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Key points

- Both obesity and common mental health disorders account for a significant proportion of the global burden of disease.
- There are bi-directional associations between mental health problems and obesity, with levels of obesity, gender, age and socioeconomic status being key risk factors.
- The mental health of women is more closely affected by overweight and obesity than that of men.
- There is strong evidence to suggest an association between obesity and poor mental health in teenagers and adults. This evidence is weaker for younger children.
- The relationships between actual body weight, self-perception of weight and weight stigmatisation are complex and this varies across cultures, age and ethnic groups.
- The perception of being obese appears to be more predictive of mental disorders than actual obesity in both adults and children.
- Weight stigma increases vulnerability to depression, low self-esteem, poor body image, maladaptive eating behaviours and exercise avoidance.
- Intervention strategies should consider both the physical and mental health of patients. It has been recommended that care providers should monitor the weight of depressive patients and, similarly, in overweight or obese patients, mood should be monitored. This awareness could lead to prevention, early detection, and co-treatment for people at risk, ultimately reducing the burden of both conditions.
- There is an urgent need for evaluations of weight management interventions, both in terms of weight loss and psychological benefits.

Introduction

This paper provides an overview of current evidence on the relationship between obesity and mental health for adults and children in the UK. It draws particular attention to the bi-directional associations between common mental health disorders and obesity, and the risk factors associated with obesity and mental health. It addresses issues around inequalities, the implications of psychological distress caused by weight-related stigma and discrimination. It also highlights specific issues relating to child and adolescent obesity and summarises current knowledge on the effectiveness of interventions, best practice and scope for services for those at risk.

This document highlights key findings in the literature identified using the methodology as described in Appendix 1. It is not a systematic review.

Relationship between common mental health disorders and obesity

The relationship between obesity and common mental health disorders is complex. There are several theories about how the two are linked. Some researchers suggest that obesity can lead to common mental health disorders, whilst others have found that people with such disorders are more prone to obesity. Other studies have found no association between the two.

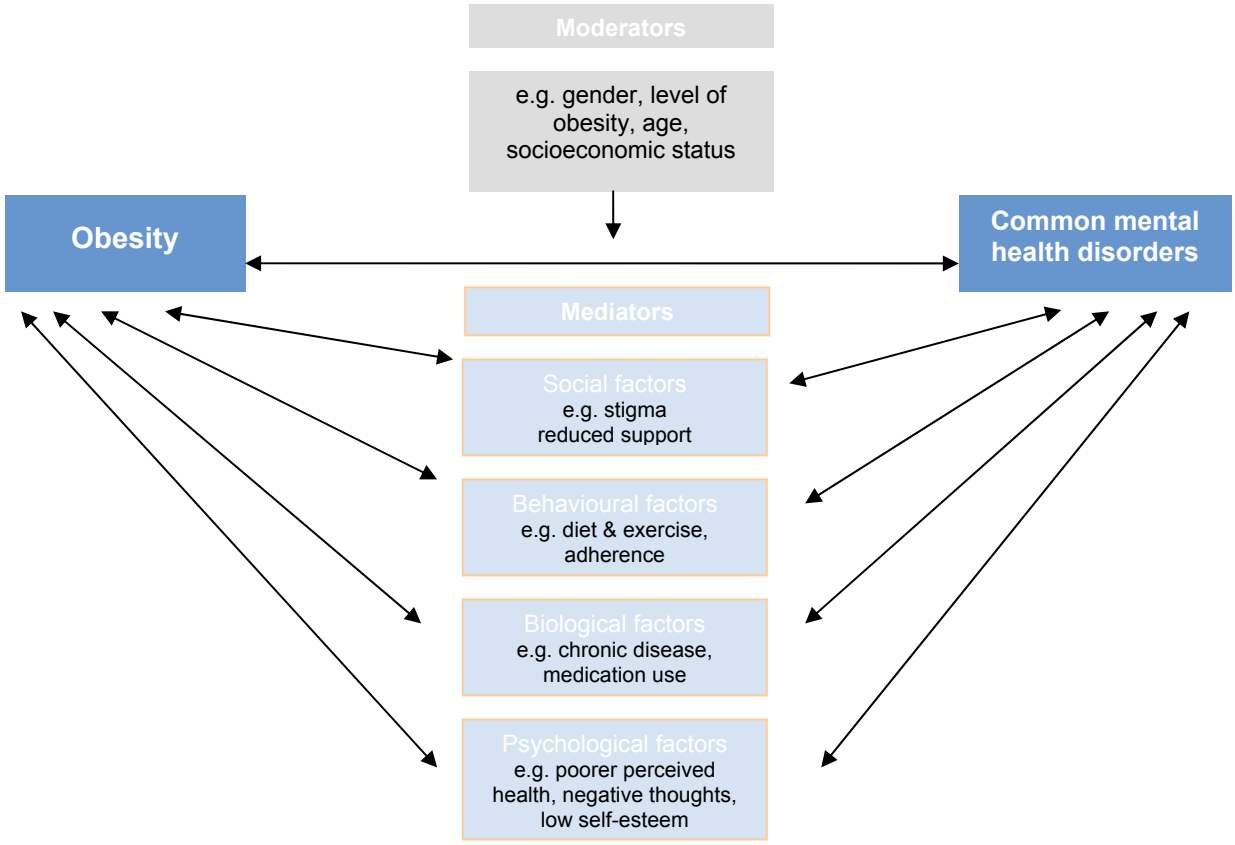
Results from the most recent systematic review of longitudinal studies point towards bi-directional associations between depression and obesity. The authors conclude that: 'Obese persons had a 55% increased risk of developing depression over time, whereas depressed persons had a 58% increased risk of becoming obese'.[1] Another recent systematic review and meta-analysis found a weak but positive association between obesity and anxiety disorders.[2]

