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Interpersonal Vulnerability, Eating Behaviours and Quality of Life in Bariatric Surgery Patients

A systematic review of the relationship between internal weight bias and eating behaviours in bariatric surgery patients

An observational study of how interpersonal vulnerabilities, emotional eating, anxiety and depression influence quality of life in patients assessed for bariatric surgery

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Lay Summary

People with severe obesity who have been unsuccessful in their attempts at significant and long-term weight loss can be referred by their medical professional for weight loss surgery (i.e. bariatric surgery). Past research has shown that those seeking a surgical solution to their weight loss difficulties can experience increased problems with their physical and mental health compared to people of a normal weight. This might include increased levels of psychological distress, as well as issues with eating and coping with social situations. Ultimately this could reduce someone's quality of life. This thesis aims to improve our understanding of these different elements and how the interpersonal psychotherapy model of eating disorders (IPT-ED) could be applied to bariatric surgery candidates.

The thesis is split into two chapters. Chapter one is a systematic review of the literature on the links between the eating behaviours of bariatric surgery patients and a form of weight-based stigma known as internal weight bias. This occurs when someone internalises society's negative attitudes about being overweight. The review found strong associations between increased levels of internal weight bias and unhelpful eating behaviours in bariatric surgery patients e.g. binge eating and emotional eating.

Chapter two was a research study which examined a pre-existing dataset of information collected from patients who were assessed for bariatric surgery. This was the first study to add quality of life to the IPT-ED model and demonstrate the strong positive links between interpersonal vulnerability, anxiety, depression and emotional eating and their impact on quality of life in bariatric surgery candidates. Neither anxiety nor depression moderated the relationship between interpersonal vulnerability and emotional eating. That said, the relationship between interpersonal vulnerability and quality of life was partially explained by emotional eating. Future research is needed to understand how these relationships are affected after someone has bariatric surgery and in the years that follow.

Abstract

Background

Bariatric surgery is a recommended treatment for people with morbid obesity. Patients who seek or undergo bariatric surgery experience a range of psychosocial difficulties which affect their quality of life, including interpersonal difficulties, maladaptive eating patterns and psychological distress. This thesis aims to investigate how weight-based bias was associated with maladaptive eating patterns in this patient population, and how the interpersonal psychotherapy model of eating disorders (IPT-ED) could be extended to consider the quality of life in those seeking bariatric surgery.

Method

A systematic review of quantitative studies (*n* = 11) was undertaken to examine the relationship between internalised weight bias and eating behaviours in bariatric surgery patients. Also, a cross-sectional empirical study examined a pre-existing dataset of routinely collected clinical data from bariatric surgery candidates (*n* = 193). Drawing on the IPT-ED model, the study used mediation and moderation analyses to explore the relationships between interpersonal vulnerability, anxiety, depression, emotional eating and quality of life.

Results

The systematic review found internal weight bias was associated with maladaptive eating behaviours, irrespective of whether patients were seeking or had completed bariatric surgery, and demonstrated medium to large effect sizes. The observational study found emotional eating partially mediated the relationship between interpersonal vulnerability and quality of life in bariatric surgery candidates. Moderation analyses found depression did not moderate the relationship between interpersonal vulnerability and emotional eating in those seeking bariatric surgery, however when anxiety was low interpersonal vulnerability and emotional eating were significantly related.

Conclusion

Both the systematic review and empirical study demonstrated the strong association between interpersonal vulnerability and eating behaviours (e.g. emotional eating) in bariatric surgery patients. By introducing quality of life to the IPT-ED model and applying it to bariatric surgery candidates it provides clinicians and researchers with an enhanced theoretical foundation to understand how interpersonal factors, eating behaviours and psychological distress combine to affect the psychosocial wellbeing of bariatric surgery patients. Until recently application of theoretical frameworks with this clinical population has been limited. The current study has for the first time shown how an enhanced interpersonal framework featuring quality of life might be applied to those seeking bariatric surgery. Given bariatric surgery is a significant life transition future research would benefit from investigating how this enhanced model evolves at different stages along the patient journey, from pre-surgical assessment through to long-term follow-up.

Systematic Review

A systematic review of the relationship between internal weight bias and eating behaviours in bariatric surgery patients

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Key words
Bariatric surgery, internalised weight bias, stigma, eating.

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Conflict of interest
The author has no conflict of interest to declare.

Written in accordance with the author submission guidelines for Obesity Reviews (Appendix 1).

Abbreviations

Kg/m^2	Kilograms divided by height in metres squared
BMI	Body Mass Index
IWB	Internalised Weight Bias
WBIS	Weight Bias Internalisation Scale
WSSQ	Weight Self-stigma Questionnaire
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analysis
p	Statistical significance
GRADE	Grading of Recommendations, Assessment, Development and Evaluations
AAQ-W	Acceptance & Action Questionnaire for Weight
DEBQ	Dutch Eating Behaviour Questionnaire
EDE-Q	Eating Disorders Examination Questionnaire
BES	Binge Eating Scale
EES	Emotional Eating Scale
GB	Gastric bypass surgery
SG	Sleeve gastrectomy surgery
GBD	Gastric band surgery
DS	Duodenal switch surgery
n	Total number of participants
r	Pearson correlation coefficient
WBIS-M	Weight Bias Internalisation Scale-Modified
BSSMQ	Bariatric Surgery Self-Management Questionnaire
DEBS	Disordered Eating after Bariatric Surgery
EAHQ	Eating in the Absence of Hunger Questionnaire
EDE-Q7	Eating Disorder Examination (Brief Version)
EOQ	Emotional Overeating Questionnaire
FFQ-DA	Food Frequency Questionnaire Dietary Adherence

QEWP-5	Questionnaire of Eating & Weight Patterns-5
Rep(EAT)-Q	Repetitive Eating Questionnaire
TFEQ	Three-Factor Eating Questionnaire
TFEQ-R18	Three-Factor Eating Questionnaire – Revised
YFAS	Yale Food Addiction Scale
b	Beta coefficient
BCa	Bias-corrected confidence interval

Abstract

Background

People with obesity can experience weight-based stigma, but when a person accepts and applies society's negative stereotypes about excess bodyfat to themselves internalised weight bias can arise and negatively impact their psychosocial wellbeing. Whilst bariatric surgery is the recommended treatment for people with morbid obesity, little is known about internal weight bias in this population. Maladaptive eating behaviours are a key concern for patients and clinicians prior to and after bariatric surgery, yet evidence on the relationship with internal weight bias is limited.

Method

A literature search of multiple electronic databases was undertaken for studies which used validated instruments to examine the relationship between internal weight bias and eating behaviours in bariatric surgery patients.

Results

Eleven studies met the inclusion criteria. Internal weight bias was significantly associated with all assessed eating behaviours and typically had moderate-large effect sizes. Potential moderating factors were identified including emotional dysregulation and low-self compassion.

Conclusions

Internal weight bias was associated with maladaptive eating behaviours irrespective of whether patients were seeking or had completed bariatric surgery. Longitudinal research is required to assess the pre/-post bariatric surgery changes in these domains and how other important psychosocial factors might moderate this relationship and affect patients' long-term wellbeing.

Introduction

As a global issue obesity has almost tripled since 1975 and was estimated to affect 650 million adults worldwide in 2016.[1] Obesity in adults is defined as a body mass index of ≥30kg/m^2 and spans three classes: Class I (BMI 30.0-34.9), Class II (BMI 35.0-39.9) and Class III (BMI above 40).[2] Although the accumulation of excess body fat is considered to be preventable it has significant health, psycho-social and economic consequences for individuals and society.[3] This includes increased risk of adverse outcomes from COVID-19 through to reduced self-esteem, compared to people of normal weight.[4] One area within the research literature which has gained increasing recognition is weight bias.[5] Weight bias refers to the negative weight-based attitudes, behaviours and stereotypical beliefs experienced by people with obesity.[6] Whether experienced directly (i.e. discrimination) or indirectly (e.g. size of airline seats) societal devaluation based on a person's weight is omnipresent.[7] Weight bias has been linked to western ideals about "thinness" and negative perceptions that obesity is a consequence of lack of willpower, personal responsibility and competency.[5,7] Previous systematic reviews and meta-analyses have demonstrated the association between weight bias and increased psychological distress[6], reduced health-related quality of life[8] and increased maladaptive eating behaviours[9] in people with obesity. Furthermore, in a meta-analysis by Spahlholz et al.[10] pooled prevalence rates of weight discrimination were found to increase with BMI, from 19.2% for people with Class 1 obesity to 41.8% for people with Class II obesity. Thus it would appear that not only does weight bias increase as weight increases but also affects a range of psychosocial indicators.

However, whilst these reviews related to the external experience of weight bias, they did not consider emerging evidence related to the concept of internalised weight bias (IWB). Internalised weight bias, or as it is sometimes known self-directed stigma, refers to the internalisation of negative weight-based stereotypes held by society, such that a person with obesity accepts and applies these negative concepts to oneself.[11] Understanding the effects

of internal weight bias is particularly important given evidence which indicates that internalisation of weight-based stereotypes more strongly predicts worse mental and physical health outcomes than the experience of weight bias.[12] Although based on the US population, estimated prevalence rates indicated that 52% of adults with obesity experienced internal weight bias and the highest levels of internal weight bias were found in women.[13] Of the few systematic reviews to examine internal weight bias, Pearl & Puhl[14] found internal weight bias was negatively associated with physical and mental health outcomes, meaning higher levels of internalised weight bias were linked to increased symptoms of anxiety, depression and binge eating, as well as reduced self-esteem and mental health-related quality of life. A systematic review and meta-analyses by Alimoradi et al.[15] found moderate associations between internal weight bias and depression (corrected Fisher's Z = 0.40) and anxiety (corrected Fisher's Z = 0.40). Furthermore, in a recent systematic review by Bidstrup et al.[16] internal weight bias was found to mediate the relationship between weight bias and psychosocial outcomes including disordered eating behaviours, body shame and body dissatisfaction. However, inconsistent findings were reported for the relationship between internal weight bias and anxiety and depression. The growth of evidence would seem to indicate a greater understanding of the relationship between internal weight bias and the psychosocial wellbeing of people living with obesity.

Nonetheless, whilst there was homogeneity in how internal weight bias was assessed, with most studies using either the Weight Bias Internalisation Scale (WBIS) or the Weight Self-Stigma Questionnaire (WSSQ), there was heterogeneity of samples. For example, of the fifteen included studies in the review by Bidstrup et al.[16], eight studies used a community sample, five studies recruited university students and just two studies pertained to a clinic population. Additionally of the thirty studies included in the review by Alimoradi et al.[15], just one in five studies (n = 6) had a sample population solely comprised of people with obesity and eight studies included participants classified as underweight (BMI <18.5). Furthermore, of

the seventy-four studies included in the review by Pearl & Puhl[14] less than 10% of studies related to people with morbid obesity who were seeking or had completed bariatric surgery.

It is important to recognise people living with obesity are not a homogeneous population, in relation to either their psychological presentation or its management. For example, compared to people with Class I and II moderate obesity (BMI 30 - 39.9), people with Class III morbid obesity (BMI > 40) were found to have greater risk of psychological distress.[17] In terms of obesity management, multicomponent lifestyle interventions (e.g. behavioural, dietary, physical activity, pharmaceutical) are the recommended treatment.[18] However, when a person with Class III obesity (or Class II obesity and a comorbid condition) has been unable to achieve and maintain a "clinically beneficial weight loss", bariatric surgery is considered the treatment of choice and most effective intervention for long-term weight reduction. Nevertheless, those who seek a surgical solution to their weight loss difficulties have been found to experience a double weight bias. Firstly, for having excess weight and secondly for some people believing that bariatric surgery is an "easy" or "passive" route to reaching a healthy weight.[5] To-date no systematic review has examined internal weight bias within the bariatric surgery population, including those who are seeking or have completed surgery.

One of the reportedly most important factors within this population is people's eating psychopathology, whether that takes the form of a diagnosed eating disorder (e.g. binge eating disorder, bulimia) or other maladaptive eating behaviours (e.g. emotional eating, night eating syndrome, grazing). Binge eating disorder is the most frequent eating disorder in this population, and although prevalence rates of eating disorders can vary by assessment criteria and measure, it was found to range from 2% to 49% in bariatric surgery candidates. This contrasted with 0.7% to 4% in community samples and 1% to 30% in those pursuing a non-surgical weight reduction intervention.[19] Sub-threshold disordered eating, such as emotional eating, has also been identified as a significant risk factor in the development and perpetuation of obesity, affecting between 38% and 59% of bariatric surgery candidates.[20] Although the

primary aim of bariatric surgery is weight loss, it is recognised as a significant life transition affecting people's psychosocial wellbeing post-surgery including their identity, relationships and eating behaviours.[21] The twelve to twenty-four month period following surgery is often known as the "honeymoon phase" where the greatest positive changes in physical and mental health occur, but these changes do not always occur and are not always maintained.[22,23] Indeed, for 20-30% of patients post-surgery weight loss is sub-optimal and in some patients the emergence, continuation or re-emergence of maladaptive eating patterns can occur.[24,25] For example, emotional eating has been found to precede and follow bariatric surgery, and whilst improvements occurred in the four to eighteen months post-surgery these were not maintained long-term.[26,27]

Systematic reviews have found significant and positive relationships between internal weight bias and eating disorder psychopathology.[14,16] However, in the review by Pearl & Puhl[14] just four of the seventy-four studies pertained to bariatric surgery patients and the evidence base has increased substantially since their initial search of the literature four and a half years ago. Furthermore, whilst Bidstrup et al.[16] found internal weight bias significantly mediated the relationship between weight bias and disordered eating outcomes, none of the eight included studies examined bariatric surgery patients. Given the (i) difference in psychopathology of patients by BMI class and treatment setting, (ii) the absence of a systematic review solely examining internal weight bias in bariatric surgery patients and (ii) the significance of eating psychopathology in this population, the aim of this review was to systematically evaluate the relationship between internal weight bias and eating behaviours in bariatric surgery patients.

Methods

The systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines.[28] The PROSPERO registry of systematic review protocols was checked to identify if a similar systematic review had been conducted recently.[29]

A prospective systematic review entitled Weight Bias Before and/or After Bariatric Surgery was registered with PROSPERO on 18 June 2021.[30] The authors were contacted by email on 11 January 2022 and it was established they were finalising a draft paper ahead of peer review. This review differs from the review by Bennett et al.[30] by focusing exclusively on internal weight bias and the role of eating behaviours in bariatric surgery patients rather than adopting a broader approach which includes internal, external and experienced weight stigma and its relationship with psychosocial, medical and behavioural outcomes.

Eligibility criteria

Population

Eligible studies contained participants 18 years or older who were seeking or had completed bariatric surgery, regardless of race, gender or nationality. Studies were excluded if people were seeking or had completed non-bariatric procedures for weight loss (e.g. gastric balloon) or aesthetics (e.g. liposuction). Studies were also excluded if the primary intervention was pharmaceutical treatment, physical exercise, dietary, lifestyle or behavioural modification. Studies with samples from hospital, outpatient and community settings were eligible for inclusion, as well as online support forums for bariatric surgery patients.

