnosis. For example, Keski-Rahkonen et al. (2007) calculated lifetime prevalence and incidence rates of EDs within a cohort (N=55) of Finnish women from 1975-1979 birth cohorts. They reported that of those who reached the threshold for ED diagnosis on various standardised ED measures, only 53% of these individuals had received a formal diagnosis of an eating disorder. If prior research into ED populations is underestimated by this frequency, reported outcomes may be an underestimate and may result in Type II errors relating to findings.

[3] CI – Confidence interval

As such, it is queried whether this misrepresentation in the current field may lead to further misunderstandings of ED's broader presentations and trajectory. More ecologically valid outcomes could be achieved by considering the broader spectrum of ED presentations by not stipulating a formal diagnosis to participate in such research. Recent research, such as Boscoe, Stanbury & Harrison (2021), considered ED symptoms in the community. Their rationale was that a greater understanding of the breadth of presentations across EDs could be achieved by widening the cohort sampled to those who displayed ED symptoms (EDSY). This would aim to give a broader representation of the true breadth of this disorder and to improve preventative interventions and treatment outcomes while reducing the risk of Type II errors.

Eating disorder symptoms

EDSY are frequently referenced in the literature to include a range of behaviours and cognitions which predispose individuals to EDs, as well as perpetuate the disorder. EDSY can include any behaviours involving unhealthy eating, weight control or weight loss behaviours, such as restricting food intake, taking laxatives, diuretics, or diet pills as well as inducing vomiting (Thogersen-Ntoumani, Ntoumanis, & Nikitaras, 2010). EDSY can also include cognitions that are specific to the ED itself such as beliefs about body shape and weight (Cooper, Rose & Turner, 2006) and more personalised ones such as underlying beliefs about oneself, such as low self-worth or value (Cooper, 2005).

To better understand the nature and trajectory of EDs, it is important to consider the 'driving forces' or psychological processes influencing these behaviours and cognitions. Research has demonstrated that there is a relationship between maladaptive schemas and the severity of the disorder (Meneguzzo et al., 2021). As such careful consideration must be given to the unique psychological processes and cognitive experiences of those with EDs to better understand how these factors influence the severity of the symptoms related to this disorder. Of these cognitive processes, preliminary research has suggested that 94.5% of ED sufferers report the experience of internal self-critical cognitions, compared to only 29.3% in the control group (Noordenbos, Aliakbari & Campbell, 2014). This strikingly high frequency suggests that this cognitive phenomenon is a key feature in this disorder and as such should be a variable considered in further exploration.

Eating disorders and the 'Anorexic voice'

Many individuals who are diagnosed with an eating disorder report the experience of an internal 'voice' as a key feature in their experience (Pugh, Waller, & Esposito, 2018); commonly referred to in the literature as the 'Anorexic voice' (AV) (Pugh & Waller, 2016). The construct of the AV is frequently referenced within clinical literature on eating disorders (Higbed & Fox, 2010; Pugh & Waller, 2016; Tierney & Fox, 2010). Current literature reports that this voice is typically experienced internally as opposed to externally, in a similar way to pseudo hallucinations (Pugh, 2016). The AV is often described by suffers as another entity positively or negatively commenting on actions and behaviours related to diet, shape, and weight (Pugh, 2016).

Although coined as a 'voice', the AV has been differentiated from auditory verbal hallucinations, being described as a both a separate entity and as part of an individual's inner speech (Higbed & Fox, 2010; Williams & Reid, 2012). It has been argued that the concept of the AV is merely a way of conceptualising an individual's thoughts related to their eating disorder (Fairburn, Shafran & Cooper, 1999). However, there is a growing body of research which demonstrates that the AV can be reliably captured and distinguished from other internal thoughts and dialogues (Noordenbos, Aliakbari, & Campbell, 2014), suggesting that it is a distinctive phenomenon (Pugh, 2016). There has also been criticism as to whether the AV is a social construct that has emerged through semantics in clinical practice and research as opposed to individual experience (Maisel, Epston & Borden, 2004). However, there is a growing body of qualitative research which demonstrates that suffers identify this experience prior to input from services (Williams, King & Fox, 2015). Furthermore, from a quantitative perspective current research is ongoing into the reasons how and why the anorexic voice develops, with measures being developed which have demonstrated to be reliable in capturing the voice (Hampshire et al., 2020).

The relationship between the AV and the individual is unique and has been argued to be a powerful maintaining factor in the longevity and severity of symptoms within such disorders (Pugh & Waller, 2016). The experience of the AV itself has been reported as both nurturing and persecutory (Tierney & Fox, 2010) and that the nature of the AV is liable to change over the course of an individual's ED (Aya, Ulusoy & Cardi, 2019). As such it is

considered whether the AV may be one of the primary factors involved in the maintenance and evolvement of EDSY.

It is queried what the presence of this internal AV offers for the individual, and hypothetically it could be assumed to have some function, due to its noted prevalence within this disorder. Voices offer us an internal dialogue, a guiding force, and a sense of companionship (Corstens, Longden & May, 2012). Iudici, Quarato and Neri (2018) stated that voices (non-specific to EDs) can play a relational function that is not fulfilled by the hearer's social network or compensates for the lack of other social contacts. Therefore, it is queried whether the presence of the AV may be to fulfil a need for social connection. By pursuing, engaging with or experiencing this 'internal' relationship more devotedly or frequently, sufferers may achieve a sense of connection, at the detriment of the iatrogenic effects of the ED, as the voice incites engagement in EDSY (Aya, Ulusoy & Cardi, 2019). As such it is important to consider the importance of this connection and the reasons an individual may be more inclined to engage with or experience it, as the frequency of interaction with the AV has been associated with ED severity (Noordenbos, Aliakbari, & Campbell, 2014).

Loneliness and internal dialogues

Loneliness has been defined as a perceived loss or deprivation of social contact (Yanguas, Pinazo-Henandis & Tarazona-Santabalbina, 2018) or an absence of others to connect with emotionally and socially (Roberts & Krueger, 2020). Cumulatively, loneliness is a negative internal experience (Dahlberg, 2007) that has an observed detrimental effect on wellbeing (Hawkins-Elder et al., 2017), physical health (Victor & Yang, 2012) and mental health (Meltzer et al., 2012). Human beings are a social species that rely on cooperation and interaction to survive and thrive ("The cooperative human", 2018). Being isolated and experiencing loneliness for extended periods is distressing, as well as being associated with extensive negative impacts (Schoenmakers, van Tilburg & Fokkema, 2015). In times of loneliness individuals often seek to fulfil this need for social connection by pursuing different coping strategies, which can include exploring various social avenues as well as seeking more internal connection with themselves (Rokach, 2004).

Brinthaupt (2019) considered the broader prevalence of hearing voices within the general population, noting a link between unsatisfactory social circumstances and the increased

presence of an internal dialogue. It has been hypothesised that the internal dialogue could have a constructive function, aimed at providing the otherwise missing social interaction.

Loneliness, eating disorders, and the anorexic voice

This raises the question as to whether interaction with voices within EDs also has a social function or serves to meet a social need of the individual. The theory behind this hypothesis is supported by studies of EDs, where psychologists have found that feelings of loneliness can be a relevant factor in their symptomology (Levine, 2012). Troop and Bifulco (2002) found that women with eating disorders reported higher levels of loneliness than those without eating disorders. McFillin et al. (2012) argued that for many individuals, certain aspects of their anorexia are used to manage and cope with this feeling of loneliness. Furthermore, Arkell and2 Robinson (2008) argued that engaging with the AV, acts as a function to meet social needs 'The illness is a friend who is always there, stopping them from being alone'.

A feature of the AV which is also frequently mentioned in the literature is its propensity to offer views on the intentions of others toward the individual as well as its engulfing relationship with the sufferer (Tierney & Fox, 2010). People with EDs frequently report that the AV suggests that others who attempt to support the individual with their ED are attempting to 'trick them' or 'to make them fat' (Williams, King & Fox, 2015). The chronic cyclical nature of these interactions often results in the individual with the ED withdrawing from social connections through fear and belief that others are 'against them' (Lock et al., 2005). Social withdrawal is hypothesised to result in further loneliness for the individual as they attempt to appease the AV as well as distance themselves from those who may object to it. This may then intensify the drive to meet their social needs by engaging more frequently with the AV and meeting its demands to engage in EDSY, and therefore a feedback loop is created.