Obesity is also associated with an increased risk for a variety of chronic diseases, most of which are associated with depression which in turn can precipitate chronic disease due to diminished treatment adherence and/or response.[3]

There are a number of mechanisms that could explain potential casual associations between obesity and common mental health disorders. Figure 1 is a helpful overview of this complex relationship. The moderator variables are those that might influence the strength of a relationship between the two conditions, whilst the mediator variables help to explain this relationship.[a]

[a] For example, 'gender' is a moderator variable, in that the relationship between obesity and common mental health disorders appears to be stronger for women than men. 'Diet and exercise' is a mediator variable in that it explains why there is a relationship between obesity and common mental health disorders. It should be noted that the distinction between mediating or moderating factors is not always clear cut. For example, in one context a moderating variable such as socioeconomic status (SES) could be a mediating variable in another setting.

Figure 1: Model for the mediator/moderator relationship between obesity and common mental health disorders



Source: Adapted from Markowitz et al. 2008 and Napolitano et al, 2008[4,5]

The relationship between obesity and common mental health disorders will be explored firstly for adults and then for children and adolescents. For each age group, both mediating and moderating factors will be addressed.

Adults

Key points

- Evidence suggests that there are bi-directional associations between depression and obesity.
- Mediating factors (i.e. factors which help explain the relationship between two conditions) for obesity causing mental health disorders in adults include low self-esteem, stigma, dieting and weight cycling, medication, and hormonal and functional impairment.
- Mediating factors for mental health disorders causing obesity in adults include unhealthy lifestyles, medication and reduced support.

- Moderating factors (i.e. factors that might influence the strength of a relationship between two conditions) for obesity and mental health disorders in adults include severe obesity, female gender and socioeconomic status.

Overview

There are various theories as to why obesity could lead to poor mental health in adults. These emphasise the increased medical problems and mobility restrictions associated with obesity which can have a direct impact on psychological well-being, and can lead to depression, eating disorders, distorted body image and low self-esteem.[6]

There is less research on the mechanisms that may cause adults with common mental health disorders to become obese. It has been suggested that poor mental health can lead to unhealthy lifestyle choices and increased appetite. A combination of the biological affect of increased stress alongside poor adherence to weight loss programmes, binge eating, negative thoughts and reduced social support, may make it difficult for a depressed person to avoid weight gain.[4] There is also evidence that people with chronic or repeated episodes of depression are at particular risk of subsequent obesity.[7]

Mediating factors

The main mediating factors relating to obesity and mental health disorders in adults include:

Obesity as a cause of mental health disorders

Behavioural:	dieting and binge eating
Biological:	increased rates of chronic disease, body pain, reduced physical activity, sleep problems, medication side effects and abnormal hormonal concentrations
Psychological:	poorer perceived health, low self-esteem and body image concern
Social:	weight-related stigma and weight bias

Mental health disorders as a cause of obesity

Behavioural:	adoption of unhealthy lifestyles, use of food as a coping strategy, attrition from weight loss programs
Biological:	medication side effects
Psychological:	low expectations of weight loss attempts
Social:	reduced support from family and friends

See Table 1 in Appendix 2 for further details and references.