Intervention

Internal weight bias and eating behaviours were the primary psychological variables investigated in this review. These variables were chosen because difficulties in these areas have been evidenced in people with severe obesity who meet the criteria for bariatric surgery i.e. BMI >40kg/m^2 or BMI >35k/m^2 and at least one comorbidity.[14,31] For clarity, internal weight bias is defined as the extent to which someone applies negative weight stereotypes and/or beliefs to themselves as a consequence of societal views about thinness and obesity.[14] This contrasts with external weight bias which is the direct experience of weight-based stigmatisation, discrimination and prejudice someone with obesity might experience.

Outcome measures

Studies were eligible for inclusion if they reported quantitative results comparing at least one psychometrically validated measure of internal weight bias with at least one psychometrically validated measure of eating behaviour. Studies which reported results of external weight bias but did not separately report results of internal weight bias were excluded. Outcomes from validated observer and/or-self-report measurement tools were eligible for inclusion.

Study design

Whilst all types of quantitative studies were eligible, mixed-method studies were eligible if results from quantitative measures were reported separately. Qualitative studies were excluded. Studies which used data collected retrospectively or prospectively were eligible for inclusion.

Information sources

Searches were conducted on 16 February 2022. To facilitate a comprehensive search of the literature guidance on appropriate databases and search terms to use was sought from a specialist librarian. The following electronic databases were searched: CINAHL Plus (1937 - 2022), EMBASE (1974 - 2022), Global Health (1910 - 2022), Medline (1946 - 2022), APA PsycInfo (1806 - 2022), Web of Science Core Collection (1900 - 2022) and ProQuest Dissertation & Theses Global (1997 - 2022). EBSCOhost was used to access CINAHL Plus, whilst OVID was used to access EMBASE, Global Health, OVID Medliner and APA PsycInfo.

Search strategy

All searches were conducted by the author and without peer review. Only studies written in the English language were included due to limited translation capabilities. There were no restrictions on publication date nor report status, meaning studies published in peer reviewed journals as well as unpublished manuscripts and conference abstracts were eligible for inclusion.

For each database two initial searches were undertaken using the search strings listed in Table 1. Search one identified literature related to bariatric surgery and search two identified literature relating to internal weight bias. Results from search one and search two were then combined using the term “and” to produce a list of potentially relevant articles for screening and possible inclusion in the systematic review (Search 3).

Table 1: Search terms used to identify literature relating to bariatric surgery and internal weight bias.

Search	*Topic*	*Search terms*
1	*Bariatric surgery*	*("bariatric surger*" or "bariatric operat*" or "obesity surger*" or "obesity operat*" or "gastric bypass" or "weight loss surger*" or "weight loss operat*" or "weight reduction surger*" or "gastric sleeve" or "gastric banding" or "metabolic surger*" or "metabolic operat*" or "stomach stapling" or "sleeve gastrectom*" or "biliopancreatic diversion*" or "biliopancreatic bypass*")*
2	*Internal weight bias*	*("internal* weight bias" or "internalised weight bias" or "internalized weight bias" or "weight bias internalisation*" or "weight bias internalization" or "weight bias internal*" or "internalised weight stigma" or "internalized weight stigma" or "internalised weight prejudice" or "internalized weight prejudice" or "internalised weight discrimination" or "internalized weight discrimination" or "internal* weight" or “self-stigma” or “self stigma” or “internalised stigma” or “internalized stigma” or “self stigmatisation” or “self stigmatization”)*

For all electronic databases, except ProQuest Dissertation & Theses Global, searches were undertaken in the domains of title, abstract and keywords. Due to the search functionality of the ProQuest database this search was conducted using the “anywhere except full text” domain. Backward and forward citation searching was conducted using Web of Science but no additional studies were identified which met the inclusion criteria. A validation test of the search strategy was also undertaken and confirmed the accuracy of the search terms and strategy. Search three yielded a total of 123 articles for consideration in the selection process.

Selection process

The selection and screening process is outlined in Figure 1 and was solely undertaken by the author. By screening abstracts and titles 123 articles were identified as being potentially relevant for inclusion in the review. After duplicated articles were removed 54 articles were assessed in more detail using specific inclusion and exclusion criteria. This resulted in 43 articles being excluded for reasons specified in Figure 1. After completion of the full screening process a total of 11 articles were included in the final review.

Data collection process

The author was solely responsible for the collection of data from each report. No automation tools were used to collect data and no software was used to extract data from figures. One author of a conference abstract which met the inclusion criteria was contacted by email for a copy of their research. The author replied and a copy of their conference poster was received for review.[32]

Data items

For each study which met the inclusion criteria the author extracted the following data: country of origin, type of bariatric surgery, study design, data collection period (pre- or post- surgery, follow-up period), recruitment (method, timescale, inclusion/exclusion criteria), sample size and non-completion rate, sample characteristics (mean BMI pre- and or/ post-surgery, age, gender, education, race), psychometric measures (internal weight bias, eating behaviour, any additional measures), statistical methods (controlled variables, data checks, statistical analysis), reported results (e.g. effect sizes, p-values) and study evaluation (strengths, limitations).

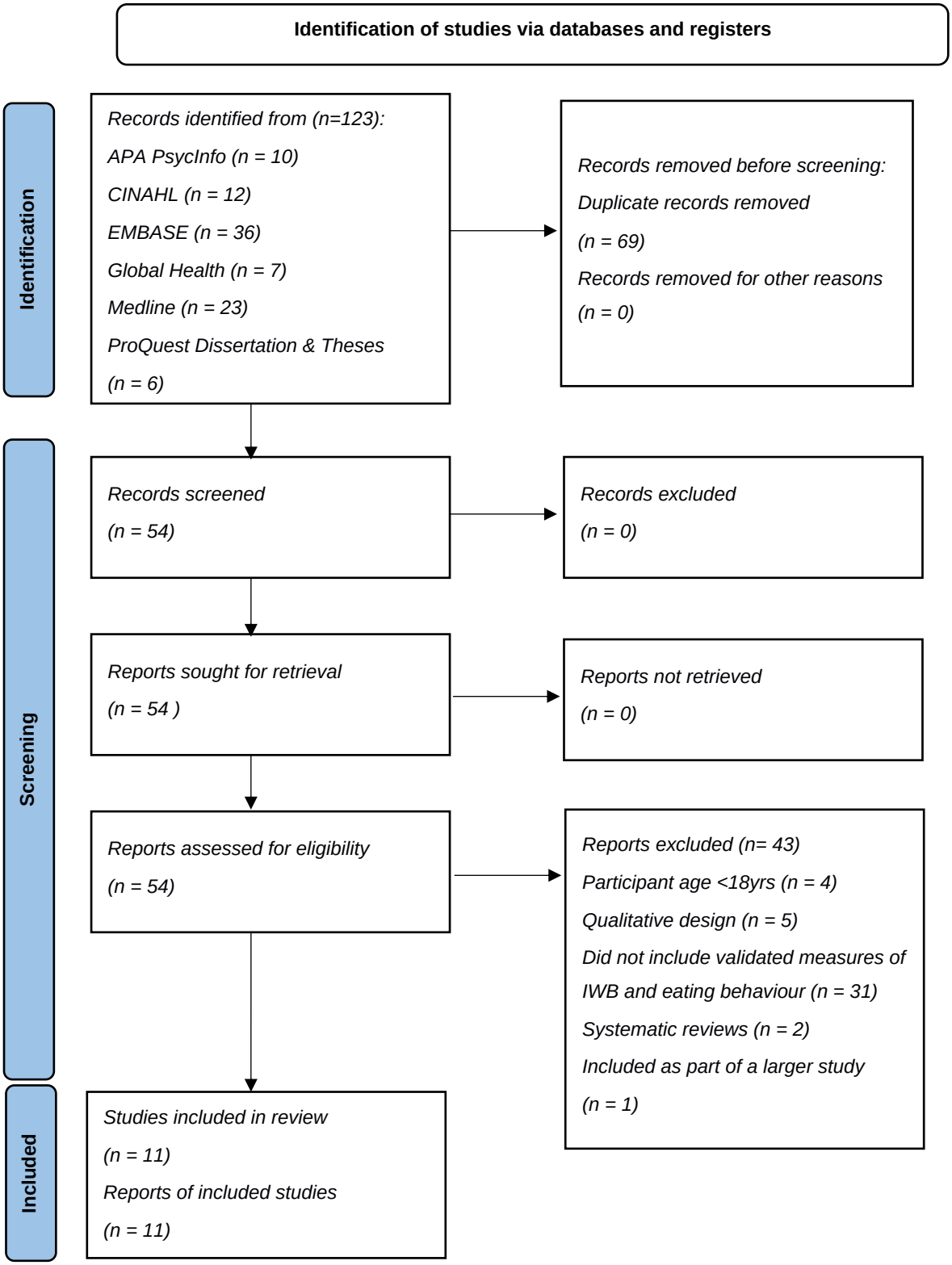

Figure 1: PRISMA flow diagram of systematic review of databases and registers.[28]

Study risk of bias assessment

With no single recommended tool for the assessment of observational studies[33,34], based on critical appraisal of the literature a customised tool to assess the risk of bias was created by the author. Bias was examined using ten domains which were operationalised at three levels: "well-covered" (2 points), "adequately addressed" (1 point); "poorly addressed", "not addressed", "not reported" and "not applicable" (all 0 points). The domains assessed for risk of bias related to the theoretical foundations of the research, the study sample, accuracy of information during data collection, modifications of validated measures, the appropriateness of statistical analyses and the robustness of reported findings. Each study was given an overall rating.

The risk of bias was independently assessed by two people using the customised tool. The author (reviewer one) assessed each of the eleven studies included in the final review. The second reviewer was randomly allocated half of the studies using an online random number generator.[35] They were a recent graduate from The University of Edinburgh Doctorate of Clinical Psychology course and using the same assessment tool independently assessed the risk of bias in five studies. Inter-rater checks were performed to assess the level of agreement across each of the ten domains i.e. the number of domains where agreement was exact, the agreement differed by one point and the agreement differed by two points. The reviewers discussed each area of difference and through agreement domain scores were updated accordingly.

Effect measures

Effect sizes were recognised as small, medium or large according to Cohen's effect size benchmarks and interpreted according to 95% confidence intervals.[36] Statistical significance was recognised as $p < .05$.

Synthesis methods

Given the data in this review did not lend itself to a meta-analysis, a narrative synthesis was undertaken to summarise and interpret the findings from multiple heterogenous studies using a textual approach. Drawing upon guidance by Popey et al.[37] and Campbell et al.[38] a preliminary synthesis was undertaken where the findings of each study were organised in a table and grouped, for example, by population type (pre-/post-surgery) and outcome measures. This allowed patterns to be identified across various factors which potentially influenced the findings of each study. Thereafter a process of rigorously investigating the relationships identified within and between studies meant explanations and conclusions could be drawn to help answer the review question.

Certainty assessment

The GRADE Approach (Grading of Recommendations, Assessment, Development and Evaluations) was used to assess certainty based on risk of bias, imprecision of 95% confidence intervals, inconsistency of evidence, the indirectness of measured outcomes and sample populations and publication bias.[39] The GRADE Approach enables the quality of the evidence to be rated according to one of four levels i.e. very low, low, moderate or high.

Results

Characteristics of included studies

The focus of the systematic review was on assessing the relationship between internal weight bias and eating behaviours in bariatric surgery patients. Research into internal weight bias is a relatively new development and of the eleven studies which met the inclusion criteria half were published in the last three years. Table 2 outlines the summary characteristics and key findings of the reviewed studies. Overall, seven studies examined psychopathology prior to bariatric surgery and four studies after bariatric surgery. Whilst all eleven studies were observational and used cross-sectional data, two studies were part of a longitudinal data registry[40] and prospective trial,[41] respectively.

Sample sizes ranged from 112 to 708 participants. Homogeneity of sample recruitment meant nine out of eleven studies recruited participants directly from a bariatric surgery clinical programme. The remaining two studies recruited from online community groups designed to support bariatric surgery patients. In ten out of eleven studies over 75% of participants were female. Where the level of education was reported, on average three out of five participants had completed some level of college education. Across the studies the weighted average mean age was 44.34 years (SD = 10.89), with a weighted average mean age of 42.70 years (SD = 11.13) before surgery and 47.47 years (SD = 10.43) after surgery. Of the seven studies which provided pre-surgery BMI the weighted average score was 47.15kg/m^2, (SD = 7.57) (i.e. Class III obesity), and of the three studies which provided mean post-surgery BMI the weighted average score was 30.58kg/m^2 (SD = 5.82) (i.e. Class I obesity). In the post-surgery studies the follow-up period ranged from 1 month to 15.75 years, with a weighted average mean time of 25.99 months (insufficient data to calculate SD). Where the type of bariatric surgery was specified the majority of participants were being assessed for, or had completed, sleeve gastrectomy or gastric bypass surgery (Table 2).

To study internal weight bias nine out of eleven studies used the Weight Bias Internalisation Scale (WBIS) (10 or 11 item version), whilst one study used the Weight Self-Stigma Questionnaire (WSSQ) and one study used the self-stigma subscale of the Acceptance & Action Questionnaire for Weight (AAQ-W). The measurement of eating behaviours was more heterogenous with fifteen different measures used. This ranged from instruments designed to measure several different eating behaviours (e.g. Dutch Eating Behaviour Questionnaire Eating (DEBQ), Eating Disorders Examination Questionnaire (EDE-Q)) to eating behaviour specific measures (e.g. Binge Eating Scale (BES), Emotional Eating Scale (EES)).