Study rationale

This study seeks to explore the relationship between loneliness, the frequency of the AV, and EDSY severity. The theory to be tested is that those who are lonely are more likely to experience the AV more frequently, and in doing so will have more severe EDSY.

The hypotheses are: -

1. Those who reported higher levels of loneliness on the University of Los Angeles Loneliness Scale (UCLA) will score higher on the Eating-Disorder examination questionnaire (EDE-Q) (a measure of eating disorder symptom severity)

2. Those with more frequent experiences of the AV captured on the Topography of voices questionnaire (TOV) will score higher on the EDE-Q measure of eating disorder symptom severity

3. These two independent variables (loneliness (UCLA) and frequency of AV (TOV)) will interact in predicting eating disorder symptom severity (EDQ), i.e. the ability of higher loneliness to predict higher eating disorder symptom severity will be stronger for those experiencing a higher frequency of the AV than those experiencing a lower frequency of the AV.

A better understanding of these associations will further the understanding of the factors involved in the development and maintenance of the AV and EDSY and give insight into possible preventative strategies to reduce their development. Further exploratory analysis in keeping with the main hypotheses and previous research findings will be completed: -

1. Comparing levels of loneliness (UCLA) and ED symptom severity (EDE-Q) in those who experience/don't experience an AV
2. Exploring how specific aspects of loneliness (social versus emotional) and different characteristics of the AV (for example loudness, clarity etc.) relate to ED symptom severity and body mass index (BMI)

Method

Participants

The sample consisted of 165 individuals who accessed online forums relating to eating disorders. Participants ranged in age from 18 – 64 years of age with a mean age of 27.54 years. The sample consisted of 3 Males, 154 Females and 8 individuals who recorded their gender as 'Other'. Regarding country of residence, 98.8% (N=163) of the sample were from a western country, with the remaining 2 participants from Asia. Most respondents (66.6%, N= 110) were from the United Kingdom, (12.1%, N= 20) Canada and the United States of America (10.3%, N= 17).

The inclusion criteria for were any individuals over the age of 18, of any race, gender, nationality who have experienced eating disorder related behaviours, thoughts, or beliefs (Appendix E). This study did not draw its sample from clinical services and as such participants may not have received a clinical diagnosis. This study included both individuals who have experienced an AV in some form and those who have not, with some participants reporting an AV and some not. These were classed as 2 groups for analysis (AV group and Non-AV Group).

A power calculation was conducted using G*power (Faul et al., 2007). It was determined that a sample size of 77 would be required to detect a moderate effect ($f^2 = .15$) for the interaction of interest, assuming a power of .80 and an alpha level of .05.

Ethical approval

Ethical approval for the project was obtained through Cardiff University (Appendix F). Relevant bodies that disseminated the research study also reviewed the questionnaire and approved for this to be shared on their platforms. A risk assessment was also completed via Cardiff University's risk assessment procedures (Appendix G).

Recruitment strategy & procedure

Participants were recruited via online forums and social media platforms (Twitter & Instagram) which promote discussion and interest in this area of research. This was done by contacting relevant platforms who then shared information and links to the survey on their

online forums for potential participants to review study requirements (Appendix H) and further information about the study (Appendix E).

The questionnaire was open between 21st January and 17th December 2021 (See Appendix I for an example of a recruitment post shared on relevant forums). People viewing the survey were provided with additional information before choosing to give consent and complete the questions (Appendix J). The survey included questionnaires relating to: -

- Demographic information (sex, age, location)
- Experiences of the AV, ED symptom severity, and loneliness (Table 1)

Participants were provided with a debrief statement after completing the survey and were given information on sources of support should these be required (Appendix K). Data was collected at a singular time point and was collected via the platform Qualtrics.

Specific methods and measurements

To investigate the above hypotheses, measures were selected (Table 1), which were deemed to be commensurate with the focus of the study. Measures were selected for their reliability, validity, usability, and robustness in capturing the discussed concepts. For measures which included multiple subscales, Cronbach's alpha was calculated between subscales to assess the internal consistency of the measures in relation to the degree to which each subscale contributed to the overall construct captured by the measure. Scores of internal consistencies were also compared to those cited within the literature.

The Beliefs about Voices Questionnaire (BAVQ-R; Chadwick, Lees & Birchwood, 2000) and the Topography of voices rating scale form (TOV; Hustig & Hafner, 1990) were both originally developed for capturing the experiences of auditory hallucinations. They were selected for use in this study as the constructs they capture are commensurate with the aims of this research i.e., capturing the experience of internal dialogues. Furthermore, relevant research within this field (Pugh & Waller, 2016) has utilised the BAVQ-R, and found it to be an efficacious tool to capture the experience of the AV.

Table 1

Psychometrics utilised to capture and conceptualise the constructs of the experience of the AV, loneliness, and severity of EDSY

Experience of AV

Name of measure	Reference	Description of measure	Subscales	Internal consistency of measures (From current literature)	Internal consistency of measures within current data set [1]
Topography of voices rating scale form (TOV)	(Hustig & Hafner, 1990)	A 5-item rating scale measuring the topographic features of the AV	**5 Subscales** • Frequency (F) • Loudness (L) • Clarity (CL) • Distressing (D) • Controlling (CT)	Cronbach's alpha: Global score = .92.	Cronbach's alpha: Global score = .85, F = .79; L = .77; CL = .83; D = .87, CT = .83
The Experience of an Anorexic VoicE Questionnaire (EAVE-Q)	(Hampshire et al., 2020)	An 18-item measure of eating disorder symptoms, mood, and quality of life in relation to the AV	**1 Global score & 5 subscales** • Benefits of adherence (B) • The compassionate AV (C) • Turning away from others (T) • Externalising the AV (E) • Dominated by the AV (D)	Cronbach alpha: Global score = 0.83; B = .81; C = .85; T = .78; E = .77; D = .70.	Cronbach alpha: Global score = .75; B = .68; C = .68; T = .73; E = .74; D = .74.
The Beliefs about Voices Questionnaire (BVAQ-R)	(Chadwick, Lees & Birchwood, 2000)	A 35-item measure of people's beliefs about auditory hallucinations, and their emotional and behavioural reactions to them.	**4 Subscales** • Persecutory (P) • Benevolence beliefs (B) • Engagement (E) • Resistance (R)	Cronbach alpha: P = .79; B = .88, E = .87; R = .85.	Cronbach alpha: Global score = 0.71 P = .71; B = .62, E = .70; R = .52.

Loneliness

Name of measure	Reference	Description of measure	Subscales	Internal consistency of measures (From current literature)	Internal consistency of measures within current data set [1]
University of California, Los Angele Loneliness scale (UCLA Version 3)	(Russell, 1996)	A 20-item scale designed to measure one's subjective feelings of loneliness as well as feelings of social isolation.	**1 Global score**	Cronbach alpha: Global score = 0.84	Cronbach alpha: Global score = 0.82
The De Jong Gierveld short scales for emotional and social loneliness	(De Jong Gierveld & Van Tilburg, 2010)	Two three-item questionnaires exploring the concepts of social loneliness and emotional loneliness.	**1 Global score & 2 subscales** • Emotional Loneliness (EL) • Social Loneliness (SL)	Cronbach's alpha: Global score = .70 - .76; EL = .67 to .74; SL =.70 to .73.	Cronbach's alpha: Global score = .89

Eating disorder symptom severity

Name of measure	Reference	Description of measure	Subscales	Internal consistency of measures (From current literature)	Internal consistency of measures within current data set [1]
Eating Discorder examination questionnaire (EDE-Q 6.0)	(Fairburn & Beglin, 2008)	A 28-item questionnaire exploring eating disorder-related behaviours and thoughts over the last 28 days.	**1 Global score & 4 subscales** • Restraint concern (RC) • Eating concern (EC) • Shape concern (SC) • Weight concern (WC)	Cronbach's alpha: EDE-Q = .96; RC = .92; EC = .80; WC = .83; SC = .92	Cronbach's alpha: Global score = .91; RC = .90; EC = .88; WC = .88; SC = .87

Note. [1] Cronbach's alpha displayed for subscales represents internal consistency of measure if subscale variable was deleted

Analysis

Data cleaning and profiling (AV Group & Non-AV Group)

Step 1: All raw data was examined and cleaned, removing incomplete and invalid data sets and data sets including extreme outliers or erroneous data points[4] which may bias the analyses.

Primary analysis – Hypotheses 1 -3 (AV Group only)

Step 2: Correlational analyses examined associations among ED symptom severity, loneliness, and frequency of the AV. These were used to consider broad patterns in the findings and review whether data met the necessary assumptions for multiple regression analyses.