Moderating factors

The following factors could affect the direction and/or strength of the relationship between obesity and common mental disorders in adults.

Level of obesity

Level of obesity appears to be an independent risk factor for common mental health disorders. Several reviewers have suggested that severe obesity puts individuals at greater risk of depression.[4,8]

Extremely obese people who seek bariatric surgery have been found to have lower self-esteem and higher depression scores than less obese individuals who seek pharmacological and behavioural weight loss interventions.[9] One study found that almost two-thirds of morbidly obese patients presenting for bariatric surgery had a psychiatric diagnosis, with major depression being the most common. Most patients were depressed about the negative effects of obesity in every aspect of their life, for example, health, social life, finances, mobility and functioning.[10]

Gender

Gender has been shown to modify the association between obesity and common mental health disorders, with some studies demonstrating a positive association for women and a negative relationship for men.[1,4, 11,12]

Women seem to be more concerned about obesity than men and are two to three times more likely to seek weight-loss treatment.[13] Research has found that they experience greater dissatisfaction with their weight and shape than men do, and this dissatisfaction increases with BMI.[14] Women also experience more stigma in relation to obesity and are under greater pressure to be slim.[8]

Alcohol abuse also appears be related to depression and obesity in young women but not their male counterparts.[15]

Socioeconomic status and level of education

While socioeconomic status and level of education have been identified as potentially important risk factors for common mental health disorders in obese individuals, the relationship between obesity and socioeconomic status remains unclear.

Research has found that those of lower socioeconomic status may be more likely to experience depression or obesity. For example, recent analysis of HSE data found that the negative impact of obesity on health-related quality of life was greater for people from lower socioeconomic backgrounds.[16] However, it also appears that among the obese, high socioeconomic status may in fact increase the risk of depression.[4,11]

Whilst lower socioeconomic status is strongly associated with a greater risk of obesity among women, this pattern is less clear for men.[17]

Other factors

Age is also likely to be a moderating factor between obesity and common mental disorders. Younger women appear to be at a increased risk of both obesity and mental health disorders.[3,18] Older people may also be at greater risk, as health problems associated with aging might cause both weight gain and depression or anxiety.[19]

Furthermore, cumulated exposure to common mental disorders in older age groups is associated with increased risk of obesity.[7,19]

Recent studies from the US suggest that the obesity-depression relationship varies significantly across ethnic groups with US-born non-Hispanic white and US-born black women at particular risk,[20] although the differences in health status dramatically change the pattern of associations.[21]

Children and adolescents

Surveys among children and adolescents have not consistently reported a clinically meaningful association between poor mental health and obesity. Where evidence does exist, it can be summerised in the following key points:

Key points

- Obesity in adolescence may lead to depression in adulthood, and adolescent depressive symptoms may put individuals at risk of obesity later in life.
- Mediating factors for obesity causing mental health disorders in children and adolescents include lack of physical activity, low self esteem, body dissatisfaction, eating disorders and weight-based teasing.
- Mediating factors for mental health disorders causing obesity in children and adolescents is less researched but may include lack of energy to exercise, medication, family breakdown and poverty.
- Moderating factors for obesity and mental health disorders in children include gender and age. The impact of obesity on mental well-being increases with age and is stronger in girls than boys.

Overview

Research is less advanced in understanding the relationship between obesity and common mental health disorders in children and adolescents,[5] and results are inconsistent.

Being overweight as a child or adolescent has been found to have an adverse effect on a young person's self esteem, self image, and self concept,[22] with physical appearance and athletic/physical competence being most affected.[23,24] Obesity has also been associated with depression in adolescents.[25] The health-related quality of life of severely obese children treated in clinical settings has been reported to be particularly poor and has been found to be similar to those diagnosed with cancer.[26] However, literature reviews have concluded that in spite of adverse social and interpersonal consequences, obese children may only have moderate levels of body dissatisfaction and few are depressed or have low self esteem.[27] Evidence also suggests that obese children are not pre-destined for depression and do not see themselves without merit.[23]