Table 2: Summary of characteristics and key findings of reviewed studies

Study Country	Baldofksi et al.[40] (2016) Germany	Braun et al.[41] (2021) USA	Feig et al.[43] (2020) USA	Friedman et al.[32] (2015) Canada	Lawson et al.[42] (2021) USA
Recruitment	Part of longitudinal registry of pre-surgical assessments at bariatric surgery medical facility	Via mailings, support groups & bariatric surgery medical facility to participate in longitudinal study	Online support groups for obesity	Part of pre-surgical assessment at bariatric medical facility	Near end of 3-6 month pre-surgery psycho-educational weight management programme at bariatric surgery medical facility
Sample size (type)	n = 240 Pre-surgery	n = 314 Pre-surgery	n = 112 Post-surgery	n = 134 Pre-surgery	n = 316 Pre-surgery
Gender (% female)	68.8	82.1	91.1	79.6	82.6
Mean age (years) (SD)	45.08 (10.43)	42.28 (11.95)	50.3 (11.3)	42.37 (10.83)	42.8 (11.0)
Bariatric surgery type	N/A	Any	SG 50.9% GB 40.2% Other 8.9%	N/A	N/A
Pre-surgery mean BMI kg/m2 (SD)	48.63 (7.48)	47.64 (8.7)	N/A	50.31 (9.08)	49.5 (9.4)
Post-surgery mean BMI kg/m2 (SD)	N/R	N/R	31.3 (7.4)	N/R	N/R
Measure of internal weight bias	WBIS (10 items)^	WBIS (10 items)	WBIS-M (11 items)	WBIS (11 items)	WBIS (10 items)
Measure(s) of eating behaviour	EDE-Q (22 items)^ YFAS (25 items)^ DEBQ - Emotional eating subscale (10 items)^ EAHQ (7 items)^	TFEQ-R18: Emotional Eating subscale (3 items)	BSSMQ (33 items)	EES (25 items) BES (16 items)	EDE-Q7 (7 items)
Main associations between IWB & eating behaviours (correlation coefficients)	Eating disorder psychopathology (r = 0.66)*** Food addiction (r = 0.38)*** Emotional eating (r = 0.37)*** Eating in absence of hunger (r = 0.33)***	Emotional eating (r = 0.47)**	Dietary adherence (r = -0.14)**	Emotional eating: anger / frustration (r = .40)** Emotional eating: anxiety (r = .38)** Emotional eating: depression (r = .29)** Binge eating (r = .59)**	Loss of control eating: frequency (r = .29)*** distress (r = .37)***

Table 2 continued: Summary of characteristics and key findings of reviewed studies

Study Country	Raves et al.[49] (2016) USA	Romano, E.[48] (2019) UK	Sevincer et al.[47] (2017) Turkey	Soulliard et al.[46] (2021) USA	Wagner et al.[45] (2020) USA	Weineland et al.[44] (2013) Sweden
Recruitment	Mail survey of patients who had surgery at bariatric surgery medical facility	Online support groups for bariatric surgery patients	Bariatric surgery medical facility	Part of pre-surgical assessment at bariatric surgery medical facility	Part of pre-surgical assessment at bariatric surgery medical facility	Previous patients of bariatric surgery medical facility
Sample size (type)	n = 298 Post-surgery	n = 253 Post-surgery	n = 120 Pre-surgery	n = 708 Pre-surgery	n = 253 Pre-surgery	n = 253 Post-surgery
Gender (% female)	77.0	94.5	80.0	79.4	76.4	83.8
Mean age (years) (SD)	52.7 (11.9)	45.37 (9.91)	37.65 (12.42)	42.91 (11.00)	N/A	42.17 (8.83)
Bariatric surgery type	All, most common RYGB, SG	GB 56.9% GS 29.6% GBD 9.9% DS 3.6%	N/A	SG 71.8% GB 26.3% 1.8% U/C	N/A	70.5% SG 29.5% GBD
Pre-surgery mean BMI kg/m2 (SD)	N/A	N/A	46.05 (6.05)	48.92 (7.81)	N/A	36.24 (3.62)
Post-surgery mean BMI kg/m2 (SD)	N/A	34.06 (7.92)	N/R	N/R	N/R	26.78 (3.02)
Measure of internal weight bias	WBIS (8 items)	WBIS (11 items)	WSSQ (12 items)^^	WBIS (11 item)	WBIS (11 & 10 items)	AAQ-W: self-stigma subscale (5 items)
Measure(s) of eating behaviour	DEBS (7 items) FFQ-DA (5 items)	Rep(EAT)-Q (12 items)	EDE-Q (32 items) DEBQ-E (13 items)	BES (16 items) TFEQ (16 items): cognitive restraint, disinhibition & hunger subscales	DEBQ: restraint, emotional eating & external eating subscales (33 items)	EDE-Q (28 items) EOQ (8 items)
Main associations between IWB and eating behaviours (correlation coefficients)	Disordered eating (r = 0.35)** Diet plan adherence (r = -0.18)*	Grazing (r = .35)***	Disordered eating (r = .34)** Emotional eating (r = .29)**	Binge eating (r = .53)*** Cognitive restraint (r = -.08)* Disinhibition (r = .42)*** Hunger (r = .35)***	Restraint (r = .30)** Emotional eating (r = .51)** External eating (r = .46)**	Disordered eating (r = .63)** Emotional overeating (r = .50)**

^German version; ^^Turkish version; N/A, Not available; N/R, Not relevant. Statistical significance: *p < .05, **p < .01, ***p < .001
Bariatric surgery type: **GB**, gastric bypass; **SG**, sleeve gastrectomy, **GBD**, gastric band; **DS**, duodenal switch; U/C, Uncertain.
Internal weight bias psychological measures: **AAQ-W,** Acceptance & Action Questionnaire for Weight; **WBIS**, Weight Bias Internalisation Scale; **WBIS-M,** Weight Bias Internalisation Scale-Modified; **WSSQ**, Weight Self-Stigma Questionnaire. Eating behaviour psychological measures: **BES**, Binge Eating Scale; **BSSMQ**, Bariatric Surgery Self-Management Questionnaire; **DEBS**, Disordered Eating after Bariatric Surgery; **DEBQ**, Dutch Eating Behaviour Questionnaire; **EAHQ**, Eating in the Absence of Hunger Questionnaire; **EDE-Q**, Eating Disorder Examination; **EDE-Q7,** Eating Disorder Examination (Brief Version); **EES**, Emotional Eating Scale; **EOQ**, Emotional Overeating Questionnaire**; FFQ-DA** Food Frequency Questionnaire Dietary Adherence; **QEWP-5,** Questionnaire of Eating & Weight Patterns-5; **Rep(EAT)-Q**, Repetitive Eating Questionnaire; **TFEQ,** Three-Factor Eating Questionnaire; **TFEQ-R18,** Three-Factor Eating Questionnaire - Revised; **YFAS**, Yale Food Addiction Scale

Key findings

Internal weight bias was consistently associated with maladaptive eating behaviours in bariatric surgery patients before and after bariatric surgery. The review found mostly small-to-medium and medium-to-large, statistically significant effect sizes.

Although emotional eating was the most frequently assessed eating behaviour and measured in over half of the reviewed studies, it was assessed using four different instruments (i.e. DEBQ, TFEQ-R18, EES, EOQ). Effect sizes for emotional eating ranged from small to medium (r = .29, p < .01) in both studies by Friedman et al.[32] and Sevincer et al.[47], through to large effect sizes in the studies by Wagner et al.[45] (r = .51, p < .01) and Weineland et al.[44] (r = .50, p <.01). The association between internal weight bias and binge eating was measured in two studies using the BES, with large effect sizes found by Friedman et al.[32] (r = .59, p < .01) and Soulliard et al.[46] (r = .53, p < .001). The association between internal weight bias and disordered eating psychopathology, as measured by the EDE-Q, had a large effect size in the studies by Weineland et al.[44](r = .63, p < .01), and Baldofksi et al.[40] (r = .66, p < .001), but only a medium effect size in the study by Sevincer at al.[47] (r = .34, p < .01).

In the study by Lawson et al.[42] the association between internal weight bias and loss of control eating had a small-to-medium effect size for frequency of loss of control eating (r = .29, p < .001), but the effect was greater for loss of control distress (r = .37, p < .001). For the association between internal weight bias and the eating behaviours of grazing and eating in the absence of hunger, medium effect sizes were evidenced by Romano[48] (r = .35, p < .001) and Baldofksi et al.[40], (r = .33, p < .001), respectively. The latter study also found the presence of food addiction and its association with internal weight bias had a medium effect size (r = .38, p < .001). The eating behaviour which had the smallest effect size, and the only negative association with internal weight bias, was dietary adherence post-surgery, as evidenced by Feig et al.[43] (r = - 0.14, p < .01) and Raves et al.[49] (r = -0.18, p < .05).

Three studies examined the relationship between internal weight bias and eating behaviours using mediation analysis. All studies investigated pre-surgery bariatric patients. Baldofksi et al.[40] found emotional dysregulation fully mediated the relationships between internal weight bias and emotional eating with a large effect size (standardised value 0.51) and also eating in the absence of hunger which had a medium effect size (standardised value 0.48). Whilst emotional dysregulation partially mediated the relationship between internal weight bias and food addiction (standardised value 0.26), there was no mediation effect for eating disorder psychopathology. The aspects of emotional dysregulation found to mediate the relationship between internal weight bias and the aforementioned eating behaviours were nonacceptance of emotional responses, difficulties engaging in emotional goal-directed behaviour, lack of emotional clarity and limited access to emotional regulation strategies.

The study by Braun et al.[41] used as a serial mediation model and found the relationship between internal weight bias and emotional eating was partially mediated by internalized shame and low self-compassion, total indirect effect b = 4.58 $\pm$ 1.54, 95% BCa [1.61, 7.70]. On its own self compassion mediated the relationship between internal weight bias and emotional eating, indirect effect b = 0.88 $\pm$ 0.54, 95% BCa [0.004, 2.28]. However, by itself internal shame did not mediate the effect between internal weight bias and emotional eating, indirect effect b = 2.03 $\pm$ 0.88, 95% BCa [-1.64, 4.68].

Lastly the study by Soulliard et al.[46] found the relationship between internal weight bias and binge eating was mediated by disinhibition, indirect effect b = 0.11 $\pm$ 0.02, 95% BCa [0.008, 0.14], and also hunger, indirect effect b = 0.08 $\pm$ 0.01, 95% BCa [0.05, 0.11]. These effects were present even when depression was controlled for. However, cognitive restraint did not mediate the relationship between internal weight bias and binge eating, indirect effect b = 0.004 $\pm$ 0.01, 95% BCa [-0.01, 0.02].

Quality and risk of bias of included studies

Given the emerging nature of the literature in the field of internal weight bias, eating behaviours and bariatric surgery, the evaluation of methodological quality and risk of bias is important if studies are to improve the robustness of the evidence base. Table 3 outlines the risk of bias assessment, which contains the agreed ratings between reviewer one and reviewer two. The two reviewers agreed exactly on 88% (44/50) of the ratings. They differed by one point on the remaining 12% of items (Appendix 2). Where differences occurred a final risk of bias rating for each item was agreed through discussion.

Across the studies the aims and objectives were generally well covered with a clear outline of the rationale for each study. However, from the outset there was a risk of sample bias, with seven of the reviewed studies from North America and the remainder from the UK[48], Germany[40], Sweden[44] and Turkey[47]. Furthermore, only two studies, those by Friedman et al.[32] and Wagner et al.[45], specified study inclusion criteria. There was an inherent assumption in the remaining studies that participants had met criteria to be assessed for, or undergo, bariatric surgery given their attendance at a bariatric surgery clinic. However, national clinical guidelines for the indication of bariatric surgery in adults can vary (e.g. BMI thresholds, previous weight loss attempts).[50] The risk of participant selection bias was also present, given that healthcare systems vary (e.g. publicly funded, private insurance, hybrid model), and those who use bariatric surgery support forums may differ from those who do not. Only two studies, those by Braun et al.[41] and Romano[48] provided details of any exclusion criteria (e.g. seeking revisional bariatric surgery). Furthermore, just four studies, those by Braun et al.[41], Raves et al.,[49], Romano[48] and Weineland et al.[44] clarified how many people were eligible/enrolled in the study compared to how many completed the study. Taken together, these factors highlight multiple sources of sample bias which could potentially make comparison of findings and replication of studies more difficult.

In terms of data collection, only the four studies by Baldofski et al.,[40] Braun et al.,[41] Soulliard et al.[46] and Wagner et al.[45] specified the time period when data was collected. This could be an important consideration if the role of external events (e.g. COVID-19, changing social media behaviours) influences personal and societal appraisals of obesity. Furthermore, given the potential influence of clinically desirable answers to gain clearance for bariatric surgery,[51] it is notable that only three out of seven pre-surgery studies clearly acknowledged whether data collection was part of the pre-screening, surgery approval process: the study by Baldofski et al.[40] collected data independently of surgery clearance, whilst studies by Soulliard et al.[46] and Wagner et al.[45] stated data collection was part of the pre-surgical assessment and approval process. Although all studies of patients seeking bariatric surgery provided baseline BMI, only the study by Braun et al.[41] objectively measured every participants' height and weight. The remaining studies relied, either on a combination of objective and patient self-reported measurements of height and weight, or solely on patient self-reported measurements of height and weight. Only three studies, those by Baldfoski et al.,[40] Raves et al.,[49] and Wagner et al.,[45] supported their decision to use self-report data by citing literature on reduced self-reporting bias of weight and height measurements in bariatric surgery candidates. The remaining studies provided no details for their use of self-report data. Of the four studies which collected data post-surgery there was heterogeneity in how BMI was reported (e.g. current BMI, post-surgery change in BMI, % excess BMI lost) and the follow-up period. The latter meant it was difficult to ascertain if the effects occurred during the 12-24 month post-surgery "honeymoon period" of typically positive change and if the effects were sustained.[25] Overall, nine out of eleven studies provided a clear rationale for the modification of psychometric measures (e.g. language translation) or their partial use (e.g. subscales to measure specific eating behaviours).

With regards to statistical power, only two studies made reference to statistical power and sample size, with Romano[48] providing an a priori power calculation and Soulliard et al.[46] stating their sample size was sufficient to detect a medium effect size at 0.80 power. Although the

use of appropriate statistical analyses and data checks was well covered in nine out of eleven studies, there was heterogeneity in the identification and control of confounding variables. Whilst age, gender and BMI were the most frequently controlled variables, just four studies considered race or socioeconomic status, which are factors known to affect obesity levels and the uptake of bariatric surgery[52]. Notably, only Lawson et al.[42] made any acknowledgement of current or past psychological input (i.e. participation in pre-surgery psycho-educational groups) or the use of medication, however even then these variables were not controlled for.

Furthermore, Romano[48] appeared to be the only study to consider the role of substance misuse and whether participants had a history of an eating disorder diagnosis. Just over half of the studies provided details about missing data and how this was managed thereby limiting the reliability and validity of the review findings. Whilst the study by Raves et al.,[49] acknowledged variability of completion rates in different outcome measures it was unclear how the missing data was managed. By contrast, Wagner provided the most comprehensive account of missing data e.g. frequency of missing data by outcome measure and individual items, use of Little's[53] MCAR test to detect if data was missing at random, and use of maximum likelihood estimation to manage the missing data.

In undertaking the risk of bias and quality assessments the methodologically strongest studies were conducted by Raves et al.,[49] and Wagner et al.[45]. However, taking into account all of the reviewed studies, in terms of the GRADE Approach,[39] the certainty of the evidence is considered to be low. Overall, based on the methodological strengths of the included studies, the balance of evidence would indicate that internal weight bias is positively associated with a maladaptive eating behaviours in bariatric surgery patients. However, the evidence is not sufficiently strong enough to identify which eating behaviours are most associated with internal weight bias and the causal direction of these relationships.