Step 3: Linear simultaneous multiple regression analyses were used to test whether levels of loneliness and the frequency of the AV explained variance in ED symptom severity above and beyond either predictor variable alone. This acted as a baseline to compare in relation to the interaction analysis (Step 4).

Step 4: To determine whether there is an interaction between loneliness and AV frequency in predicting ED symptom severity, the two predictors were entered into a regression model individually and as an interactive term (loneliness x AV frequency).

Exploratory analysis (AV Group & Non-AV Group)

Step 5: Independent sample T-tests were used to assess whether there was any significant group difference on measures of 'ED symptom severity', 'BMI' and measures of 'loneliness' between those with an AV (AV Group) and those without (Non-AV Group).

Step 6: Correlational analyses were used to examine further associations among all constructs and measures utilised to explore patterns within the data and inform further regression analysis.

[4] Extreme outliers or erroneous data points were defined as data points which lay 1.5 *IQRs below the first quartile or above the third quartile (Aguinis, Gottfredson & Joo, 2013).

Step 7: Simultaneous multiple regression analyses were again used to further explore whether subtypes of loneliness and other characteristics of the AV predict ED symptom severity.

Step 8: To determine whether there was an interaction between any of the exploratory variables, if significant in the prediction model, the two predictors would be entered into a regression model individually and as an interactive term.

Results

Respondents were split into two independent groups. Individuals who reported currently experiencing an AV (AV Group) and respondents who did not or who had never experienced an AV (Non-AV Group).

Subjects in the AV Group had a mean age of 27.84 years, consisting of 131 Females, 3 males and 7 individuals who associated as 'Other' gender; the mean BMI was 20.73.

Subjects in the Non-AV Group had a mean age of 26.87 years, consisting of 22 Females, 0 males and 1 individual who associated as 'Other' gender; the mean BMI was 21.79.

Confirmatory analyses addressed hypotheses regarding the AV, and as such only examined subjects from the AV Group.

Correlational analyses

Pairwise correlations were conducted between all variables to examine associations between eating disorder symptom severity, loneliness, and frequency of the AV. Data was found to meet parametric assumptions (normality, etc.) and as such Pearson's correlations were calculated. There was a significant positive correlation between all variables (Table 2).

Table 2

Pearson's correlation coefficients between primary variables (AV Group only)

	Frequency	EDEQ global score	UCLA (Total score)
Frequency	-	-	-
EDEQ global score	.604*	-	-
UCLA (Total score)	.341*	.356*	-

*Note. * Correlation is significant at the 0.001 level (2-tailed)*

Confirmatory analyses

Hypotheses 1 and 2

The preliminary correlational analysis confirmed the independence of the independent variables with a Pearson's correlation coefficient ($r = .341$, $p < .001$). Data was also inspected for other regression assumptions and was found to meet the assumptions for a regression analysis. These included (1) The dependant variable was measured on a continuous scale (2) Both independent variables were continuous (3) There was an independence of residuals (4) There was a linear relationship between the dependant variable and both independent variables (5) The data demonstrated homoscedasticity (6) The data did not show multicollinearity (7) There were no significant outliers (8) The residuals were approximately normally distributed.

Simultaneous multiple regression analyses were used to test whether the severity of loneliness and frequency of the AV was related to ED symptom severity above and beyond the influence of either variable alone (Appendix L). Hence to test whether the frequency of the AV and the severity of loneliness experienced determines eating disorder symptom severity, in which those who are most lonely and experience the highest frequency of the AV will have significantly higher eating disorder symptom severity scores.

Within the model, the independent variables (Frequency of AV and loneliness) cumulatively explain 39% (R^2) of the variability in the dependent variable (severity of eating disorder symptoms). Singularly the variables predicted the variability of the dependant variable (severity of eating disorder symptoms), by 36% (R^2) (frequency of AV) and 13% (R^2) (loneliness). The F ratio implies that the overall combined regression model is a good fit for the data. Hence the independent variables statistically significantly predict the dependent variable (F (2, 141) = 44.43, $p < .001$).

Unstandardised coefficients indicated how much the dependent variable varies with the independent variables when all other independent variables are held constant:

- As loneliness increases by 1 unit, severity of EDSY increases by .016
- As the frequency of AV increases by 1 unit, severity of EDSY increases by .605

The coefficients of both independent variables were statistically significantly different from 0: Loneliness (t = 2.39, p<.05) and Frequency (t = 7.76, p<.001).

Finally, the multiple regression was run to predict the severity of eating disorder symptoms (EDE-Q) from Frequency of AV (Captured on the Topography of Voice Questionnaire) and Loneliness (UCLA). These variables statistically significantly predicted the severity of eating disorder symptoms (EDE-Q) **F (2, 140) = 44.425 p < .001, R^2 = .39.** Both variables added statistically significantly to the prediction, p < .05.

Hypothesis 3

An interaction analysis was conducted to determine whether there was an interaction between the two predictor variables in predicting variance in ED symptoms. The interaction between loneliness and frequency of the AV was entered as a third predictor variable in addition to the original independent variables (loneliness and frequency of AV). The analysis revealed that there was not a significant interaction effect between loneliness and frequency of the AV on ED symptom severity (*p* =.733).

Therefore, Hypothesis 3 was not supported. The frequency of the AV and levels of loneliness add statistically significantly to the severity of eating disorder behaviours, however, the interaction of the two variables was not significantly greater than the cumulative effect of the two independent variables.

Exploratory analyses

Further exploratory analysis was completed to consider other findings within the data (Table 3, Table 4, Table 5, Table 6, Table 7).

Comparison between AV group & Non-AV group

Table 3

The outcomes from independent samples t-test conducted between AV Group and Non-AV group on the primary variables

Variable	Independent samples T-test
BMI	t (163) = .984, p = .326.
EDEQ Total Score	t (163) = -5.585, p < .001.
Restraint Subscale	t (163) = -5.626, p < .001.
Eating Concern Subscale	t (163) = -3.601, p < .001.
Shape Concern Subscale	t (163) = -5.922, p < .001.
Weight Concern Subscale	t (163) = -5.163, p < .001.
UCLA	t (163) = -1.62, p = .107
Emotional loneliness (De Jong)	t (163) = -.99, p = .320
Social loneliness (De Jong)	t (163) = -.124, p = .902.

Analysis showed that between the AV and Non-AV groups there was no significant difference in mean scores on BMI (t (163) = .984, p = .326) and loneliness on both UCLA (t (163) = -1.62, p = .107**)** and De Jong Scales of "emotional loneliness" (t (163) = -.99, p = .320) and "social loneliness" (t (163) = -.124, p = .902) (Table 3).

Analysis showed that ED symptom severity, as measured by the total EDE-Q score, was significantly higher in the AV Group (Mean: 4.53) than in the Non-AV Group (Mean: 3.08) *(*t (163) = -5.585, p < .001). All the EDE-Q subscales were significantly higher in the AV Group, indicating higher restrained, eating concern, shape concern, and weight concern (Table 3).

Correlational analyses

Pairwise correlations were conducted between and within exploratory variables to examine associations between measures of similar constructs and subscales of measures (Table 4, Table 5, Table 6, Table 7). Data was found to meet parametric assumptions (normality, etc.) and as such Pearson's correlations were calculated.

Table 4

Pearson's correlation coefficients between variables of loneliness

	Emotional loneliness (De Jong)	**Social loneliness (De Jong)**	**UCLA (Total score)**
Emotional loneliness (De Jong)	-	-	-
Social loneliness (De Jong)	.795*	-	-
UCLA (Total score)	.601*	.772*	-

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

Table 5

Pearson's correlation coefficients between subscales of the TOV

	Frequency	**Loudness**	**Clarity**	**Distress**	**Controlling**
Frequency	-	-	-	-	-
Loudness	.761*	-	-	-	-
Clarity	.556*	.637*	-	-	-
Distress	.395*	.538*	.339*	-	-
Controlling	.640*	.649*	.500*	.305*	-

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

Table 6

Pearson's correlation coefficients between subscales of the BVAQ-R

	Persecutory	**Benevolence**	**Engagingness**	**Resistance**
Persecutory	-	-	-	-
Benevolence	.271*	-	-	-
Engagingness	-.008	.673*	-	-
Resistance	.608*	.454*	.396*	-

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

Table 7

Pearson's correlation coefficients between subscales of the EAVE-Q

	EAVE-Q Total	**EAVE-Q B**	**EAVE-Q C**	**EAVE-Q T**	**EAVE-Q E**
EAVE-Q Total	-	-	-	-	-
EAVE-Q B	.753**	-	-	-	-
EAVE-Q C	.782**	.657**	-	-	-
EAVE-Q T	.556**	.196*	.230**	-	-
EAVE-Q E	.484**	.052	.159	.222**	-
EAVE-Q D	.508**	.160	.188*	.300**	.196*

Note. EAVE-Q (B) Benefits of adherence (C) Compassionate AV (T) Turning away from others (E)
Externalising the AV (D) Dominated by the AV
*** Correlation is significant at the 0.01 level (2-tailed)*
** Correlation is significant at the 0.05 level (2-tailed)*

Exploratory interaction analyses

Further simultaneous multiple regression analyses (Table 8) were completed to test whether other measures of the same constructs uniquely predicted variance in ED symptom severity. Interaction effects were calculated only when both predictor variables were independently predictive of the outcome. All interaction effects were non-significant, although it was noted that the 'Engagement' subscale of the BVAQ-R approached significance (p = .089).