Longitudinal studies have also found that depression can predict obesity in adolescents and young adults. The authors of one study on adolescent girls conclude that this could be because depressed individuals eat more to provide comfort or distraction from negative emotions, or that serotonin dysregulation could lead them to eat more carbohydrate-rich foods.[28]

Some research studies indicate that obesity in adolescence may lead to depression in adulthood,[6] and that adolescent depressive symptoms, especially among girls, may put individuals at risk for the onset of obesity later in life.[4,29,30,31]

Mediating factors

The main mediating factors relating to obesity and mental health disorders in children include:

Obesity as a cause of mental health disorders

Behavioural:	lower levels of physical activity, lower perceived athletic competence, unhealthy diets and loss of control in eating
Biological:	disruption of hormonal pathways
Psychological:	low self-esteem, body dissatisfaction, perception of being overweight
Social:	stigma, social rejection and weight-based teasing

Mental health disorders as a cause of obesity

Behavioural:	lack of energy to exercise
Biological:	medication side effects
Psychological:	low expectations of weight loss attempts
Social:	psychosocial stressors in the household

See Table 2 in Appendix 2 for further details and references.

Moderating factors

Gender

As with adults, research points to a stronger relationship between common mental health disorders among girls than boys.[32] This may reflect the different socio-cultural pressures on girls to conform to an idealised physique.[27] Increases in BMI and decreases in physical activity over time have also been found to be significantly associated with depressive symptoms in young women.[33]

Age

The impact of obesity on mental well-being in children appears to increase as they get older. In younger children, weight may have little impact on perceived or actual friendship status. However, by teenage years, peer relationships can become more problematic, leading to obese adolescents being more at risk of marginalisation and victimisation.[23]

For girls, the effects of obesity on self-esteem are often detectable before puberty. One study even found that the impact of overweight on self-competence may start as young as five years old.[34] For boys, it is only during early teenage years that self-competence is impaired.[23]

Recent findings from the Millennium Cohort Study, however, appear to contradict earlier research and suggest that childhood obesity may in fact be associated with emotional and behavioural problems from a very young age, with obese boys at particular risk.[35]

Other factors

Whilst there is little literature on ethnic differences in body dissatisfaction, research from the US has suggested that African-American girls may consider themselves to be more attractive and socially acceptable at a higher BMI than white girls, and are less vulnerable to low self esteem.[27] A study of East London adolescents found that in girls, obesity was associated with higher self-esteem among Black-African groups, but lower in Bangladeshi groups. However, among boys, overweight or obesity had a negative impact on self-esteem of boys from white and Bangladeshi groups. This suggests that the influence of cultural valuation of weight and shape on self-perception and psychological distress may differ between ethnic groups.[36] Further recent research on British children aged 13-15 also suggests that Asian boys may be at particular risk of low body esteem.[32]

Some studies on clinical populations have found that self-esteem is related to the severity of obesity in female adolescents and children.[37]

Socioeconomic factors have generally not been found to be risk factors in the relationship between childhood obesity and mental health. One study of Australian adolescents did find that experiences of shame in conjunction with parental separation or unemployment appeared to account for an observed relationship between BMI and depression in older adolescents.[38]

Interventions

Key points

- The risk for co-morbidity should be considered in the treatment of people with obesity and with common mental health disorders.
- Strategies to enhance self-worth and develop self-efficacy can help overweight patients to take control of their well-being.
- Treatment of obesity in children and adolescents requires not only diet and exercise but measures to address wider social and emotional issues such as self-esteem and social confidence.
- Strong parental support and social networks can help reduce unhealthy eating behaviours and psychosocial distress in children and adolescents.
- There is an urgent need for evaluation of interventions, both in terms of the weight loss and psychological benefits.

Adults

Whilst both obesity and common mental health disorders share similar symptoms such as sleep problems, sedentary behaviour and poorly controlled food intake, for the most part they are treated as separate health problems, often leading to poor treatment outcomes.[6] It has been recommended that the risk for co-morbidity should be considered in the treatment of the obese and the depressed,[39] with care providers made aware that in depressive patients, weight should be monitored and in overweight or obese patients, mood should be monitored.[1] A comprehensive review of psychological interventions for overweight or obesity concluded that behavioural and cognitive behavioural therapies make a significant difference to the success of weight management interventions, especially when combined with diet and physical activity.[40]