Table 3: Risk of bias assessment of reviewed studies

Study	Baldofski et al. 2016	Braun et al. 2021	Feig et al. 2020	Friedman et al.2020	Lawson et al. 2021	Raves et al. 2016	Romano, E. 2019	Sevincer et al. 2017	Soulliard et al. 2021	Wagner et al. 2020	Weineland et al. 2013
Were the aims/objectives of the study clearly described?	Well-covered	Well-covered	Adequately addressed	Adequately addressed	Well-covered	Well-covered	Well-covered	Well-covered	Well-covered	Well-covered	Well-covered
Was the sample selected from an appropriate population to closely resemble the target population?	Adequately addressed	Well-covered	Adequately addressed	Adequately addressed	Adequately addressed	Well-covered	Well-covered	Adequately addressed	Well-covered	Well-covered	Well-covered
Were weight & height calculated by a robust measure?	Well-covered	Well covered	Adequately addressed	Not addressed	Well-covered	Well covered	Adequately addressed	Not addressed	Adequately addressed	Well-covered	Well-covered
Did the study specify if data collection was part of the pre-surgery approval process?	Well-covered	Not addressed	Not applicable	Not addressed	Poorly addressed	Not applicable	Not applicable	Not addressed	Well-covered	Well-covered	Not applicable
Post-surgery: was an appropriate follow up period specified?	Not applicable	Not applicable	Well-covered	Not applicable	Not applicable	Adequately-covered	Poorly addressed	Not applicable	Not applicable	Not applicable	Well-covered
Was a clear rationale given if outcome measures were partially used or modified?	Well-covered	Well-covered	Adequately addressed	Adequately addressed	Well-covered	Well-covered	Well-covered	Well-covered	Well-covered	Well-covered	Well-covered
Was the study sufficiently powered to detect the reported effects?	Not addressed	Not addressed	Not addressed	Not addressed	Not addressed	Not addressed	Well-covered	Not addressed	Adequately addressed	Not addressed	Not addressed
Were appropriate statistical analyses & data checks used?	Well-covered	Well-covered	Adequately addressed	Adequately addressed	Well-covered	Well-covered	Well-covered	Well-covered	Well-covered	Well-covered	Well-covered
Were confounding variables identified & appropriately controlled?	Adequately addressed	Well-covered	Well-covered	Not addressed	Adequately addressed	Well-covered	Well-covered	Not addressed	Adequately addressed	Adequately addressed	Not addressed
Was information provided about missing data & how this was managed?	Adequately addressed	Adequately addressed	Not addressed	Not addressed	Not addressed	Adequately addressed	Adequately addressed	Not addressed	Not addressed	Well-covered	Adequately addressed

Ratings: 2 Points = well-covered; 1 Point = adequately addressed; 0 Points = poorly addressed, not addressed, not reported, not applicable

Discussion

This systematic review investigated the relationship between internal weight bias and eating behaviours in bariatric surgery patients. Whilst research on internal weight bias is still relatively new, the number of studies has increased rapidly in recent years and over half of the included studies were published in the last three years. The review identified that internal weight bias was significantly associated with all assessed eating behaviours, and this occurred irrespective of whether patients were seeking or had completed bariatric surgery. Moderate-to-strong correlations were identified between internal weight bias and a range of eating behaviours, including symptoms of emotional eating, binge eating and disordered eating. The only eating behaviour with a consistently small, and negative, effect size was dietary adherence post-surgery. Additionally, five mechanisms were identified as mediating factors in the relationship between internal weight bias and specific eating behaviours, namely emotional dysregulation, internalised shame, self-compassion, disinhibition and hunger.[40,41,46] Whilst only a limited number of eating behaviours were assessed and no mediation analyses were conducted on post-surgery patients, it would appear the ability to have access to, and engage in coping strategies focused on emotional regulation, self-compassion and impulse control could help support the psychosocial wellbeing of those seeking bariatric surgery.

The current review's finding of medium-large effect sizes between internal weight bias and maladaptive eating behaviours in bariatric surgery patients, supports findings from a previous systematic review by Pearl & Puhl[14] who examined these constructs in community and clinical populations of obesity. However, whilst effect sizes for emotional eating ranged from r values = 0.29 - 0.51 in the current review, Pearl & Puhl[14] combined the effect sizes for emotional eating, disinhibition and uncontrolled eating making direct comparisons more difficult, r values = 0.46 - 0.65. A review of weight stigma in adults with overweight and obesity by Papadopoulos & Brennan[8] did not include these eating behaviours meaning no comparisons could be made.

In terms of the relationship between internal weight bias and binge eating, the current review found large effect sizes (*r* values = 0.53 - 0.59) for binge eating in bariatric surgery patients compared to medium-to-large effect sizes (*r* values = 0.43 - 0.62) in the review by Pearl & Puhl[14]. The review by Papadopoulos & Brennan[8] documented an inconsistent relationship in treatment seeking individuals but a significant positive relationship in a community sample of people with obesity. It appears some of these differences may be a consequence of how binge eating has been operationalised. For example, whether patients present with symptoms of binge eating or have been diagnosed with binge eating disorder, and whether studies have measured the severity or frequency of symptoms. The current review was based on studies that only examined binge eating symptoms and their severity.

With regards to disordered eating psychopathology, the current review found a narrower range of correlation coefficients (r values = 0.34 - 0.66) compared to Pearl & Puhl[14] (r values = 0.29 - 0.77), despite both demonstrating medium to large effect sizes. However, the review by Papadopoulos & Brennan[8] combined twelve studies with different eating behaviours under the term “eating disorder psychopathology” meaning comparison was not possible.

Previous literature has demonstrated that internalised weight bias acts as mediator in the relationship between weight stigma and eating behaviour in a sample of undergraduate students[54] and between perceived weight discrimination and binge eating across BMI categories.[55] However, the current review is the first to demonstrate the mechanisms linking internal weight bias and maladaptive eating behaviours in bariatric surgery patients, namely emotional dysregulation, internalised shame, low self-compassion, disinhibition and hunger.[40,41,46]

Strengths of review

One of the strengths of the current review was the exclusive focus on the relationship between internal weight bias and eating behaviours in adult bariatric surgery patients, thereby allowing

a more detailed understanding of these psychosocial factors in this population. This contrasts with previous reviews where heterogenous samples were based on multiple classes of obesity and treatment settings.[14-16] Whilst the review by Papadopoulos & Brennan[8] recognised the qualitive differences of treatment seeking individuals with obesity from those in the community, they did not always differentiate between those seeking non-surgical and surgical solutions to their weight loss difficulties. A second strength of the review was the inclusion criteria. By requiring the use of validated instruments to collect internal weight bias and eating behaviour data this aided the comparison of study results and improved the reliability and validity of the overall review findings. As with previous reviews the homogeneity of assessment tools used to assess internal weight bias also enabled comparison of studies.

Limitations of review

There are some limitations in the current review. First, although a statistically significant medium-to-strong relationship was found between internal weight bias and eating behaviours, the majority of the evidence was based on correlation analysis therefore casualty could not be inferred. Second, all of the included studies used a cross-sectional design meaning the magnitude of change in the relationship between internal weight bias and eating psychopathology pre- and post-surgery could not be analysed. An understanding of this pattern would help identify if and when psychological interventions might be appropriate to support patients' wellbeing. Third, all the studies relied on subjective measures to collect data on internal weight bias and eating psychopathology, and in some instances weight and height for BMI calculations. Whilst this is a common feature of research in this area it increases the risk of bias from memory recall errors and socially desirable answers. The latter is particularly pertinent if research data is collected as part of the pre-surgery screening process and patients' seek to gain clearance for bariatric surgery.[51] Indeed, only three studies in the current review addressed this issue, with just one study[40] making it explicitly clear that data collection was not part of the surgery approval process and two studies[45,46] stating data collection was part of the surgery approval process. Fourth, although there was homogeneity of

measurement in using the WBIS to assess internal weight bias there is some concern regarding the content validity of the instrument.[8] Indeed, there is evidence to suggest that internal weight bias might be better understood as a multidimensional construct, one which requires an assessment measure which distinguishes between weight-related distress and weight-related self-devaluation.[8,56] Fifth, the decision to only include studies written in English and the predominance of studies from North America introduced publication bias and reduced generalisability. Future reviews would benefit from including studies with greater cultural, ethnic and racial diversity, given effect sizes for internal weight bias in American studies are reported to be significantly higher than Asian and European studies (0.57 vs 0.43).[15]

Implications for research, clinical practice and policy

The review identified that internal weight bias was significantly associated with all assessed eating behaviours. Given treatment guidelines require all patients to undertake a psychological assessment prior to bariatric surgery and receive a period of follow-up care, it would be beneficial to incorporate measures of weight bias into these processes. This could foster a greater understanding of each patient's case conceptualisation, what effect internalised biases might have along the weight reduction journey, and enable appropriate psychotherapeutic interventions to be considered before and after surgery.[57]

As the growth in research on internal weight bias in bariatric surgery patients continues, it will be beneficial for studies to examine the personal and social factors which moderate the strength of association between internal weight bias and eating behaviours. For example, bariatric surgery involves a multi-disciplinary team of clinicians and evidence indicates healthcare professionals can be a source of implicit and explicit bias, such as for dietary adherence.[49,58]

Bariatric surgery patients often experience a 1-2 year post-surgery "honeymoon" period of positive change in their wellbeing, but this does not always happen and is not always sustained

when it does.[25] Future research would benefit from using longitudinal studies to examine pre-/-post changes in internal weight bias and eating behaviours in the medium (2-5 years) and longer-term (5+ years).[59] By taking account of the different phases of each patient's weight reduction journey it would enable targeted interventions to be developed to support the long-term adjustment and wellbeing of bariatric surgery patients.

Conclusion

The current review examined the relationship between internal weight bias and eating behaviours in bariatric surgery patients for the first time. Eleven studies were included in the review and statistically significant relationships were found across all assessed eating behaviours, irrespective of whether patients were seeking or had completed bariatric surgery. Medium-large effect sizes were found in thirteen out of fourteen eating behaviours. Emotional dysregulation, internalised shame, self-compassion, disinhibition and hunger were found to act as mediating factors in the relationship between internal weight bias and specific eating behaviours in bariatric surgery patients. Research in this field is at an early stage and would benefit from longitudinal studies to examine pre- /post- changes in internal weight bias and eating behaviours for bariatric surgery patients. It is important we continue to increase our understanding of how bariatric surgery patients internalise society's attitudes to obesity and weight reduction if we are to support their long-term wellbeing.

Conflict of interest

The author has no conflict of interest to declare.

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Original Research Article

Interpersonal vulnerabilities and quality of life in bariatric surgery candidates: The mediating role of emotional eating and the moderating roles of anxiety and depression

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Written in accordance with the author submission guidelines for Health Psychology and Behavioral Medicine (Appendix 3).

Abstract

Background

Bariatric surgery is the recommended treatment for people with morbid obesity. Those seeking bariatric surgery are known to experience interpersonal vulnerability, emotional eating, psychological distress and reduced quality of life, yet the application of theoretical models to understand this patient population is limited. Studies have started to use the interpersonal psychotherapy model of eating disorders (IPT-ED) with bariatric surgery candidates, but have yet to investigate how interpersonal vulnerability is associated with quality of life, and how emotional eating, anxiety and depression might influence this relationship.

Method

This cross-sectional study used routinely collected data from a total of 193 consecutive patients seeking bariatric surgery from an NHS Bariatric Surgery Service in Scotland. Mediation and moderation analyses using the bootstrap method explored the relationships between interpersonal vulnerability, anxiety, depression, emotional eating and quality of life.

Results

Interpersonal vulnerability, anxiety and depression significantly predicted emotional eating. Neither anxiety nor depression moderated the relationship between interpersonal vulnerability and emotional eating. Mediation analysis found emotional eating partially mediated the relationship between interpersonal vulnerability and quality of life.

Conclusions

These findings broaden our understanding of the IPT-ED model in bariatric surgery candidates by demonstrating that the causal link between interpersonal difficulty and eating behaviours extends to include quality of life. It also highlights the importance of emotional eating as a mechanism mediating this relationship and the implications for targeted psychosocial interventions to support bariatric surgery patients before and after surgery.

Key words

Bariatric surgery, quality of life, emotional eating, interpersonal factors

Introduction

Obesity is a significant global issue associated with multimorbidity and chronic conditions e.g. Type 2 diabetes, cancer, cardiovascular disease.[60,61] Scotland has highest rate of obesity of any OECD country, with two-thirds of the adult population overweight/obese (66%) and more than one in four classified as obese (29%). The recommended treatment for effective long-term weight loss in adults with morbid obesity i.e. Body Mass Index ≥40kg/m^2 (or BMI ≥35kg/m^2 and a comorbid physical illness) is bariatric surgery.[62] It is not without risks including surgical complications, weight regain, emergence or re-emergence of disordered eating patterns and increased substance misuse.[20,24,27,63] Clinical guidelines advise an assessment is undertaken to evaluate the psychological suitability of candidates for bariatric surgery. Compared to people of a normal weight, those who seek a surgical solution to their weight issues experience increased difficulties in four key psychosocial domains: interpersonal vulnerabilities, psychological distress, disordered eating and reduced quality of life.[24,25] Given evidence on the long-term improvements in these areas post-surgery is mixed, and application of theoretical models within this population is limited, it is important that our understanding of bariatric surgery candidates is advanced if appropriate pre- and post-surgery psychological interventions are to be developed to address these psychosocial difficulties.[57,64]

The Interpersonal Psychotherapy Model for Eating Disorders (IPT-ED) offers a theoretical framework to understand how interpersonal vulnerabilities might trigger psychological distress and disordered eating in bariatric surgery candidates.[65] A central concept of the IPT-ED model is the link between negative social evaluation and disturbances of the self (Figure 1). Negative social judgements lead to the deterioration of a person's mood and how they view themselves, which in turn reinforces, and is reinforced by, disordered eating behaviours. This can take the form of external judgements known as weight bias (e.g. weight-based rejection, weight-based stigma, weight-based prejudice), or internal judgements known as internalised weight bias (e.g. negative self-identity based on society's weight stereotypes).[14]

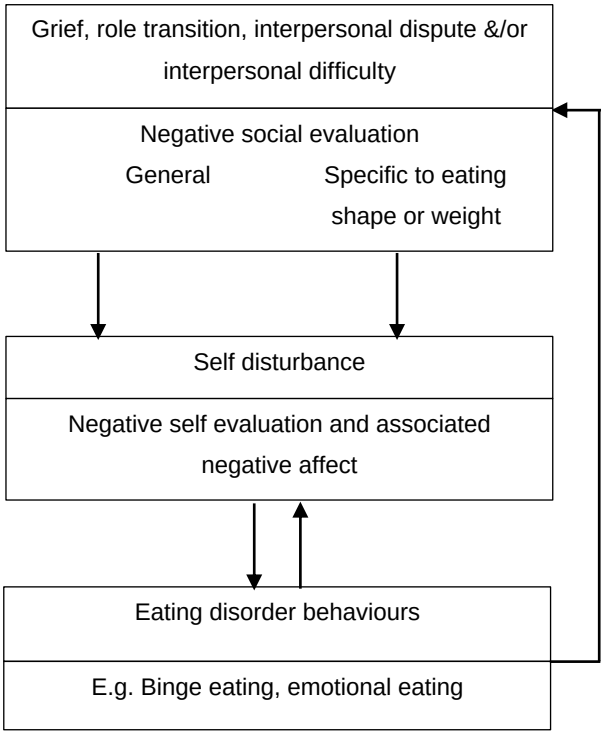

Figure 1. The IPT-ED model. Adapted from "An eating disorder-specific model of interpersonal psychotherapy (IPT-ED): Causal pathways and treatment Implications," by Rieger et al.[65]

The majority of bariatric surgery candidates have experienced weight bias and 50.6% experienced weight-related teasing during childhood.[25,66] Qualitative accounts highlight the "profound impact" of weight-based stigma on their psychological wellbeing and quality of life, including difficulties with body shame, social avoidance and heightened embarrassment undertaking activities of daily living.[67] In the general population[68] and bariatric surgery candidates[40] higher rates of internalised weight bias were evident in females and younger people. The effects of gender and age in obesity may be associated with societal ideals about thinness and attractiveness for women and young people.[10] Recently Braun et al.[41] found internalised weight bias had a stronger and more direct effect on psychological wellbeing than the extent of the stigma experienced by an individual, which supported evidence by Pearl and Puhl.[14] Although Pearl and Puhl's[14] review included clinical and non-clinical samples of obesity, they found internalised weight bias was significantly positively associated with depression (moderate-strong relationship), anxiety (weak-moderate relationship) and

emotional eating (strong relationship). Moreover, significant negative associations were found between internalised weight bias and mental health-related quality of life, although the strength of associations for physical-related quality of life were inconsistent and dependent on the measure used. Despite these significant associations quality of life, whether mental health-related or physical health-related, is notably absent from the IPT-ED Model.