Table 8

Hierarchical multiple regression analyses completed to explore the impact of other variables on the severity of EDSY

DV	IV 1				IV2				Linear multiple regression	Interaction effect
		ß	*t*	*p*		*ß*	*t*	*p*		
Severity of EDSY	Frequency[1]	.655	.861	*p*<.001	EL (De Jong)	.031	.835	*p* = .88	F (2, 140) = 40.53 p < .001, R^2 = .368	-
Severity of EDSY	Frequency[1]	.644	.835	*p*<.001	SL (De Jong)	.041	1.21	*p* = .23	F (2, 140) = 41.06 p < .001, R2 = .371	-
Severity of EDSY	Loudness	.529	7.35	*p*<.001	UCLA	.016	2.39	*p*<.05	F (2, 140) = 40.89 p < .001, R2 = .370	*p* =.857
Severity of EDSY	Clarity	.485	6.89	*p*<.001	UCLA	.024	3.56	*p*<.001	F (2, 140) = 36.97 p < .001, R2 = .349	*p* =.317
Severity of EDSY	Distress	.362	3.42	*p*<.001	UCLA	.028	3.72	*p*<.001	F (2, 140) = 16.69 p < .001, R2 = .195	*p* =.327
Severity of EDSY	Controlling	.441	6.53	*p*<.001	UCLA	.021	2.85	*p*<.005	F (2, 140) = 34.445 p < .001, R2 = .331	*p* =.322
Severity of EDSY	BVAQ-R (P)	-.064	-3.79	*p*<.001	UCLA	.033	4.49	*p*<.001	F (2, 140) = 18.314 p < .001, R2 = .210	*p* =.216
Severity of EDSY	BVAQ-R (B)	.031	1.23	*p* = .23	UCLA[1]	.032	4.15	*p*<.001	F (2, 140) = 11.006 p < .001, R2 = .138	-
Severity of EDSY	BVAQ-R (E)	.051	3.01	*p*<.005	UCLA	.031	4.24	*p*<.001	F (2, 140) = 15.339 p < .001, R2 = .182	*p* =.089
Severity of EDSY	BVAQ-R (R)	<.001	.021	*p* = .98	UCLA[1]	.034	4.42	*p*<.001	F (2, 140) = 10.031 p < .001, R2 = .127	-
Severity of EDSY	EAVE-Q Total	.033	4.95	*p*<.001	UCLA	.027	3.69	*p*<.001	F (2, 140) = 24.338 p < .001, R2 = .261	*p* =.261
Severity of EDSY	EAVE-Q (B)	.055	3.29	*p*<.001	UCLA	.032	4.41	*p*<.001	F (2, 140) = 16.121 p < .001, R2 = .189	*p* =.541
Severity of EDSY	EAVE-Q (C)	.034	1.74	*p* = .85	UCLA[1]	.033	4.41	*p*<.001	F (2, 140) = 11.823 p < .001, R2 = .146	-
Severity of EDSY	EAVE-Q (T)	.093	3.22	*p*<.005	UCLA	.026	3.35	*p*<.001	F (2, 140) = 16.096 p < .001, R2 = .189	*p* =.166
Severity of EDSY	EAVE-Q (E)	.034	1.44	*p* = .15	UCLA[1]	.035	4.59	*p*<.001	F (2, 140) = 11.307 p < .001, R2 = .141	-
Severity of EDSY	EAVE-Q (D) [1]	.207	7.41	*p*<.001	UCLA	.012	1.69	*p* = .10	F (2, 140) = 42.114 p < .001, R2 = .379	-
BMI	Frequency	-.526	-1.07	*p* = .29	UCLA[1]	-1.07	-2.51	*p*<.05	F (2, 140) = 5.253 p < .05, R2 = .070	-

Note. All preliminary analysis of the variables met the threshold for multicollinearity of the independent variables
N.S. = non-significant. [1] *Demonstrates which variable was uniquely predictive of the DV when only one variable added significantly to the prediction*
Interaction effects were only calculated when both variables added statistically significantly to the prediction, p < .05.
EL Emotional Loneliness Scale (De Jong), SL Social Loneliness Scale (De Jong), BVAQ - (P) Persecutory, (B) Benevolence, (E) Engagement, (R) Resistance
EAVE-Q (B) Benefits of adherence (C) Compassionate AV (T) Turning away from others (E) Externalising the AV (D) Dominated by the AV

Discussion

Main findings of the study

In line with the study's first two hypotheses, the analyses found that:

1. Those with higher loneliness demonstrated significantly higher eating disorder severity
2. Those with more frequent experiences of the AV demonstrated higher eating disorder severity

Hypothesis 3 was not supported, as the interaction of the two predictor variables did not explain any variance in ED symptom severity beyond that already predicted by the two variables separately.

Loneliness and ED symptom severity

Like findings of the previous research discussed (Levine, 2012; McFillin et al., 2012), this study found that there was a positive correlation between the degree of loneliness and ED symptom severity. Despite a significant prediction being found, this only accounted for a small amount of variability in eating disorder symptom severity.

Further exploratory analysis was completed which considered the impact of other standardised measures of loneliness (Social and Emotional Loneliness captured via De Jong Gierveld & Van Tilburg (2010)). Neither of these alternative measures added statistically significantly to the prediction of the severity of the eating disorder symptoms independently. Within measures, this is likely to be due to these two subscales of loneliness being highly correlated i.e., multicollinearity between constructs of social and emotional loneliness measured on the De Jong (De Jong Gierveld & Van Tilburg, 2010). In terms of construct validity between measures of loneliness, previous research (Grygiel, Humenny & Rębisz, 2016) has argued the reliability, stability, and external validity of the De Jong in capturing this concept amongst a similar cohort. It is then theorised that perhaps social or emotional loneliness may be a temporary predisposing factor in this presentation but may not be a consistent perpetuating factor throughout. Broader experiences of loneliness as captured on the UCLA may be more pertinent throughout an ED's trajectory, hence the discrepancy in these outcomes. This theory is explored within 'Interaction of Loneliness and the AV'.

The AV and ED symptom severity

In line with previous research discussed (Noordenbos, Aliakbari & Campbell, 2014), this study found that the frequency of the AV significantly predicted ED symptom severity, with the frequency of AV accounting for variability in ED symptom severity. This outcome aligns with previous research which argued that the AV is a factor in the severity of such disorders (Pugh & Waller, 2016).

This finding is consistent with the theory that increased AV frequency leads to heightened ED symptom severity; however, as the analysis was run on data collected at a single time-point, testing the causality of this effect over time would require a controlled longitudinal design. Furthermore, this outcome only considers 'frequency' alone, as opposed to any relational measure of the AV or any consideration of the nature of the AV. For example, an AV could be considered high-frequency but comforting, as opposed to a low-frequency AV which is abusive and controlling. Further research would be needed to consider whether other relational aspects are impactful on the eating disorder symptom severity. See *'Interaction of Loneliness and the AV'* for further consideration of this.

Interaction of loneliness and the AV

Findings from this study demonstrate that the frequency of the AV and levels of loneliness add statistically significantly to the severity of eating disorder symptoms, which is in line with the theory from which this hypothesis was developed. However, the interaction of the two variables was not significantly greater than the cumulative or singular effect of the two independent variables alone. This implies that despite these two variables being impactful on the severity of eating disorder symptoms, the unique relationship between them is not likely to be the factor that predominantly increases the severity of eating disorder symptoms. From exploring these findings there are several rationales as to why the relationship between these two factors (frequency of the AV and loneliness) is not more impactful than either variable alone.