There are some situations where the treatment for either obesity or mental health problems has been found to actually exacerbate the other condition. For example, dieting may worsen mood, particularly if it is part of a pattern of repeated dieting failure. Conversely, some pharmacological treatments for depression have the side effect of weight gain. It has been suggested that practitioners should encourage the patient to engage in behaviours that will improve both conditions, such as stress management, exercise, and potential lifestyle modification in lieu of simply dieting or just taking medication.[4] Differences in motivation, cognitive processes, social support and financial and social resources are but some of the potential factors that may need to be considered in adapting weight control programmes or interventions for patients with mental health disorders.[12]

Weight loss treatment

Evidence from intervention studies suggests that participation in weight-loss treatment may have a substantial but temporary effect on mood, which is not related to actual weight loss and may decline on cessation of treatment.[4]

Physical activity adherence

Whilst there is strong evidence that physical activity is associated with decreased anxiety and depression, enhanced mood, improved self-worth and body image, it may be

challenging for patients to adhere to it. Giving patients practical suggestions for adding small amounts of exercise in their daily routine and stressing the importance of lifestyle modification, may be as effective as prescribed physical activity.[4]

Diet

There is growing evidence to suggest that good nutrition is just as important for mental as it is for physical health and that a number of conditions, including depression, may be influenced by dietary factors. The Mental Health Foundation has produced a booklet giving advice on dietary changes to improve mood.[41]

Stress management

Assisting patients to effectively manage stress should have a positive impact on their ability to control both mood and weight.[4]

Sense of self-worth

Treatments are needed that include strategies to improve self esteem, enhance self-worth and develop self-efficacy, so that overweight patients can become agents of change in pursuit of their own well-being.[42]

Psychological Therapies[b]

Overeating and poor exercise levels are health issues which may be helped via a Motivational Enhancement Therapy (MET) approach.[43] Behavioural Activation (BA) may also help mood and weight, and has been used in obese depressed adults with some success.[44]

Children

A recent systematic review of obese children and adolescents' self-esteem and quality of life, found that the majority of studies that reported weight loss also found increases in general self-esteem or quality of life. In addition, whilst some studies reported no change in weight status, they did find improvements in self-worth, athletic competence, social acceptance and more positive feelings/emotions. This suggests that weight management programmes have the potential to equip obese young people with positive self-evaluations that may enhance their future well-being, even if weight loss is not apparent in the short-term.[24]

Focus on psychosocial factors rather than weight loss

It has been argued that psychosocial factors in childhood obesity are more important than functional limitations, and that we might better help the obese child by providing social support rather than to focus on the child's obesity.[45]

For an obese child who is exhibiting either low levels of self-esteem or depressive symptoms, merely encouraging healthy eating and physical activity is likely to prove ineffective in attaining weight reduction.[46] The clinical treatment of obesity should take psychosocial aspects of the condition into account. Treating obesity may not just be a matter of diet and exercise but also of dealing with issues of shame and social isolation.[25] The importance of early detection of weight problems or shape concern has

[b] Motivational Enhancement Therapy (MET) is an approach that explores and works upon the individual's motivation and readiness for change. Behavioural Action (BA) seeks to help people understand environmental sources of their depression in order to target behaviours that might maintain or worsen the depression.

also been recommended to help prevent psychological distress in obese children and adolescents.[47]

Depression and self-esteem should be monitored. Where significant depression is found to be present, it should be treated as such and not presumed to be an inevitable consequence of obesity. Clinicians should be mindful of the sensitivity of obese children and adolescents to teasing and derogatory remarks and treatment programmes should include elements designed to enhance and protect their self-esteem.[27]

Destigmatisation of obesity

A recent review found no evidence to indicate that any type of stigmatising experience, teasing or commentary regarding weight, or any enhancement of body image dissatisfaction, has any positive influence on the motivation of children to lose weight or to engage in effective weight reduction strategies.[48]

Importance of parental support/social networks

Strong parent-adolescent relationships are associated with reduced behavioural and psychosocial risk factors associated with overweight during adolescence. Children who talk to their parents about their eating habits are less likely to indulge in unhealthy behaviours and displayed less psychosocial distress. Participation in collective activities, such as sports and club activities, is also associated with improved social ties.[49]

For overweight adolescents, greater psychological well-being and fewer unhealthy weight control behaviours have also been associated with a positive experience of eating family meals.[50,51]

Studies have shown that interventions involving parents, carers, siblings or peers with similar weight issues could prove more successful than those that target individuals alone.[52]