Given people affected by obesity and mental health issues reportedly experience twice the rate of prejudice and stigma compared to those with mental health issues who are not obese, within the context of the IPT-ED model it would be important to better understand the extent of psychological distress in bariatric surgery candidates.[69]

A cohort study of more than 8,000 bariatric surgery patients in the US found 57% had a history of mental illness compared to 20.6% in the general population.[70,71] Whilst different geographies and healthcare systems influence the detection, classification and treatment of conditions it highlights the magnitude of psychological distress. In bariatric surgery candidates, variability exists in both the lifetime prevalence rates for anxiety (15.5% - 54.7%) and depression (22.0% - 56.1%), and the current prevalence rates for anxiety (11.5% - 46.3%) and depression (6.4% - 31.5%).[51,72-75] Such variability appears to be a consequence of methodological inconsistencies e.g. higher reported levels of psychological distress when data collection was independent of the surgery approval process, and for structured interviews versus questionnaires.[63,72,73] Furthermore, many studies combined anxiety and depression scores into a single measure of psychological wellbeing. However, a bidirectional link has been reported between depression and obesity, and post-surgery improvements in anxiety are typically smaller than those of depression.[25]

Whilst higher levels of anxiety and depression (current and historic) are consistently found in female bariatric surgery candidates compared to their male counterparts, gender may exhibit a cofounding effect; female candidates are significantly more likely to report a history of

psychological distress and typically comprise more than 70% of study samples.[73,76,77] Furthermore, low socioeconomic status might also act as a confounding factor given its strong association with increased obesity and its ability to independently lead to a "cascade" of inter-connected psychological and psychical health conditions (e.g. mood, Type 2 diabetes) irrespective of obesity.[61,78,79] That said, the increased risk of depression and obesity associated with low socioeconomic status was found to vary by type of depression diagnosis, with no link found in major depression.[80]

From the perspective of the IPT-ED model, if interpersonal vulnerabilities interact with psychological distress to influence disordered eating, it would be important to consider how different levels of anxiety and depression influence this relationship and the role of disordered eating in bariatric surgery candidates.

Whilst not all bariatric surgery candidates have disordered eating patterns, it is considered one of the most notable features of this population with prevalence rates of 2%-53% for binge eating disorder and 37%-59% for emotional eating.[20,31,81-83] The variability of prevalence rates is related to a range of methodological and clinical issues, including the inclusion and exclusion criteria of studies, the use of unvalidated and varied assessment measures, and the hesitancy of individuals to share information when historically an eating disorder diagnosis was a contraindication for bariatric surgery.[19,20,25,84]

Lo Coco et al.[85] used the IPT-ED model in people to demonstrate that negative affect mediated the association between interpersonal difficulties and binge eating in people with obesity, as well as between interpersonal difficulties and eating behaviours where binge eating was not present in this population. However, no regard was given to the role of emotional eating or how this affected patients seeking bariatric surgery. Salerno et al.[86] applied the IPT-ED model specifically to bariatric surgery candidates. In controlling for binge eating they found self-esteem mediated the relationship between negative affect, body image disturbance and

interpersonal problems. Whilst they recognised, but did not investigate, the possibility that interpersonal difficulties might be a cause rather than a consequence of psychological distress in bariatric surgery candidates, they also omitted to assess the influence of emotional eating.

However, emotional eating is considered a significant risk factor in the development and maintenance of obesity in adults.[87] Emotional eating has been conceptualised as a subclinical form of disordered eating where people eat consciously or reflexively in response to psychological distress.[26,81,88] However, with no single definition or measure of emotional eating it makes interpretation of the literature more nuanced. In line with Braden et al.[89], and the psychosomatic theories of obesity[90], the current study understands emotional eating as a behavioural pathway for regulating psychological distress in obese individuals facing intrapsychic and interpersonal difficulties.

The role of emotional eating in people with bariatric surgery candidates was considered by Baldofski et al.[40] They found the relationship between internalised weight bias and emotional eating was partially mediated by emotional dysregulation in patients seeking bariatric surgery. More specifically, Willem et al.[91] found the relationship between emotional dysregulation and emotional eating was dependent on obesity levels and type of distress. In people with Class III (i.e. BMI ≥40) obesity higher levels of emotional dysregulation were directly and strongly associated with increased emotional eating, however this relationship was partially mediated through depression but not through anxiety. In people with Class I (i.e. BMI ≥30.0–34.9) and Class II (i.e. BMI >35.0-39.9) obesity anxiety fully mediated the relationship, but there was no mediating effect of depression and no direct association between emotional dysregulation and emotional eating. Spinosa et al.[92] found socioeconomic status had a significant indirect effect on BMI via psychological distress and emotional eating, albeit just 20% of participants were classed as obese. Furthermore, although Claes et al.[93] identified a group of “emotionally dysregulated” bariatric surgery candidates who used binge eating as a means of coping with higher levels of interpersonal difficulties, anxiety and depression, it is worth noting that they

also identified a second group of “resilient/high functioning” candidates without interpersonal difficulties, where eating was not perpetuated by emotions and external events. In their sample all candidates were female and no regard was given to the potentially confounding effect of gender on emotional eating: higher rates of emotional eating have been found in women versus men in the general population and in those seeking bariatric surgery.[94,95]

The studies by Braun et al.[96], Baldofski et al.[40] and Willem et al.[91] examined mediation effects, however from the perspective of the IPT-ED model there has been no examination of the potential moderating effects of anxiety and depression on the strength and direction of the relationship between interpersonal vulnerabilities and emotional eating in bariatric surgery candidates, whilst controlling for potentially confounding socio-demographic variables such as gender, age and socio-economic status.

Traditionally bariatric surgery has considered weight loss as the primary “measure of success”. However, there is increasing recognition that this has ignored the importance of bariatric surgery candidates’ quality of life.[25] Indeed, apart from improvements in interpersonal relationships, psychological wellbeing and eating behaviours, patients cite improvements in quality of life as a key motivation for bariatric surgery.[97-99] However, our understanding of this area is complicated by the fact that with no single definition of health-related quality of life it can comprise a range of different physical and psychosocial factors e.g. physical mobility, role functioning, self-esteem, work.[100] Moreover, many studies of quality of life in morbid obesity use generic measures such as the Medical Outcome Short-Form 36, rather than weight-specific measures such as the Impact of Weight on Quality of Life Questionnaire, meaning there is lack of consistency of reporting.[101]

People with morbid obesity, and particularly those who seek bariatric surgery, reported significantly lower levels of quality of life compared to the general population.[102,103] Whilst a recent study by Martinelli et al.[103] supported previous research[104,105] indicating that mental

health-related quality of life was more greatly impacted than physical health-related quality of life in bariatric surgery candidates, the reduction in mental health-related quality of life was greater in candidates with Class II versus Class III obesity. Moreover, compared to male bariatric surgery candidates, females were found to experience significantly lower levels of physical health-related quality of life, as well as mental health-related quality of life related to the inter-personal context i.e. self-esteem, intimacy, work and public distress.[106] A gender disparity was also noted by Pokrajac-Bulian, Kukić and Bašić-Marković [107], where aspects of physical health-related quality of life, namely physical functioning and role limitations, mediated the relationship between BMI and depression in women but not men. Yet, whilst bariatric surgery has been found to significantly improve patients' quality of life, improvements were typically related to physical rather than psychological changes, and quality of life stabilised after the 1-2 years but still remained below that of normal weight individuals.[22,100,108,109] Although the IPT-ED model recognises the role of interpersonal vulnerabilities, psychological distress and disordered eating behaviours within its theoretical framework, its failure to address the importance of quality of life is a key omission if it is to be considered for use within the bariatric surgery seeking population.

The following study will therefore seek to examine for the first time in bariatric surgery candidates the relationship between interpersonal vulnerability, anxiety, depression, emotional eating and quality of life. First, given previous research outlining the impact of interpersonal vulnerabilities through weight bias and internalised weight bias on quality of life, it is hypothesised that higher levels of interpersonal vulnerability are associated with reduced quality of life.[14] Second, with research highlighting the impact of interpersonal vulnerabilities on emotional eating[65] it is hypothesised that higher levels of interpersonal vulnerability is associated with higher levels of emotional eating. Third, with research highlighting emotional eating as an indicator of emotional dysregulation and its negative impact on people's quality of life[110], it is hypothesised that higher levels of emotional eating are associated with lower levels of quality of life. Fourth, given the influence of psychological distress on emotional

eating[92] it is hypothesised that anxiety and depression will moderate the relationship between interpersonal vulnerabilities and emotional eating, whilst controlling for gender, age and socioeconomic status. Fifth, given the conceptual link between interpersonal vulnerabilities, emotional eating and quality of life[86,107] it is hypothesised that emotional eating will mediate the relationship between interpersonal vulnerabilities and quality of life in people seeking bariatric surgery, whilst controlling for gender, age and socioeconomic status.

Methods

Participants

The study adopted a cross-sectional quantitative survey design using a pre-existing dataset. Data were collected from 193 consecutive patients seeking bariatric surgery from an NHS Bariatric Surgery Service in Scotland between 2013 to 2019. As per national clinical guidelines [18,62] all patients had a pre-surgery assessment with a Clinical Psychologist to screen for psychological suitability for bariatric surgery. As per these guidelines participants were required to meet the following criteria: (1) aged 16 or above, (2) BMI ≥40kg/m2 or BMI ≥35kg/m2 with one or more comorbid conditions expected to improve significantly with weight reduction (e.g. arthritis, severe mobility problems, type 2 diabetes), and (3) a 10% reduction in excess body weight (EBW) through completion of a structured weight management programme prior to referral for bariatric surgery. There were no exclusion criteria.

Ethics

The study used routinely collected and anonymized data in the course of standard NHS clinical practice, therefore NHS Caldicott (Appendix 5) and The University of Edinburgh (Appendix 6) ethical approvals were obtained. The use of a pre-existing anonymized dataset meant it was not possible to obtain direct participant consent for the current study. However consent was implied since data was collected as part of routine clinical practice within NHS Scotland. The information provided by participants informed whether or not they were accepted or rejected

for bariatric surgery, rather than being solely for research purposes. It is acknowledged this might have influenced their motivation to respond and the social desirability of answers in favour of the outcome they sought.[111]

Measures

Interpersonal vulnerability

The Interpersonal sensitivity sub-scale (i.e. response to rejection and criticism; $\alpha = 0.80$) from The Inventory of Interpersonal Problems-Personality Disorder 25 (IIP-PD-25) was used to assess interpersonal vulnerability.[112] The subscale contained five items which assessed participants' level of interpersonal difficulty on a Likert scale from 0 ("not at all") to 4 ("extremely distressing"). A mean score was calculated, which ranged from 0 to 4. Higher scores indicated greater interpersonal vulnerability. Use of an individual subscale to assess a specific interpersonal vulnerability was evidenced in the psychological assessment of people seeking aesthetic surgery.[113]

Anxiety and Depression

The Hospital Anxiety and Depression Scale (HADS) is a 14 item self-report measure which assessed participants' levels of anxiety and depression.[114] Participants rated the presence of seven anxiety and seven depressive symptoms on a 4-point Likert scale from 0 to 4. A total score ranging from 0 to 21 was calculated separately for both anxiety symptoms and depression symptoms. Higher scores indicated increased psychological distress. Although Bjelland et al.'s[115] systematic review highlighted the reliability and validity of the two-factor structure of the HADS, this has been contested by contrasting assertions. Whilst Crawford et al.[116] claim medium correlations between anxiety and depression mean scores can be combined into a single measure of "psychological distress", Cosco et al.[117] claim the heterogeneity of factor structures mean depression and anxiety scores should be combined to form a more general measure of "emotional distress".

Emotional Eating

The Emotional Eating subscale from the Weight Loss Readiness Test-II (WLRT-II) was used to assess the level of emotional eating in participants.[118] Using a five point Likert scale (0 = "never" to 4 = "always") it assessed the presence of emotional eating across three factors: negative feelings; positive feelings; and "unpleasant interactions" or a "difficult day at work". A total score ranging from 0 to 12 was calculated. A higher score indicated increased levels of emotional eating. Although NHS Scotland was granted permission to use the WLRT-II across its Bariatric Surgery Services by the author, its psychometric properties have yet to be assessed.[119]

Quality of Life

The Impact of Weight on Quality of Life (IWQOL-Lite) is a 31-item measure which assessed participants' quality of life across five domains: physical function, self-esteem, sexual life, public distress and work.[120] Participants rated their experiences over the past week on a five point Likert scale from 1 ("always true) to 5 ("never true"). A total score ranging from 0 to 155 was calculated, with a higher score indicating poorer quality of life. The IWQOL-Lite was found to have excellent overall reliability (α = 0.96).[121]

Procedure

Patients were sent a total of five psychological measures with the appointment letter and completed the measures prior to attending the assessment appointment. These included three measures used in the current study (i.e. IIP-PD-25, WLRT-II, IWQOL), as well as the Self-Liking Self-Competence Scale (SLSCS)[122] and the Standardised Assessment of Personality Abbreviated Scale (SAPAS)[123] which were not used in the current study. The HADS was the only psychological measure completed at the appointment. Participants' weight and height were measured at the appointment and their BMI calculated. Socio-economic status was calculated from the participants' postcode using the Scottish Government's Scottish Index of Multiple Deprivation (SIMD).[124] SIMD scores ranged from 1 (most deprived) to 10 (least

deprived). The questionnaire scores and other relevant demographic information were entered into an anonymised database.

Statistical Analysis

Data analyses were conducted using SPSS (version 25)[125] and PROCESS.[126] Descriptive statistics (means, standard deviations) for the demographic variables were calculated to summarise the scores for each variable. Bivariate correlations were then undertaken to assess the relationship between study variables.

The moderating effects of anxiety and depression on the relationship between interpersonal vulnerability and emotional eating were assessed separately by running two individual moderations using Process Model 1. The mediating effect of emotional eating on the relationship between interpersonal vulnerability and quality of life was assessed using Process Model 4.