A possible reason behind why the null hypothesis was found concerning hypothesis 3 is an error in interpreting the theory behind this relationship. As discussed, for many individuals increased engagement with the AV may have a function in reducing feelings of loneliness. It

could be hypothesised that initially when the relationship with the AV commences levels of loneliness may be high. However, as this relationship continues, it is possible that levels of loneliness may plateau or even reduce as the relationship with the AV develops further. As discussed, sufferers have often referenced the AV as 'a friend who is always there, stopping them from being alone'; with this in mind, it is possible to consider whether there is another variable other than 'frequency' that is mediating this relationship. This rationale considers the trajectory of the unique relationship of these factors as part of ED presentation, as opposed to considering these as a static phenomenon. It is noted that the AV is liable to change over the course of an individual's eating disorder (Aya, Ulusoy & Cardi, 2019). Facets of the AV changing over a period suggest that there are more relational factors that must be considered in better understanding this relationship. For example, reviewing voice-hearing experiences in psychosis, Pilton et al. (2016) found that there was the potential to alleviate voice-related distress by fostering secure attachments with others and varying attachment patterns. Although voice-hearing associated with psychosis may differ from that of the AV, it would be commensurate to consider whether attachment styles are relevant to the relationship between the individual and their AV.

The Beliefs about Voices Questionnaire (BVAQ-R) (Chadwick, Lees & Birchwood, 2000) is a 35-item measure of people's beliefs about auditory hallucinations, and their emotional and behavioural reactions to them. This measure was utilised within this research to consider some of the exploratory hypotheses discussed. Within the exploratory analysis it was highlighted that although not statistically significant, the interaction effect of loneliness, engagingness of the AV, and the severity of eating disorder symptoms approached significance. Hypothesis-driven research on clinical populations could clarify whether this interaction exists; in the current study, this result arose in the context of multiple exploratory analyses without statistical corrections, and therefore may have arised by chance.

Items used to capture the construct of 'engagingness' in the BVAQ-R include 'My Voice reassures me' and 'My Voice makes me feel happy'. Higher scores on these items would imply that the individual views the connection with their AV as a positive one, depicting a nurturing and supportive interpersonal relationship. In line with the considerations above, it is considered whether those who are more lonely, due to their desire to reduce the distress associated with this, initially seek this engaging and supportive interpersonal relationship as a means of reducing this negative experience. Short term, this relationship may meet this need,

however, as discussed it is important to consider that eating disorders are not a static phenomenon. Longer-term loneliness may reduce as the interpersonal relationship strengthens, but iatrogenically the severity of eating disorder symptoms could increase as the individual becomes more relationally invested with the AV. Future research into the association between loneliness and experiences of a more engaging AV and the influence on eating disorder symptom severity would be valuable.

Clinical implications of the study

In terms of working clinically with individuals with ED presentations, this research adds to the evidence base behind current models for intervening with this cohort. These models consider the influence of the AV on ED symptom severity (Waller et al., 2007). Clinicians should continue to query experiences of the AV when exploring EDSY with individuals to consider its impact within their unique discourses. On a broader level, although from this research it is not possible to determine the causation behind this link, exploratory findings highlighted a queried influence of the interaction between 'engagingness' of the AV and loneliness on the severity of EDSY (which approached statistical significance). This raises hypotheses about the social function of the AV. If the interpersonal relationship with the AV were to hold a social function, consideration must be given as to how interventions could be developed to support individuals to meet this need for connection via other more positive avenues. Further research is needed to investigate whether this link exists and, if so, to consider how relational work could be integrated into therapeutic interventions.

This study contributes to the existing literature and is consistent with previous findings which report the influence of loneliness on EDSY severity (Arkell & Robinson, 2008; Levine, 2012; McFillin et al., 2012; Troop & Bifulco, 2002). Feeding this back into the evidence base helps to further inform clinical practice of the importance of meeting unmet needs regarding social contact and/or social engagement within this population. Clinically it could be considered whether preliminary support systems could be influential in decreasing levels of loneliness for individuals who may be clinically vulnerable or displaying early signs and symptoms of EDs. This in turn may be influential in reducing the risk of the development of EDs and has the potential to reduce pressures on acute services. Furthermore, consideration could be given to the exploration of other potential mediators influencing the interaction between loneliness and EDSY severity. For example, Cauberghe et al. (2021) considered how

the use of social media to cope with feelings of loneliness was influential on the severity of disordered eating (Cherikh et al., 2020). Should loneliness lead to increased social media use, it is possible that an individual may then develop a desire for a more 'socially acceptable' appearance. This could lead to increases in appearance-related social media behaviours, which have been found to be indicative of eating disorder risk (Lonergan et al., 2020). Reducing the impact of loneliness and relevant mediators could be achieved on a clinical level by prescribing or offering more social support opportunities in primary services. On a broader level, findings could be fed back into the research field to inform further studies and provide guidance on how to promote social wellbeing in the general population.

Limitations of the research

Several limitations must be considered when drawing any meaningful outcomes from these findings, some of which have been discussed above in relation to the interpretation of the outcomes.

A key limitation of this research is that the data set represents a fully self-reported analysis of participants' experiences. Individuals are often biased when reporting their own experiences (Devaux & Sassi, 2015) with feedback more likely to be influenced consciously or unconsciously by social desirability. Furthermore, given the nature of the AV (Accusatory and suspicious) (Holmes, Malson & Semlyen, 2021), it is plausible to consider the 'view of the voice' on the purpose of the research, and whether this may be influential on the provided answers. Mitigating this limitation is both practically and theoretically difficult, given that the AV is a subjective experience, as such it would be impossible to fully capture it via anything other than a self-report measure. However, if this research were to be repeated it would be beneficial to consider whether guidance from experts by experience could be used to explore the most appropriate way to capture this experience.

Another limitation of this study is its generalisability, as the sample was limited by certain factors. Firstly, as the sample was not a clinical one, it is not possible to generalise these findings to 'eating disorders' rather, it relates to those with 'eating disorder symptoms'. Furthermore, this study could have been advanced by participants whether they self-identified as having eating disorder of some kind, which could have provided further insight within the outcomes. However, as previously discussed, there is an argument regarding the reliability and

validity of the diagnosis of EDs and thought given as to the reliability of stipulating a formal diagnosis to participate in future research. Although this limits this study's influence upon formal diagnosis, it gives a powerful insight into the possible trajectory of EDs in the community as well as insight into possible rationales for engagement with the AV, as a function to meet social needs and reduce the negative impact of loneliness. Secondly, the sample is underrepresented by males as well as those from non-western ethnicities. Although the research did not exclude these populations it is of note that limited data was captured from these groups. As such the generalisability of findings to these groups must be considered as well as exploring rationales for the constitution of this sample, and future avenues to broaden data collection if relevant.

Further research

Across the evaluation of this work, several further avenues for research have been considered. Of those mentioned, the following are the most pertinent concerning these findings.

1. Research into the impact of 'Engagement' with the AV – There is evidence to suggest that the factor of 'Engagingness' of the AV could be influential on the relationship between loneliness and eating disorder symptom severity. It would be advantageous to consider this further due to the limitations of the current analyses to draw more consequential conclusions from the interaction effect.

2. As discussed, an ED presentation is not a static phenomenon, and therefore cross-sectional research such as this only offers insight into this relationship but does not inform us about causation between variables, merely their relationships at a static point in time. Longitudinal research into the influence of loneliness, the AV and the severity of eating disorder symptoms would be beneficial in understanding the trajectory of this relationship as well as other potential mediators within this relationship. This is likely to enhance the development of interventions as well as the consideration for preventative strategies and targeted interventions.

3. In terms of developing current interventions and guidelines for those with eating disorder related presentations, research into the integration of relationship enhancement strategies

into interventions would be beneficial. To review whether this is impactful on not only rates of recovery but also in relation to reducing the incidence of relapse should an individual experience times of loneliness again in the future.

4. In general, further research into this population must consider the implications of only utilising 'clinical samples' within the development of guidelines and interventions. There are several issues about the validity of these diagnoses and narrowing research to this is likely to result in the wider presentations of this disorder being missed as well as the breadth of the trajectory of these disorders.