To maximise the robustness of the moderation and mediation models 5,000 bootstrapping samples were used to more accurately calculate the 95% confidence intervals and standard error,[127] Cribari-Neto's HC4 was used to control for bias from unequal error variances (i.e. heteroscedasticity),[128] conditional values were set at -1SD, mean and +1SD, and whilst mean centering does not reduce collinearity it assists statistical interpretation.[126] For Process Model 1 (moderation), based on squared partial correlations, a medium effect size of 0.13 and power of 0.8, the required sample size was $n = 55$.[129] For Process Model 4 (mediation), based on calculations by Fritz & MacKinnon[130] and the assumption of effect sizes when the *a* path = 0.26 and the *b* path = 0.26, the estimated required sample size for 0.8 power was $n = 148$. In the moderation models Johnson-Neyman intervals and simple slopes were assessed for significance of interpersonal vulnerability on emotional eating at different levels of anxiety and depression.[131]

Results

The study used a pre-existing dataset which contained an original sample of *n* = 193. However, during data screening issues were identified with fourteen participants which meant they were excluded from the statistical analysis; ten participants did not meet the inclusion criteria (i.e. BMI <35), two participants were missing all psychometric data, and two participants were found to have invalid data with scores beyond what would have been possible for the measures used. With these participants excluded from the dataset this resulted in a final sample of *n* = 179.

Assumption checks

Regression analysis requires certain statistical assumptions are met, therefore a series of statistical tests were undertaken to check the data further. Missing values can lead to biased estimates.[132] Overall, 5% of the values were missing from the final sample, whilst 38% of participants were missing data for one or more variables. There were no missing data for gender and age and just 1% of missing data for anxiety (*n* = 2) and depression (*n* = 2). The rates of missing data were 6% for emotional eating (n = 11) and BMI (n = 11), and 7% for socioeconomic status (*n* = 12). The highest rates of missing data were 12% for interpersonal vulnerability (*n* = 21) and 15% for quality of life (n = 27); two of the measures participants completed at home and brought to the assessment appointment. It is unclear if participants had difficulty completing the questionnaires, chose not to complete a particular measure or forgot to bring the questionnaire pack to the appointment. The MCAR Test[53] was used to check the assumption that values were missing completely at random. The MCAR Test was not statistically significant (X^2 (1, 87) = 104.27, *p* = .10), which indicated the data were missing completely at random. To address the issue of missing data and maximise the available sample the statistical method of Expectation-Maximisation was undertaken. Whilst this approach can underestimate the standard error, it predicts the missing data values using existing parameters and creates a single dataset for statistical analysis.[133]

Bias can also arise in the form of influential cases and data outliers. Data were checked at the multivariate level using Mahalanobis distance ($p < .001$, $X^2 = 20.52$) and no influential cases were found.[134] Outliers at the univariate level were checked using boxplots [135]. Ten potential high outliers were found in the measure of anxiety (HADS anxiety scores of 16-21), eight potential high outliers in depression (HADS depression scores of 15-19) and two potential low outliers in quality of life (IWQOL scores ≤11). Winsorizing was used to replace these data points with the next closest values that were not outliers.[131]

The assumption of normality was checked using p-p plots, histograms and descriptive statistics. In line with these checks and the central limit theorem overall the data was found to be normal.[131] However, the data for interpersonal vulnerability, anxiety and depression exhibited some positive skewness and the data for interpersonal vulnerability and depression exhibited some positive kurtosis. The assumptions of linearity and homoscedasticity were checked using scatterplots and found to be met. The assumption of independence of errors was checked using the Durbin-Watson test and the data were found to be within expected range of between one and three. Multicollinearity was not evident when assessed through tolerance (>0.2) and Variance of Inflation Factors (> 10).[131] All moderation and mediation analyses were conducted while controlling for gender, age and socioeconomic status.

Demographic and descriptive statistics

Almost four out of five bariatric surgery candidates were female and the average age was approximately 44 years old (Table 1). Of the ten categories of socioeconomic deprivation, just over half of bariatric surgery candidates (50.9%) were from the lowest four categories. Almost three quarters of the final sample (73.2%) presented with Class III obesity (BMI >40) whilst the remainder had Class II obesity (BMI 35 to <40). Of the ten participants who did not meet the inclusion criteria and were excluded from the final sample seven had Class I obesity (BMI 30 to <35).

Table 1. *Demographic information and descriptive characteristics.*

(n = 179)	*Value n (%)*	*Range*
Gender		
Male	*37 (20.7)*	
Female	*142 (79.3)*	
Age		
M	*43.8*	*20 - 65*
SD	*10.6*	
Socioeconomic status		
M	*4.8*	*1 - 10*
SD	*2.8*	
Body mass index		
M	*45.7*	*35.0 - 71.5*
SD	*8.0*	
Type of surgery assessed for		
LAGB	*158 (88.2)*	
SG	*16 (8.4)*	
LAGB or SG	*6 (3.4)*	

Abbreviations: M, Mean; SD, Standard deviation; LAGB, Laparoscopic adjustable gastric banding, SG, Sleeve gastrectomy.

Hypothesis 1: Increased interpersonal vulnerability will be associated with reduced quality of life.

Interpersonal vulnerability demonstrated a statistically significant, strong and positive association with reduced quality of life (r = .55, p < .001), meaning higher levels of interpersonal vulnerability were associated with poorer quality of life (Table 2).

Hypothesis 2: Increased interpersonal vulnerability will be associated with higher levels of emotional eating

It was found that interpersonal vulnerability exhibited a statistically significant, strong and positive association with emotional eating (r = .50, p < .001), such that higher levels of interpersonal vulnerability were associated with increased emotional eating (Table 2).

Table 2. *Means, standard deviations and correlations of study variables.*

	M	*SD*	*1*	*2*	*3*	*4*	*5*
1. Interpersonal vulnerability	*1.50*	*1.05*	*1*				
2. Anxiety	*6.16*	*4.24*	*.62***	*1*			
3. Depression	*5.36*	*3.92*	*.63***	*.66***	*1*		
4. Emotional eating	*5.23*	*2.85*	*.50***	*.45***	*.47***	*1*	
5. Quality of life	*94.82*	*29.34*	*.55***	*.39***	*.49***	*.45***	*1*

***p < .001 *p < .05*

Hypothesis 3: Higher levels of emotional eating will be associated with reduced quality of life

The results indicated a statistically significant, moderate to strong, positive relationship with quality of life (r = .45 p < .001), therefore higher levels of emotional eating were associated with reduced quality of life (Table 2).

In addition to the results which supported the above three hypotheses, a negative association existed between interpersonal vulnerability and age (r = -.18, p < .05), meaning interpersonal vulnerability reduced with age. Furthermore, a positive relationship was identified between emotional eating and being female (r = .15, p < .05), as well as between increased age and higher socioeconomic status (r = .25, p < .001).

Hypothesis 4: Moderation analyses

Two separate moderation analyses were conducted to examine if psychological wellbeing in the form of anxiety and depression moderated the relationship between interpersonal vulnerability and emotional eating.

Hypothesis 4.1: Anxiety will moderate the relationship between interpersonal vulnerability and emotional eating.

The overall model had a large effect, $F(6,172) = 5.76$, p < .001, R^2 = .31 and explained 31% of the variance when controlling for gender, age and socioeconomic status. Both interpersonal

vulnerability, *b* = .95, t(172) = 3.64, *p* = < .001, and anxiety, *b* = .14, *t*(172) = 2.21, *p* = < .05, were significant predictors of emotional eating (Table 3). The test of moderation found the interaction effect was not statistically significant, *b* = .05, 95% CI [-.034, .125], *t*(172) = 1.14, *p* = 0.257. When two confidence intervals contain zero it can be assumed that the effect is non-significant. This meant anxiety did not moderate the relationship between interpersonal vulnerability and emotional eating, and there was no significant improvement on the model with the addition of the interaction, *F*(1,172) = 1.30, *p* = .257, R^2 = .005.

Table 3. Linear model of predictors of emotional eating with anxiety as moderator

	b	*SE B*	*Bootstrapped Confidence Interval (95%)*	*t*	*p*
Constant	*2.47*	*1.11*	*.268 to 4.668*	*2.22*	*p < .05*
Interpersonal vulnerability (centred)	*.95*	*.26*	*.433 to 1.458*	*3.64*	*p < .001*
Anxiety (centred)	*.14*	*.06*	*.015 to .262*	*2.21*	*p < .05*
Interpersonal vulnerability x anxiety	*.05*	*.04*	*-.034 to .125*	*1.14*	*p = .257*

All coefficients represent unstandardized regression coefficients controlling for gender, age and socioeconomic status (5,000 bootstrap samples).

Hypothesis 4.2: Depression will moderate the relationship between interpersonal vulnerability and emotional eating.

The overall model had a large effect, *F*(6,172) = 5.81, *p* < .001, R^2 = .31 and explained 31% of the variance when controlling for gender, age and socioeconomic status. Both interpersonal vulnerability, *b* = .92 *t*(172) = 3.66, *p* = < .001, and depression, *b* = .17, *t*(172) = 2.27, *p* = < .05, were significant predictors of emotional eating (Table 4). The test of moderation found the interaction effect was not statistically significant, *b* = .03, 95% CI [-.054, .112], *t*(172) = .70, *p* = .487. Given the two confidence intervals contained zero it can be concluded that the effect was non-significant. This meant depression did not moderate the relationship between interpersonal vulnerability and emotional eating, and there was no significant improvement on the model with the addition of the interaction, *F*(1,172) = .49, *p* = .487, R^2 = .002.

Table 4. Linear model of predictors of emotional eating with depression as moderator

	b	*SE B*	*Bootstrapped Confidence Interval (95%)*	*t*	*p*
Constant	*2.91*	*1.12*	*.698 to 5.118*	*2.60*	*p < .05*
Interpersonal vulnerability (centred)	*.92*	*.25*	*.425 to - 1.420*	*3.66*	*p < .001*
Depression (centred)	*.17*	*0.07*	*.021 - .309*	*2.27*	*p < .05*
Interpersonal vulnerability x depression	*0.03*	*.04*	*-.054 - .112*	*.70*	*p = .487*

All coefficients represent unstandardized regression coefficients controlling for gender, age and socioeconomic status (5,000 bootstrap samples).

Hypothesis 5: Emotional eating will mediate the relationship between interpersonal vulnerability and quality of life

There was a significant indirect effect of interpersonal vulnerability on quality of life through emotional eating, b = 2.89, 95% BCa CI [.916, 4.800] (Table 5). Since the two confidence intervals did not contain zero it can be concluded that the effect is significant. It was found that 18.98% of the effect of interpersonal vulnerability on quality of life operated indirectly through emotional eating, when controlling for gender, age and socioeconomic status (Figure 2). Overall, the model was significant with a large effect size, $F(5, 173) = 26.10$, $p < .001$, $R^2 = .362$ and explained 36.2% of the variance when controlling for gender, age and socioeconomic status.

***Table 5**. Summary of mediation analysis with bootstrapped confidence.*

Model	*β*	*SE*	*95% BCa CI*	*t*	*p*
Total effect	*15.22*	*1.50*	*[12.246, 18.184]*	*10.12*	*p <. 001*
Direct paths					
IV → EE	*1.37*	*.19*	*[.995, 1.734]*	*7.29*	*p <. 001*
EE → QoL	*2.12*	*.69*	*[.753, 3.480]*	*3.06*	*p < .01*
IV → QoL	*12.33*	*1.75*	*[8.865, 15.788]*	*7.03*	*p <. 001*
Indirect effects					
IV → EE → QoL	*2.89*	*.99*	*[.916, 4.800]*		

All coefficients represent unstandardized regression coefficients controlling for gender, age and socioeconomic status (5,000 bootstrap samples). Abbreviations: IV, Interpersonal vulnerability; QoL, Quality of life; EE, Emotional eating.

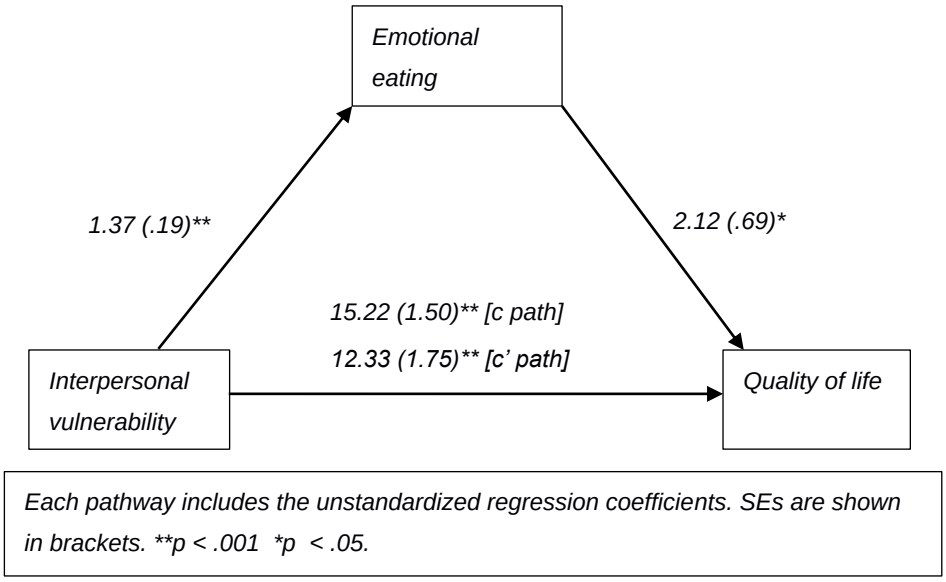

Figure 2. Mediation model of the relationship between interpersonal vulnerability, emotional eating and quality of life.

Discussion

Recent research has started to apply the IPT-ED model to people seeking treatment for obesity and consider the relationships between their interpersonal functioning, eating behaviours and psychosocial wellbeing.[40,85,86] This study was the first to consider quality of life as an outcome in the IPT-ED model when applied to bariatric surgery candidates, assess the

mediating effects of emotional eating in the relationship between interpersonal vulnerability and quality of life, and examine the moderating effects of psychological distress on the relationship between interpersonal vulnerability and emotional eating. Figure 3 outlines the proposed addition of quality of life in the IPT-ED model.

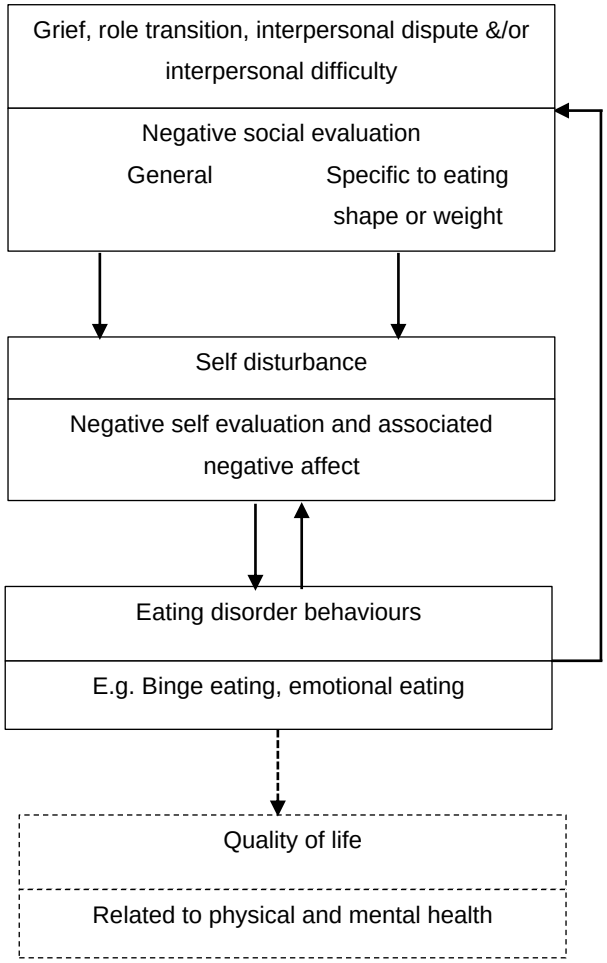

Figure 3. Proposed enhanced IPT-ED model including quality of life. Adapted from "An eating disorder-specific model of interpersonal psychotherapy (IPT-ED): Causal pathways and treatment Implications," by Rieger, Van Buren, Bishop, Tanofsky-Kraff, Welch and Wilfley [65] Dashed lines indicate the addition of quality of life in the IPT-ED model.

Findings supported the first and second hypotheses, namely that increased interpersonal vulnerability would be associated with reduced quality of life and increased emotional eating in bariatric surgery candidates. This was consistent with previous studies by Latner et al.[136,137], Wagner et al.[45], and Baldofski et al.[40], who found higher levels of interpersonal vulnerability

in bariatric surgery candidates were significantly associated with reduced quality of life and increased emotional eating. Additionally, the finding that interpersonal vulnerability was significantly associated with increased symptoms of anxiety and depression was also consistent with previous literature.[14,41,45]

The third hypothesis was also supported whereby emotional eating was significantly and positively related with quality of life. This parallels previous findings from a study of adolescents with severe obesity.[138] It also lends support to the multi-centre, Longitudinal Assessment of Bariatric Surgery-2 (LABS-2) study which found a relationship between other maladaptive eating behaviours and quality of life in adult bariatric surgery patients (e.g. binge eating, night eating syndrome).[31]

The fourth hypothesis was not supported as neither anxiety nor depression moderated the relationship between interpersonal vulnerability and emotional eating. Previous research indicated that emotional eating tends to increase in response to negative emotions and it might have been expected that the strength of the relationship between interpersonal vulnerability and emotional eating would be influenced by different levels of anxiety and depression.[20,81] Whilst the current study found psychological distress had no moderating effect, previous research found emotional dysregulation mediated the relationship between internal weight bias and emotional eating in bariatric surgery candidates.[40] Furthermore, negative affect was found to mediate the relationship between interpersonal problems and those who had binge eating symptoms, as well as those who did not.[85,86] In the current study it may have been there was insufficient power to detect the effects of any moderation and with a larger sample this might have been observed.

The fifth hypothesis was supported when emotional eating was found to mediate the relationship between interpersonal vulnerability and quality of life in bariatric surgery candidates. These findings support previous work by Canetti et al.[139] who demonstrated the

connection between emotional eating and quality of life in bariatric surgery patients. Not only did they find that emotional eating fully mediated the relationship between social support and weight loss in patients who had completed bariatric surgery, but that weight loss fully mediated the relationship between post-surgery emotional eating and improvements in patients' quality of life. The current study also lends support to previous research by Salerno et al.[86] who used the IPT-ED model to demonstrate that self-esteem mediated the relationship between interpersonal functioning and psychological distress in people seeking treatment for obesity. The findings from the current study underscore the importance of using a theoretical framework, such as the IPT-ED, to better understand how interpersonal vulnerability, eating behaviours and quality of life impact bariatric surgery patients.

Strengths of study

The current study, as far as the author is aware, is the first to consider quality of life in the context of the IPT-ED model and apply this to the bariatric surgery population. Prior research found improvements in quality of life and interpersonal contexts were key reasons people sought to undergo bariatric surgery.[97,98] By introducing quality of life as an outcome in the IPT-ED model it affords opportunities for greater understanding of the psychosocial context of bariatric surgery patients for assessment and formulation. This could then aid treatment planning of appropriate psychosocial interventions to improve the outcomes and long-term wellbeing of bariatric surgery patients.[57,100]

Rather than use a generic measure of quality of life, such as the Medical Outcome Study 36-Item Short Form Health Survey (SF-36) whose validity in people with morbid obesity has been questioned[140], the study used a validated quality of life measure (IWQOL-Lite[120]) specifically designed for people with obesity. Additionally, the study took account of three confounding variables which have been shown to impact studies on bariatric surgery, namely gender, age and socio-economic status.[40,92] By controlling for these confounding variables, and using an

obesity-centric measure of quality of life, it strengthens the reliability and validity of the findings.

Another strength of the current study was to examine the role of emotional eating. This is a notably prevalent and disruptive eating pattern which is a major risk factor in obesity and weight regain, but is under-represented in the bariatric surgery literature.[19,20,91] The current study brought increased awareness of the importance of considering emotional eating in assessments and formulations of bariatric surgery candidates, from its significantly strong positive associations with interpersonal vulnerability and quality of life, to its ability to help explain the relationship between interpersonal vulnerability and quality of life in this population.

Limitations of study

The study used a cross-sectional design which meant causality and temporal association between variables could not be inferred.[141] Generalisability of the findings may be limited by the small sample size and recruitment of participants from a single bariatric surgery facility. Whilst data for height and weight were independently measured by clinicians, data for interpersonal vulnerability, anxiety, depression, emotional eating and quality of life were collected using subjective, self-report measures completed by patients which might have increased the risk of reporting bias.[142]

Although the study used validated measures to assess the psychometric variables of interest, not all the measures were specifically designed for use in people with obesity. Only the instruments used to assess quality of life and emotional eating were specifically designed for use in people with obesity.[118,120] Interpersonal vulnerability was assessed using a measure primarily designed to screen for personality disorders, whilst anxiety and depression were evaluated using a generic measure of psychological distress.[112,114] Additionally only a 3-item subscale of the WLRT-II[118] was used to assess emotional eating, rather than a specific measure designed to assess this type of eating behaviour such as the Emotional Eating

Scale.[143] Consequently, this might have reduced the validity and reliability of the findings in these domains.

Data collection was also part of the pre-surgery screening process which has been shown to influence responses.[25,51] Evidence of significant eating disorders or psychological distress can be contraindications for surgery, meaning the levels of anxiety, depression and emotional eating might have been under-reported in an attempt to gain clearance for surgery.[24] Finally, the study did not assess the use of psychotropic medication, lifetime adversity or past psychological history (e.g. trauma, previous episodes of depression) all of which can influence obesity and might have acted as confounding variables.[144,145]

Implications for research, clinical practice and policy

The current findings add to the literature base by demonstrating how application of an enhanced IPT-ED model featuring quality of life could aid our understanding of bariatric surgery candidates, and more importantly how interpersonal vulnerabilities might impact emotional eating, psychological distress and quality of life. Bariatric surgery is a life changing transition and there is growing recognition of the need to appropriately prepare patients for this process given they can experience unrealistic expectations of "normality".[67,99] Use of the IPT-ED model during the pre-surgery assessment process could aid formulation and help understand if psychological interventions might be appropriate either before or after surgery.[57,146]

In the 12-24 months following surgery evidence indicates patients can experience a "honeymoon" period of positive change, for example in their weight, eating patterns and quality of life, but this does not always occur and is not always maintained in the long-term.[22,27] Future research would benefit from examining how this enhanced IPT-ED model applies to patients after surgery and how the relationships between the different aspects of a patient's psychosocial wellbeing change over time. This is particularly important given growing calls to

move beyond weight loss as the primary outcome of bariatric surgery and consider changes in quality of life as a key indicator of bariatric patients' wellbeing.[25]

Conclusion

This study contributes new information to our understanding of the psychosocial wellbeing of bariatric surgery candidates by using the IPT-ED model to demonstrate the strong links between interpersonal vulnerability, emotional eating, psychological distress and quality of life. In particular, the important role interpersonal vulnerability played in the lives of those seeking bariatric surgery was highlighted, given its strong and positive correlations with increased emotional eating, anxiety and depression, as well as reduced quality of life. Nevertheless, neither anxiety nor depression moderated the relationship between interpersonal vulnerability and emotional eating. However, the current study highlighted the mediating role of emotional eating in the relationship between interpersonal vulnerability and quality of life and how the IPT-ED model could be extended to integrate this new evidence. Future research is required to understand if and how these relationships change after surgery and how targeted psychological interventions might support patients' long-term psychosocial wellbeing in these areas.

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Declaration of interest

The author reports there are no competing interests to declare.

Data availability statement

The anonymised dataset upon which the analysis has been conducted is securely stored at the School of Health in Social Science, The University of Edinburgh Medical School, Teviot Place, Edinburgh EH8 9AG, UK.

Geolocation information

The data was collected from a sample population in Scotland (United Kingdom).

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Table of Appendices

Appendix 1. Author guidelines for Obesity Reviews

Obesity Reviews[147] publishes state of the art reviews, written by experts in the field of obesity research. The journal is published monthly. Every issue will contain at least 10 authoritative, well referenced and illustrated reviews on all aspects of obesity and its related comorbidities. Obesity Reviews does not accept Case Reports or reviews on country/region obesity prevalence data unless it documents new and novel insight.

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Appendix 2. Risk of bias assessment ratings by reviewer two

Table 4 Risk of bias assessment ratings by reviewer two

Study	Baldofski et al. 2016	Braun et al. 2021	Romano, E. 2019	Sevincer et al. 2017	Soulliard et al. 2021
Were the aims/objectives of the study clearly described?	Well-covered	Well-covered	Well-covered	Well-covered	Well-covered
Was the sample selected from an appropriate population to closely resemble the target population?	Poorly addressed	Well-covered	Adequately addressed	Adequately addressed	Well-covered
Were weight & height calculated by a robust measure?	Well-covered	Well covered	Poorly addressed	Adequately addressed	Adequately addressed
Did the study specify if data collection was part of the pre-surgery approval process?	Well-covered	Not addressed	Not applicable	Not addressed	Well-covered
Post-surgery: was an appropriate follow up period specified?	Not applicable	Not applicable	Adequately addressed	Not applicable	Not applicable
Was a clear rationale given if outcome measures were partially used or modified?	Well-covered	Well-covered	Well-covered	Well-covered	Well-covered
Was the study sufficiently powered to detect the reported effects?	Not addressed	Not addressed	Well-covered	Not addressed	Adequately addressed
Were appropriate statistical analyses & data checks used?	Well-covered	Well-covered	Well-covered	Well-covered	Well-covered
Were confounding variables identified & appropriately controlled?	Adequately addressed	Well-covered	Well-covered	Not addressed	Poorly addressed
Was information provided about missing data & how this was managed?	Adequately addressed	Adequately addressed	Well-covered	Not addressed	Not addressed

Ratings: 2 Points = well-covered; 1 Point = adequately addressed; 0 Points = poorly addressed, not addressed, not reported, not applicable
Text in grey indicates difference in rating compared to reviewer one

Appendix 3. Author guidelines for Health Psychology and Behavioral Medicine

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   This work was supported by the [Funding Agency] under Grant [number xxxx].
   For multiple agency grants
   This work was supported by the [Funding Agency #1] under Grant [number xxxx]; [Funding Agency #2] under Grant [number xxxx]; and [Funding Agency #3] under Grant [number xxxx].
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At the point of submission, you will be asked if there is a data set associated with the paper. If you reply yes, you will be asked to provide the DOI, pre-registered DOI, hyperlink, or other persistent identifier associated with the data set(s). If you have selected to provide a pre-registered DOI, please be prepared to share the reviewer URL associated with your data deposit, upon request by reviewers.
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Queries

Should you have any queries, please visit our Author Services website or contact us here.
Updated 24-11-2021

Appendix 4. Study protocol

NHS Tayside Caldicott Approval Form

1. Proposal Title :	The effect of interpersonal vulnerabilities, psychological distress & emotional eating on the quality of life of patients seeking bariatric surgery.

2. Sponsor Details and Declaration

Name:	Professor Kevin Power	Address:	Tayside Areas Psychogical Therapies Service
Position:	Consultant Clinical Psychologist, Director of Psychology		Dundee Health & Social Care Partnership
Organisation:	NHS Tayside		15 Dudhope Terrace
Email:	[redacted]		Dundee
Telephone:	[redacted]		DD3 6HH

Sponsor's Declaration [1]:	I declare that the named Data User is engaged in a reputable research/audit project and that the data requested can be entrusted to this person in the knowledge that they will discharge their obligations in regard to the confidentiality of the data.
Sponsor's Dated Signature	

3. Data User Details and Declaration

Name:	Dorothy Anderson	Address:	Dudhope Young People's Inpatient Unit
Position:	Trainee Clinical Psychologist		17 Dudhope Terrace
Organisation:	NHS Tayside		Dundee
Email:	[redacted]		
Telephone:	[redacted]		DD3 6HH

Data User's Declaration :	I declare that I understand and undertake to abide by the rules of confidentiality and security in the use of patient identifiable information received from NHS Tayside.
Data User's Dated Signature	

4. Caldicott Approval

Approval is given for the release and use of patient identifiable information as specified in this application

Medical Director, NHS Tayside

[1] to be signed by an NHS Tayside Consultant if the applicant is not of that status or is not medically qualified.

Director of Public Health, NHS Tayside

5. Name and Data Protection Registration Number of the organisation requesting the information, if not NHS Tayside

6. Data Co-user(s) – please list all personnel who will have access to the patient identifiable information released to the Data User

Name	Organisation	Email Address
Professor Power	NHS Tayside	[redacted]
Dr Stuart Moulton	NHS Tayside	

7. What Information do you require and what is the Intended Use

In the following sections provide, in straightforward language, and in sufficient detail to understand the proposal, a brief description of the proposal including aims, objectives and methods. In particular, it should be clear whether the proposal relates to audit and service improvement or research.

Research Rationale

Obesity is a significant risk factor for poorer physical and psychological health (Dawes et al., 2016). In particular, those who seek bariatric surgery experience higher levels of psychological distress, weight stigmatisation and difficulties with interpersonal/social functioning (Homer, Tod, Thompson, Allmark, & Goyder, 2016). These patients cite improvements in medical conditions, psychological wellbeing and qualify of life as key motivators (Munoz et al., 2008). However, no study has yet examined the relationship between specific interpersonal vulnerabilities (i.e. interpersonal sensitivity, need for social approval, lack of sociality), psychological distress (i.e. anxiety & depression), emotional eating and quality of life within the context of the Interpersonal Psychotherapy Model of Eating Disorders (IPT-ED). Undertaking research to improve our understanding of these relationships could help facilitate the development of interventions to improve the psychological wellbeing and functioning of patients who are accepted or rejected for surgery.

Research Question & Hypotheses

What is the effect of interpersonal vulnerabilities, psychological distress and emotional eating on the quality of life of patients seeking bariatric surgery in an NHS Scotland Health Board?

- Hypothesis 1 - Higher levels of interpersonal vulnerabilities will reduce the quality of life in patients seeking bariatric surgery.
- Hypothesis 2 – Higher levels of psychological distress will moderate the relationship between interpersonal vulnerabilities and emotional eating.
- Hypothesis 3 - Higher levels of emotional eating will mediate the association between interpersonal vulnerability and quality of life in patients seeking bariatric surgery.