Conclusions

This study has highlighted the link between experiences of loneliness and the AV in individually predicting the severity of EDSY. From this research alone, it is not possible to report that there is an interaction of these two variables in predicting the severity of an ED more significantly than the influence of either variable alone. However, it has offered insight into some possible drivers behind engagement with the AV, as well as the broader trajectory of Loneliness and the AV as part of an eating disorder presentation. Further research would be beneficial to consider the relational connection to the AV by the individual as well as other mediators in the relationship between loneliness, the AV and ED symptom severity.

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Appendices

Appendix A: Author guidelines for The British Psychological Society's – Psychology and Psychotherapy – Theory, Research and Practice

1. SUBMISSION

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Once the submission materials have been prepared in accordance with the Author Guidelines, manuscripts should be submitted online at http://www.editorialmanager.com/paptrap

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- Review papers: 6000 words
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- **Effect size:** In normal circumstances, effect size should be incorporated.
- **Numbers:** numbers under 10 are spelt out, except for: measurements with a unit (8mmol/l); age (6 weeks old), or lists with other numbers (11 dogs, 9 cats, 4 gerbils).

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Author Guidelines updated 28th August 2019

Appendix B. Search terms used within PsychInfo, Medline and APA databases

1. exp Loneliness/
2. lonel*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh]
3. isolated.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh]
4. isolation.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh]
5. secluded.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh]
6. seclusion.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh]
7. remoteness.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh]
8. solitude.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh]
9. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8
10. exp College Students/
11. postgraduate students/
12. graduate students/
13. undergraduate*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh]
14. postgraduate*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh]
15. higher education.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh]
16. (university* adj2 student*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh]
17. freshman.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh]
18. fresher*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh]

19. 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18
20. exp Mental Health/
21. exp Mental Disorders/
22. exp Anxiety/
23. depress*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh]
24. mental wellbeing.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh]
25. mental well being.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh]
26. 20 or 21 or 22 or 23 or 24 or 25
27. Students/ and Universities/
28. 19 or 27
29. 9 and 26 and 28

Appendix C. Email correspondence following request for data from Zawadzki, Graha & Gerin (2013)

From: Matthew Zawadzki <mzawadzki@ucmerced.edu>

To: Mary-Jane Wheeler <WheelerM5@cardiff.ac.uk>
Subject: RE: Meta-Analysis Enquiry

Dear Mary-Jane,

Again, my apologies on the delay. Please let me know if you need any other information. And good luck with the meta.

Matthew

BDI & UCLA

- *n* = 300
- *r* = .559

From: Mary-Jane Wheeler <WheelerM5@cardiff.ac.uk>

To: Matthew Zawadzki <mzawadzki@ucmerced.edu>
Subject: Re: Meta-Analysis Enquiry

Hi Matthew,

Many thanks for your reply and support in relation to the meta-analysis I am currently completing.

Thank you so much also for your offer of running the correlations in relation to the variables I am exploring. We are looking for a Pearson's correlation between the measures of the BDI and the UCLA used within your study/data set, if this would be possible?

Many thanks again, your support is greatly appreciated.

Mary-Jane

Mary-Jane Wheeler
Trainee Clinical Psychologist
Doctoral Programme in Clinical Psychology, Cardiff University
11th Floor, Tower Building, 70 Park Place, Cardiff CF10 3AT

Seicolegydd Clinigol dan Hyfforddiant
Rhaglen Doethurol mewn Seicoleg Glinigol, Prifysgol Caerdydd
11fed Llawr, Adeilad y Tŵr, 70 Park Place, Caerdydd CF10 3AT

Appendix D. Post hoc analysis of 'key papers' and 'satisfactory papers' utilizing Hedges-Olkin method for meta-analyses

The Hedges-Olkin method (Hedges & Olkin, 2002) method was used to calculate the (1) total fixed effects (2) total random effects (3) effect size (4) precision of the estimate (95% CI) of the combined Pearson's correlation coefficients of all studies that met the threshold for being 'Key papers' or 'Satisfactory papers' from the QuADS checklist (Harrison, Jones, Gardner & Lawton, 2021) (N=15). Papers deemed as 'unsure whether the paper should be included' (scores below 37.5% as graded by the QuADS) were excluded.

The total random-effects model was selected as a large sample size was achieved and studies within the analysis varied in terms of their methods and participants (Higgins & Thompson, 2002). The total random-effects model analysis showed that there was a significant positive correlation between variables of loneliness and depression across the primary studies (g = .551, (CI 0.494 to 0.611) $p < .001$).

Post hoc analysis removing the papers marked as 'unsure whether paper should be included' (Ouellette & Joshi, 1986; Gould 1982), demonstrated that removing these from the meta-analyses did not significantly differ ($Z_{observed} \pm 1.89 > .005$) from outcomes of the primary findings of this study which included these papers. (g = .533, (CI 0.469 to 0.591) $p < .001$).

Appendix E. Study participation Information sheet

INFORMATION SHEET

An exploration of the relationship between loneliness, the severity of eating disorder related symptoms and the experience of the 'anorexic voice'

By Mary-Jane Wheeler, Professor John Fox, Dr Marc Williams

This research study is interested in exploring the relationship between experiences of loneliness, eating disorder related behaviours and experiences of the 'anorexic voice'. There is little research at current that explores the link between these three factors. As such, we think it is important to explore the impact that experiences of loneliness have, so that we can develop a better understanding of the trajectory of eating disorder related symptoms and also the experience of the anorexic voice.

The research project is being conducted by Mary-Jane Wheeler (Trainee Clinical Psychologist at Cardiff University), Professor John Fox and Dr Marc Williams who are both Clinical Psychologists.

You are being provided with this information as we would like to invite you to take part in this study. The information is provided so you can make a decision on whether to participate. Participation is voluntary, there is no pressure to be involved. If you do decide to take part you can change your mind at any time and leave the study, without having to provide a reason.

Please take your time to read this information and consider this in relation to your decision whether to take part in this research. If you have any questions about completing this research prior to your participation please get in contact with the

lead researcher who will be able to provide you with further information and guidance in relation to this project (contact details are available below). There will also be the opportunity to ask any further questions after completion of the research should you wish to partake.

What is the aim of the project?

This project aims to explore the link between individuals feelings of loneliness, their relationship with their anorexic voice, and the severity of their eating disorder related behaviours. It is hoped that findings from this research will help us to better understand this relationship and support the development of support systems for those experiencing an 'anorexic voice'.

What do we mean by the 'Anorexic voice'?

One commonly reported experience for those who struggle with disordered eating is the "Eating disorder voice," or the "Anorexic voice". This "voice" is the internal dialogue or self-talk that can be critical of one's eating, appearance, body weight and shape, and may encourage someone to engage in behaviours such as restriction, purging, or exercise. This internal voice can be experienced as an 'inner bully' that is nagging and demanding. Equally, some might experience the voice as something positive that they value.

Please note: You do not need to have experienced an 'anorexic voice' in any form in order to take part in this study. You also do not need to have received a formal diagnosis of an eating disorder at any time to take part in this study.

What will the research project involve?

After reviewing this 'Participant information sheet', you will be asked to whether you would like to take part in this research project. Consent will be requested via a 'Participant Consent Form', which is available on the next page.

You will then be asked to complete an online questionnaire which will take around 20-25 minutes to complete. Questions will focus on your experiences of loneliness, eating disorder related behaviours and also expereince of an 'anorexic voice'. There will be set questions but there will be an opportunity provided to discuss areas that may be important in understanding your individual experience.

If at any time during the completion of this questionnaire you decide you do not want to continue, you do not have to provide a reason.

Following completion of this questionnaire you will then be provided with a debrief about the study and will be provided with further details should you wish to discuss your involvement in the study further or have any additional questions. You will also be provided with details of third sector services who are able to provide additional support in the areas discussed should you experience any distress as a result of completing the questionnaires.

Who is invited to take part in this project?

To take part in this study we are inviting individuals who are aged 18 or over, of any race, gender or nationality who have experienced eating disorder related behaviours, thoughts or beliefs. You do not need to have experienced an 'anorexic voice' in any form in order to take part in this study. You also do not need to have received a formal diagnosis of an eating disorder at any time to take part in this study.

Will my participation be confidential and anonymous?

The information that you provide will kept confidential. No one other than myself (Mary-Jane Wheeler, Trainee Clinical Psychologist) will know that you have provided specific information.