NHS Tayside Caldicott Approval Form

Design

The study is a cross-sectional, retrospective analysis of routinely collected clinical data from bariatric-seeking patients who completed a psychological assessment in NHS Tayside. As per the NICE (2014) & SIGN (2010) Clinical Guidelines, psychological assessment is a mandatory component when assessing the suitability of patients for bariatric surgery.

Participants

NHS Scotland patients over 16 years of age identified by their clinician as requiring bariatric surgery & referred to the NHS Tayside Bariatric Service for pre-surgical psychological assessment.

Recruitment

All patients referred to the NHS Tayside Bariatric Service for pre-surgical psychological assessment between 2013 and 2019 (N= 188).

Inclusion Criteria

- Over 16 years old.
- Referred to the NHS Tayside Bariatric Service for bariatric surgery.
- Attended & completed a psychological assessment with a Clinical Psychologist as part of the pre-screening process for bariatric surgery.

Exclusion Criteria

- Patients who did not complete a psychological assessment with a Clinical Psychologist as part of the pre-screening process for bariatric surgery.

Procedure

Patients referred to the NHS Tayside Bariatric Service were sent a letter inviting them to attend a face-to-face psychological assessment with a Clinical Psychologist. The letter contained a series of questionnaires for patients to complete and bring to the appointment. During the psychological assessment the patient's weight and height were measured by the Clinical Psychologist to calculate the patient's BMI (Body Mass Index).

Data

For the purposes of the current study only the following routinely collected information will be accessed by the researcher & analysed:

Demographic information

Anonymised, unidentifiable data provided at the individual level. Data used for statistical analysis.

- Age: continuous variable (16+yrs)
- Gender: male / female
- Socio-economic status: 5 SIMD categories (Scottish Index of Multiple Deprivation). Dervived from patient postcode by Dr Moulton.
- BMI: continuous variable (≥35kg/m2)

Predictor Variable - Interpersonal Vulnerabilities

Psychometric measure: Inventory of Interpersonal Problems-Personality Disorders (IIP-PD-25)

Three sub-scales of anonymised, unidentifiable data provided at the individual level. Data used for statistical analysis.

- Interpersonal sensitivity (continuous variable)
- Need for social approval (continuous variable)
- Lack of sociality (continuous variable)

Moderator Variable – Psychological Distress

Psychometric measure: Hospital Anxiety & depression Scale (HADS)

Two sub-scales of anonymised, unidentifiable data provided at the individual level. Data used for statistical analysis.

- Anxiety (continuous variable)
- Depression (continuous variable)

Mediator Variable - Emotional Eating

Psychometric measure: Weight Loss Readiness Test-II (WLRT-II)

One subscale of anonymised, unidentifiable data provided at the individual level. Data used for statistical analysis.

- Emotional Eating (continuous variable)

Outcome Variable - Quality of Life

Psychometric measure: Impact on Weight of Quality of Life (IWQOL)

Total score from data provided at the individual level. Data used for statistical analysis.

- Total score - Quality of life (continuous variable)

Identification of Project Participants

Dr Stuart Moulton (Consultant Clinical Psychologist, Lead Clinician) from the Department of Clinical Health Psychology at NHS Tayside will access the databse (excel spreadsheet stored on the NHS Tayside Psychological Therapies shared drive) which contains the responses from the pre-surgery screening questionnaires and assessment appointment (File no.1). Data required for the current study will be anonymised and saved into a new and separate excel spreadsheet by Dr Moulton (File no.2).

The research will form the basis of a thesis submitted as part of the Doctorate in Clinical Psychology at the University of Edinburgh. In addition to seeking Caldicott approval, a University of Edinburgh School of Health in Social Science Research Ethics Application will also be submitted.

Consent –please describe at what stage consent is to be sought from the people whose personal data you wish to access or where there are barrier to gaining consent please describe those barriers.

No contact. The study uses routinely collected clinical data therefore informed consent was implied by their completion of the pre-surgery psychological assessment.

A separate Data Processing Specification must be completed for each source of data e.g. if your study requires the linking of data from different sources by way of using the CHI then it should be clear what data is collected from each source and how that data will be linked and at what stage and how any anonymisation of the collated data will take place.

8. **Caldicott Principle 1 – Justify the Purpose(s).** Every proposed use or transfer of patient-identifiable information within or from an organisation should be clearly defined and scrutinised, with continuing uses regularly reviewed by an appropriate guardian.

The proposed research will use routinely collected data to extend our understanding of the Interpersonal Psychotherapy Model of Eating Disorders (IPT-ED). It seeks to examine the interplay of interpersonal vulnerabilities, psychological distress & emotional eating patterns on patients' quality of life. The aim being to improve understanding of these relationships and therein facilitate the development of interventions to improve the psychological wellbeing and functioning of bariatric seeking patients.

9. **Caldicott Principle 2 – Why is Patient Identifiable Information required?** Patient identifiable information items should not be used unless there is no alternative.

To ascertain the role of key psychosocial factors in bariatric seeking patients the scores of four evidence-based measures will be collected (IIP-PD-25, HADS, WLRT-II, IWQOL). It will also be important to understand if key demographic factors (age, gender, socio-economic status, BMI) influence the IPT-ED model and patient quality of life. Once the required information has been extracted from the original dataset there will be no need for the data to be identifiable. Information will be also be anonymised in the completed write-up.

Contacting Patients - if you intend to make **contact with patients** identified through the processing of this data, indicate how this will be done and how you will ensure that it is appropriate to contact them. It is recommended that contact with patients is through correspondence signed by the patient's GP/Clinician or Head of Clinical Service.

No contact is to be made with patients

10. **Caldicott Principle 4 – Is access to the data on a need-to-know basis? -** Only those individuals who need access to patient-identifiable information should have access to it, and they should only have access to the information items that they need to see.

The original database (Excel File no.1) contains routinely collected, patient identifiable data which was obtained from the pre-assessment questionnaires and assessment interview. Only the two clinical supervisors (Professor Kevin Power & Dr Stuart Moulton) will have access to the original data file. The data is contained in a password protected excel file which is stored on the NHS Tayside Psychological Therapies shared drive (Clinical Health Psychology folder) and is not accessible to the primary investigator.

Dr Moulton will create a separate password protected Excel file which will contain only anonymised, unidentifiable information required for the current study (File no.2). File no.2 will be used for statistical analysis and will be accessible to Professor Power, Dr Moulton, Dr Morris & the primary investigator. The primary investigator will only have access to File no.2 and will not have access to the original database (File no.1)

NHS Tayside Caldicott Approval Form

11. Caldicott Principle 5 – How will you ensure that everyone with access to the data is aware of their data protection and confidentiality responsibilities? - Action should be taken to ensure that those handling patient-identifiable information – both clinical and non-clinical staff – are aware of their responsibilities and obligations to respect patient confidentiality.

Caldicott Principles will be adhered to throughout this project and afterwards. The primary investigator has completed the mandatory data protection training on the self-enrollment page on LEARN at the University of Edinburgh as well as the National Institute for Health Research (NIHR) Introduction to Good Clinical Practice (GCP) eLearning module (completed January 2019).

12. Caldicott Principle 6 – How will your organisation's legal requirements for the use of the data be met? - Every use of patient-identifiable information must be lawful. Someone in each Organisation should be responsible for ensuring that the organisation complies with legal requirements.

In line with information governance requirments Caldicott approval is being requested, the principles of which will be complied with throughout the research.

13. Application Checklist

Have you included:

Ethics Committee correspondence	☐
the proposed study protocol	☒
information provided to patients where appropriate	☐
relevant draft correspondence templates	☐
relevant Information Governance procedures	☒
Full Sponsor and Data User contact details	☒
and have both the Sponsor and Data User signed the application?	☒

NHS Tayside Caldicott Data Processing Specification

Unless patient identifiers are required to meet the purpose of the request, only anonymised or pseudo-anonymised data should be requested (in psuedonymised data identifiers are replaced by e.g. an index number)

As patients may be identified from a combination of variables in anonymous data, such as date of birth, date of admission, treating hospital, area of residence, please request only the minimum detail required to meet the purpose of the study.

14. Caldicott Principle 3 – Why is each data item required?

Where the use of patient-identifiable information is considered to be essential, each individual item of information should be justified with the aim of reducing identification and the possibility of a breach of confidentiality.

For **each separate** Data Source (casenotes, system, database) of patient identifiable information that you intend to access in support of your study please provide the following information (additional blank Data Processing Specifications are available on the Caldicott section of the Information Governance Staffnet pages otherwise email informationgovernance.tayside@nhs.net)

Data Source: **Database**

You must approach the person who you will rely on to provide you with the data that you are requesting. You must agree with the Data Source Contact that it is feasible to provide you with what you are requesting.

NHS Tayside Data Source Contact Details:	
Name: **Dr Stuart Moulton**	Designation: **Consultant Psychologist, Lead Clinician**
Location: **Clinical Health Psychology**	Tel No: [redacted]
Email address: [redacted]	

Please indicate all potentially identifying data items that you are requesting:

Data Item	Required	Reason Required
CHI number	☐	
Forename	☐	
Surname	☐	
Initials	☐	
Date of birth	☐	
Age	☒	As part of the research & description of the population sample
Gender	☒	As part of the research & description of the population sample
Address	☐	
Post code	☐	

Are there any other data items that you have requested?

Data Item	Reason Required

15. Data Transfer

Give details of how the requested information will be transferred to you from the Data Source e.g. encrypted USB device, password protected file, paper, NHSmail email attachment, etc.

The original database (File no.1) contains routinely collected, patient identifiable data which was obtained from the pre-assessment questionnaires and assessment interview. Only the two clinical supervisors (Professor Kevin Power & Dr Stuart Moulton) will have access to the original data file. The data is contained in a password protected excel file which is stored on the NHS Tayside Psychological Therapies shared drive (Clinical Health Psychology folder) and is not accessible to the primary investigator.

For the purpose of the current study, Dr Moulton will create a separate password protected Excel file which will contain only anonymised, unidentifiable information required for the current study (File no.2). File no.2 will be used for statistical analysis and will be accessible to Professor Power, Dr Moulton, Dr Morris & the primary investigator. The primary investigator will only have access to File no.2 and will not have access to File no.1.

File no.2 will be stored in a limited access sub-folder in the Trainees folder on the NHS Tayside Psychological Therapies shared drive. Only the primary investigator, Professor Power & Dr Moulton will have access to File no.2 when it is saved on the NHS Tayside Psychological Therapies shared drive. A copy of File no.2 will be sent from the primary investigator's NHS secure email to the academic supervisor's University of Edinburgh email for secure storage, as per the University of Edinburgh research governance guidelines.

16. Safeguards

Describe the measures in place to protect and use the data securely and confidentially.

Physical Location (NHS Tayside, University, etc.) : The data will be accessed on the secure server within NHS Tayside.
Device to be held on (desktop, laptop, network storage, etc.) : Data is stored on a secure computer network and files will be password protected
Access Controls (how will the data be protected from unauthorised access?) : .No unauthorised access can occur as the Line Manager needs to authorise all requests to acess the data.
Encryption (what encryption be used to protect the data?) : The data will be encrypted when it is sent by NHS email to the University of Edinburgh.
Format (spreadsheet, database, etc.) : The data is stored in the format of an excel spreadsheet.
Anonymisation (how will the identity of individuals be protected) : A unique patient participant code is used to anonymise data in the file used by the researcher (File no.2)

17. Data Transfer Regularity

How often do you intend the requested data to be provided to you?

Data is requested to be provided on a one-off basis.

18. Data Retention

How long do you intend to retain the information that you will rely on for your study and how will you dispose of the information at that time?

Unidentifiable (fully anonymised) research data will be archived within the University of Edinburgh for 10 years from the end of the project, with a review then and every subsequent 5 years to determine whether data should continue to be retained or whether it should be securely deleted. This is required for research governance purposes (e.g. for checks or clarifications by government or other appropriate organisations).

This unidentifiable research data will be securely stored on servers within the University of Edinburgh and will be accessible by members of the project team (i.e. Chief investigator / doctoral student and supervisors) and potentially by thesis examiners. Requests to reuse unidentifiable data for secondary purposes in the public interest will be considered by the project team, subject to the new project itself having any suitable ethical and other relevant approvals.

NHS Tayside Caldicott Data Processing Specification

Submitting the Caldicott Application

Once the Caldicott application has been completed and all supporting documentation gathered then the application should be submitted to:

By Post

Information Governance
Maryfield House South
Mains Loan
Dundee
DD4 7BT

By email

[redacted]

subject line to be:
Caldicott Application: *Topic*

NHS Tayside must be notified immediately on discovering that there has been a breach of confidentiality loss or theft of the provided data.

Appendix 5. Caldicott approval letter

Information Governance
Maryfield House South
Mains Loan
Dundee
DD4 7BT
Tel. 01382 740074
Ext. 70249
www.nhstayside.scot.nhs.uk

Dorothy Andersom
Trainee Clinical Psychologist
Dudhope Young People's Inpatient Unit
17 Dudhope Terrace
Dundee
DD3 6HH

Date 29 July 2021

Our Ref IGTCAL9368
Enquiries to
Extension
Email [redacted]

Dear Dorothy

CALDICOTT APPROVAL – The effect of interpersonal vulnerabilities, psychological distress & emotional eating on the quality of life of patients seeking bariatric surgery

Proposal Sponsor: Professor Kevin Power, Consultant Clinical Psychologist, Director of Psychology, NHS Tayside

Data User(s): Dorothy Anderson, Trainee Clinical Psychologist, NHS Tayside
Dr Stuart Moulton, Consultant Clinical Psychologist, NHS Tayside

Caldicott approval is given for you to access relevant and proportionate personal data, as described in your recent application and supporting information.

Thank you for your co-operation in providing us with the information required in this process.

Please contact me should any queries arise from the application of this approval.

Yours sincerely

[redacted]
Data Protection Officer

Copy to: Professor Kevin Power, Consultant Clinical Psychologist, Director of Psychology, NHS Tayside
Dr Stuart Moulton, Consultant Clinical Psychologist, NHS Tayside

Appendix 6. The University of Edinburgh ethical approval letter

University of Edinburgh
College of Arts, Humanities and Social Sciences
Research Governance Office
55 George Square
Edinburgh
EH8 9JU

24th June 2021

Dorothy Anderson
c/o School of Health in Social Science
University of Edinburgh

Dear Dorothy,

Study Title: The effect of interpersonal vulnerabilities, anxiety, depression & emotional eating on the quality of life of patients seeking bariatric sugery

Sponsor number: CAHSS2106/12

Under the requirements of the UK policy framework for health and social care research, the University of Edinburgh agrees in principle to act as Sponsor for this project. Sponsorship is subject to you obtaining institutional ethics for the project.

As Chief Investigator, you must ensure that the study does not commence until all applicable approvals have been obtained. Following receipt of all relevant approvals, you should ensure that any amendments to the project are notified to the Sponsor.

Yours sincerely

[redacted]

Research Governance Manager

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