In relation to any written feedback provided in relation to your unique experience, if

these quotes are used any personal information that could be used to identify you will be removed. What you feedback in relation to your unique experience may be directly quoted when writing up the research but you will not be identified from these quotes. Other researchers may read the transcripts but they will not know who you are. The anonymised data will be kept on a password-protected server for up to 7 years once the study is complete. However, all other documentation will be destroyed. As data will be kept in anonymous format, you will not be able to withdraw your responses once you have submitted them. The lawful basis for processing this information is public interest.

What happens if I feel distressed during the research?

It is recognised that some participants may experience distress when talking about experiences related to loneliness, eating disorder related behaviours and/or the experience of the anorexic voice. Before completing this research please careful read both this 'Participant information sheet' and the 'Participant Consent form' to ensure you are happy to take part in this study. Should you have any queries relating to your participation in this study please contact the lead researcher on the contact details provided.

If you find you are distressed following completion of this questionnaire we will provide you with contact details of third sector services whom we would advise you to contact should you feel you require further support. We also advise that should you experience any distress or concerns following the completion of this research that you contact your GP in order to seek further support.

How will the results from the research study be used?

The results from the research will be written and submitted as part of the qualification for a Doctorate in Clinical Psychology at Cardiff University. It will also be submitted for publication. Throughout this process you will remain anonymous.

Who is funding and monitoring the research?

In accordance with the Research Governance Framework for Health and Social Care the research study is funded by Cardiff University. This funding does not include payment for participation; therefore, participants will receive no payment for their involvement.

The project has been approved by Cardiff Universities School of Psychology Ethics Committee. The research study will be monitored by two Clinical Supervisors to ensure best practice throughout the research project. All relevant contact details are below:

Project Lead
Mary-Jane Wheeler
Trainee Clinical Psychologist Cardiff University
11th Floor, School of Psychology Tower Building, 70 Park Place Cardiff
CF10 3AT
(02920) 870582

Academic Supervisors
Professor John Fox and Dr Marc Williams
11th Floor, School of Psychology Tower Building, 70 Park Place Cardiff
CF10 3AT
(02920) 870582

What if I have concerns about the research project?

If you have a concern or complaint that is unable to be answered by a member of the research team, please contact The University of Cardiff's School of Psychology Research Ethics Committee

The University of Cardiff's School of Psychology Research Ethics

Committee
School of Psychology
Tower Building, 70 Park Place, Cardiff
CF10 3AT
Tel: +44(0)29 208 70360
Email: psychethics@cardiff.ac.uk
http://psych.cf.ac.uk/aboutus/ethics.html

THANK YOU FOR TAKING THE TIME TO READ THIS INFORMATION

Kind Regards,

Mary-Jane Wheeler
Trainee Clinical Psychologist (Project Lead)

EC.20.10.13.6096R

○ I confirm that I have read and understood the above

Appendix F. Approval from the University of Cardiff Psychology Ethics Committee for completion of the study

Re: Ethics Feedback - EC.20.10.13.6096R

Mary-Jane Wheeler <WheelerM5@cardiff.ac.uk>
Fri 12/11/2020 9:12 AM

To: psychethics <psychethics@cardiff.ac.uk>
Cc: John Fox <FoxJ10@cardiff.ac.uk>; Marc Williams <WilliamsM93@cardiff.ac.uk>

Hi,

Many thanks for your feedback and acceptance in relation to my proposed project.

I can confirm that question 15 will be rephrased as advised.

Many thanks again

Mary-Jane

Mary-Jane Wheeler
Trainee Clinical Psychologist
Doctoral Programme in Clinical Psychology, Cardiff University
11th Floor, Tower Building, 70 Park Place, Cardiff CF10 3AT

Seicolegydd Clinigol dan Hyfforddiant
Rhaglen Doethurol mewn Seicoleg Glinigol, Prifysgol Caerdydd
11fed Llawr, Adeilad y Tŵr, 70 Park Place, Caerdydd CF10 3AT

From: psychethics <psychethics@cardiff.ac.uk>
Sent: Tuesday, December 8, 2020 10:24 AM
To: Mary-Jane Wheeler <WheelerM5@cardiff.ac.uk>
Cc: John Fox <FoxJ10@cardiff.ac.uk>
Subject: Ethics Feedback - EC.20.10.13.6096R

Dear Mary- Jane,

The Ethics Committee has considered your PG project proposal: *An exploration of the relationship between loneliness, the severity of eating disorder related symptoms and the experience of the 'anorexic voice' (EC.20.10.13.6096R).*

The project has been approved on the condition that question 15 is rephrased to "My voice will harm me if I disobey or resist it".

Please note that if any changes are made to the above project then you must notify the Ethics Committee.

Best wishes,

Sarah on behalf of Adam Hammond

School of Psychology Research Ethics Committee

Cardiff University
Tower Building
70 Park Place
Cardiff
CF10 3AT

Tel: +44(0)29 208 70360
Email: psychethics@cardiff.ac.uk
http://psych.cf.ac.uk/aboutus/ethics.html

Prifysgol Caerdydd
Adeilad y Tŵr
70 Plas y Parc
Caerdydd
CF10 3AT

Ffôn: +44(0)29 208 70360
E-bost:
psychethics@caerdydd.ac.uk

Please note that I do not expect a response to this email outside of your normal working hours
Nid wyf yn disgwyl ymateb i'r ebost hwn y tu allan i'ch oriau gwaith arferol

Appendix G. Risk assessment for the study completed via Cardiff Universities research guidelines

Risk Assessment - Low Risk - Applicant Name: Mary-Jane Wheeler

WheelerM5@cardiff.ac.uk <WheelerM5@cardiff.ac.uk>
Mon 7/13/2020 1:06 PM
To: Mary-Jane Wheeler <WheelerM5@cardiff.ac.uk>

Thank you for submitting your application - the assessment outcome is **Low Risk.**

Applicant Name: Mary-Jane Wheeler

Applicant ID: c1990863

Email Address: WheelerM5@cardiff.ac.uk

Project Title: An exploration of the relationship between loneliness, the severity of eating disorder related sympt

Brief Description: Project title: An exploration of the relationship between loneliness, the severity of eating disorder related symptoms and the experience of the â€˜anorexic voiceâ€™ Study Aims This study aims to explore whether engagement with the anorexic voice affects the severity of eating disorder related behaviour and experiences, as well as how both of these factors are influenced through another variable of loneliness. The theory to be tested is that those who are lonely are more likely to seek out a relationship and engage with the anorexic voice, and in doing so will have more severe eating disorder symptoms. The hypotheses are that 1. Those with higher loneliness have higher eating disorder severity; 2. Those with more frequent experiences of the anorexic voice have higher eating disorder severity; 3. These two independent variables will interact in determining eating disorder severity, in which those who are most lonely and experience the highest frequency of the anorexic voice will have significantly higher eating disorder symptoms than the other 3 groups (high lonely/low voice frequency; low lonely/high voice frequency; low lonely/low voice frequency). These 3 hypotheses will be tested using a 2 x 2 ANOVA. Data collection Data collection will be collected via an appropriate online questionnaire forum such as â€˜Qualtricsâ€™. Consent and debrief forms will also be made available via this forum/portal. The following psychometrics will be made available on this platform and will be utilised to capture and conceptualise the constructs discussed above: Experience of the anorexic voice â€¢ A measure of the topographic features of the anorexic voice (such as severity and intensity) â€¢ The Experience of an Anorexic VoicE Questionnaire (EAVEâ€Q) â€¢ The Beliefs about Voices Questionnaire (BVAQ-R) (Chadwick et al , 2000) Loneliness â€¢ University of California, Los Angele Loneliness scale (UCLA Version 3) (Russell, 1996) â€¢ The De Jong Gierveld short scales for emotional and social loneliness (De Jong Gierveld & Van Tilburg, 2010) The severity of eating disorder â€¢ Eating Disorder examination questionnaire (EDE-Q 6.0) Participants This study will utilise an analogue sample which could be comparable to an eating disorder population. This analogue sample will consist of any individuals whom report to have experienced an â€˜anorexic voiceâ€™ in some form, this will ensure that the data is continuous. This participant sample will consist of individuals who access online forums relating to anorexia and is envisaged to include any age, gender and ethnicity. Due to the utilisation of an analogue sample it is proposed that only university ethics will need to be gained in order to complete this project, as opposed to full NHS ethics. As this study is not analysis a clinical population and does not include any deceptive elements it is proposed that this research can be submitted to the university ethics board as a â€˜Box Aâ€™ application. Recruitment strategy for participants Stage 1. Develop a presence on social media in order to promote discussions and interest in this area of research, and in order to assist in the recruitment from a relevant population. This will be done by exploring relevant social media forums where these topics of conversation are prevalent and where there is also foot traffic of individuals who may fall within this research criteria. Stage 2. Make available an online questionnaire using an appropriate forum e.g. â€˜Qualtricsâ€™ for those interested in completing this research, gaining consent for their involvement of the project Stage 3. After completion, participants will be fully debriefed regarding the nature of the study and signposted to additional services should this be necessary.

Project Type: online_postal

Receipt No: 1594641984_2929

Hazard	Severity	Likelihood	Risk
Working outside of psych or the normal working hours (8.30am	1	1	1
Equipment (of any sort)	1	1	1
Chemicals	1	1	1
Animals (including allergens)	1	1	1
Personal Attack	0	1	0
Human Bodily Fluids	1	1	1
Holding Cash or Vouchers	0	1	0
Travelling	1	1	1
Slips Trips and Falls	1	1	1
Administration of drugs or gases	1	1	1
Other	0	0	0
Other< /td>	0	0	0

Appendix H. Eligibility to take part form

An exploration of the relationship between loneliness, the severity of eating disorder related symptoms and the experience of the 'anorexic voice'

By Mary-Jane Wheeler, Professor John Fox, Dr Marc Williams

Thank you for your interest in this study.

We are inviting individuals who are aged 18 or over who are of any race, gender or nationality who have experienced eating disorder related behaviours, thoughts and beliefs to take part in this research. You do not need to have experienced an 'anorexic voice' in any form in order to take part in this study. You also do not need to have received a formal diagnosis of an eating disorder at any time to take part in this study.

Please confirm whether you meet these criteria to take part in this study below.

Before you give consent to taking part in this study please carefully review the 'Participant Information Sheet' and the 'Participant Consent form' and consider whether you wish to take part in this research. To take part in this research consent must be given via the consent form provided.

- ○ I confirm that I meet the requirement specified to take part in this study
- ○ I do not meet the requirements specified to take part in this study

Powered by Qualtrics

Appendix I. Example of recruitment post used for online forums

PG project proposal: EC.20.10.13.6096

An exploration of the relationship between loneliness, the severity of eating disorder related symptoms and the experience of the 'anorexic voice'

Example of Post used to recruit participants through online forums:

Opportunity to contribute to research being completed by the University of Cardiff.

Have you experienced eating disorder related behaviours or had the experience of an anorexic voice or know someone who has experienced either of these?

The University of Cardiff need people who have experienced either of these to complete an online questionnaire to help improve the academic understanding of these experiences alongside the experience of loneliness. Participation in this survey would be greatly valued and appreciated.

Take part here:

https://cardiffunipsych.eu.qualtrics.com/jfe/form/SV_2r6pSAsmvi1GDxr

If you would like further information in relation to taking part in this research, please contact Mary-Jane Wheeler on wheelerm5@cardiff.ac.uk

Appendix J. Participant consent form

PARTICIPANT CONSENT FORM

An exploration of the relationship between loneliness, the severity of eating disorder related symptoms and the experience of the 'anorexic voice'

By Mary-Jane Wheeler, Professor John Fox, Dr Marc Williams

Please read the following statements and mark next to them if you agree and sign the end of the form indicating your consent to take part.

Please confirm the following:

1. I understand that participation in the study is voluntary and I can change my mind before and withdraw from the study before submitting my responses without having to provide a reason.
2. I understand that any written responses I provide may be quoted as part of a research publication, but that I will remain anonymous
3. I understand that should any quote be used that I will be provided with anonymity, and all personally identifiable information will be removed.
4. I understand that the research will be submitted for publication.
5. I am willing to take part in the research study.

○ I consent
○ I do not conset

Appendix K. Participant debrief form

PARTICIPANT DEBRIEF FORM

An exploration of the relationship between loneliness, the severity of eating disorder related symptoms and the experience of the 'anorexic voice'

By Mary-Jane Wheeler, Dr John Fox, Dr Marc Williams

Thank you for taking part in this research study.

The aim of this project is to explore whether there is a link between individuals feelings of loneliness, their relationship with their anorexic voice, and how this impacts the severity of their eating disorder related behaviours.

It is hoped that findings from this research will help us to better understand this relationship and support the development of support systems for those experiencing an 'anorexic voice'.

If you have any further, questions, concerns or would like to receive a copy of the research once it is published please contact the lead researcher or academic supervisors on the details provided below:

Project Lead

Mary-Jane Wheeler
Trainee Clinical Psychologist Cardiff University
11th Floor, School of Psychology Tower Building, 70 Park Place Cardiff
CF10 3AT
(02920) 870582

Academic Supervisors

Dr John Fox and Dr Marc Williams
11th Floor, School of Psychology Tower Building, 70 Park Place Cardiff
CF10 3AT
(02920) 870582

If you have a concern or complaint that is unable to be answered by a member of the research team, please contact the Director of the Doctoral Programme below:

Director of the Doctoral Programme in Clinical Psychology

Professor Andrew Thompson
11th Floor, School of Psychology
Tower Building, 70 Park Place, Cardiff
CF10 3AT
(02920) 870582

If you have experienced any distress during your participation in this research

If during your participation in this research you have experienced any negative feelings or feel you would like some further support in relation to any of the topic areas discussed in this research please find below contact details for third sector services who will be able to provide relevant guidance and support in this area:

MIND
https://www.mind.org.uk
Helpline: 0300 123 3393
Helplines are open 9am to 6pm, Monday to Friday (except for bank holidays).

BEAT – Eating Disorders
https://www.beateatingdisorders.org.uk
Helpline: 0808 801 0677
Helplines are open 365 days a year from 9am–8pm during the week, and 4pm–8pm on weekends and bank holidays.

Anorexia and Bulimia Care
https://www.anorexiabulimiacare.org.uk
Helplines: 03000 11 12 13
Helplines are open Wednesdays, Thursdays and Fridays, 9am - 1pm and 2pm - 5pm

Thank you again for taking time to partake in this research. Your contribution is highly valued and appreciated.

Kind Regards,

Mary-Jane Wheeler
Trainee Clinical Psychologist (Project Lead)

EC.20.10.13.6096R
Participant Debrief form
Version 1 – 18/12/2020

Appendix L. Example of SPSS output: Confirmatory regression analysis

Simultaneous multiple regression

(IV1) Frequency of AV (TOV)
(IV2) Loneliness (UCLA)
(DV)Eating disorder severity (EDEQ)

F (2, 140) = 44.425 p < .001, R^2 = .39.

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Frequency, UCLA Total[b]	.	Enter

a. Dependent Variable: EDEQ Global Score

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.624[a]	.390	.381	.86127

a. Predictors: (Constant), Frequency, UCLA Total

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	65.908	2	32.954	44.425	<.001[b]
	Residual	103.107	139	.742		
	Total	169.015	141			

a. Dependent Variable: EDEQ Global Score

b. Predictors: (Constant), Frequency, UCLA Total

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.150	.420		2.739	.007
	UCLA Total	.016	.007	.169	2.393	.018
	Frequency	.605	.078	.547	7.758	<.001

Linear regression 1

(IV)Loneliness (UCLA)
(DV)Eating disorder severity (EDEQ)

F (1, 140) = 20.153 p < .001, R^2 = .13.

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	UCLA Total[b]	.	Enter

a. Dependent Variable: EDEQ Global Score

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.355[a]	.126	.120	1.02729

a. Predictors: (Constant), UCLA Total

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	21.268	1	21.268	20.153	<.001[b]
	Residual	147.747	140	1.055		
	Total	169.015	141			

a. Dependent Variable: EDEQ Global Score

b. Predictors: (Constant), UCLA Total

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.540	.453		5.612	<.001
	UCLA Total	.034	.008	.355	4.489	<.001

a. Dependent Variable: EDEQ Global Score

Linear regression 2

(IV) Frequency of AV (TOV)
(DV)Eating disorder severity (EDEQ)

F (1, 140) = 80.412 p < .001, R^2 = .37.

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Frequency[b]	.	Enter

a. Dependent Variable: EDEQ Global Score

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.604[a]	.365	.360	.87568

a. Predictors: (Constant), Frequency

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	61.661	1	61.661	80.412	<.001[b]
	Residual	107.354	140	.767		
	Total	169.015	141			

a. Dependent Variable: EDEQ Global Score

b. Predictors: (Constant), Frequency

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.842	.309		5.956	<.001
	Frequency	.669	.075	.604	8.967	<.001

a. Dependent Variable: EDEQ Global Score