Integration of the Child and Adolescent Mental Health Service (CAMHS) into wider obesity strategy

There is a need for child obesity practitioners to work with mental health professionals in developing and operating interventions and services. A recent review on the effectiveness of interventions, best practice and scope for services for those at risk, highlights the potential for Child and Adolescent Mental Health Services to be more integrated into a wider obesity strategy.[53]

Evaluation of interventions

The authors of a recent systematic review on school-based interventions for obesity have stressed the urgent need for the evaluation of a whole range of aspects of psychosocial outcomes, including problem behaviours such as self-concept, eating disturbances and social problems. The authors also recommend the validation and use of standardised measurement instruments should be validated and used to enable effective comparisons.[54]

The inter-dependence between improving self-regard and weight loss is complex and requires further investigation. It has been suggested that improved self-competence should be valued as an intervention outcome.[24]

Discussion

The connection between obesity and common mental health disorders is an important public health issue. Both these conditions have major implications for health care systems across the globe and account for a significant proportion of the global burden of disease.[6] Individuals who suffer from both obesity and common mental health disorders may also face particular risks to health and well-being, as it is likely that the conditions may perpetuate each other.[4]

The bi-directional association between obesity and common mental health disorders is complex and multi-factorial. Gender, severity of obesity, socioeconomic status and level of education, age and ethnicity have all been suggested as potentially important risk factors that could affect the direction and/or strength of the association between the two conditions. There is also a wide range of behavioural, biological, social and psychological moderating factors that could help explain the relationship.

Women appear to be at most risk of obesity and common mental health disorders than men.[15] The mental health of obese girls and young women also appears to be more effected than their male counterparts. One suggestion for this disparity is that more stigma is attached to excessive weight in women than men,[8] with women having to deal with the sociocultural pressures that encourage body dissatisfaction and drive for thinness.[8] Another theory is that women are more likely to engage in 'ruminative coping'[c] than men, and rumination has been linked to depression.[15] Women have also been found to suffer a disproportionately large share of the disease burden of obesity, due to higher levels of comorbidity, with mild obesity associated with marked impairment in the physical health of women, compared to only moderate obesity in men.[55]

There are differing opinions as to what age the apparent reciprocal relationship between common mental health problems and obesity begins to emerge. There are also conflicting views on the association and direction of causation between obesity and depression or low self-esteem, and the severity of these psychological factors on children.[46] However, there is strong evidence to suggest that by adolescence, there is increased risk of low self-regard and impaired quality of life in obese individuals, particularly in the perception of physical appearance, athletic competence and social functioning.[24]

The relationships between actual body weight, self-perception of weight and weight stigmatisation are complex, and these vary across cultures, age and ethnic groups. The 'perception' of being obese appears to be more predictive of mental disorders than 'actual' obesity in both adults and children. Weight-based teasing has been found to be of particular concern for children and adolescents. A recent review found that weight stigma increases vulnerability to depression, low self-esteem, poor body image, maladaptive eating behaviours and exercise avoidance. These negative consequences challenge societal notions that stigma may serve a positive function on motivating healthy eating behaviours.[56]

The relationship between common mental health disorders and obesity has been highlighted as an important consideration for clinical practice. It has been

[c] Individuals who engage in this coping method 'replay' negative events, which can also lead to more problematic coping methods such as overeating or excessive alcohol consumption.

recommended that care providers should monitor the weight of depressive patients and, similarly, in overweight or obese patients, mood should be monitored. This awareness could lead to prevention, early detection, and co-treatment for people at risk, ultimately reducing the burden of both conditions.[6] In addition, practitioners should encourage patients to engage in behaviours that will help improve both obesity and common mental disorders, such as stress management, exercise and lifestyle modification instead of simply dieting or taking medication.[4]

Findings from the Millennium Cohort Study act as a valuable reminder of how early relationships between obesity and well-being can emerge,[35] and the need for public, family and individual level interventions for children. It has been suggested that depression, low self-esteem and impaired social functioning should be targets for child obesity treatment, and psychological assessments included in interventions.[23] Whilst there are isolated examples of innovative practice in this area, there is no national guidance or strategy that brings together the different agencies involved. Policies aimed at improving the mental health outcomes of children and adolescents would also benefit from a focus on increasing awareness about healthy attitudes towards weight.[57]

Finally, the importance of evaluating interventions should not be underestimated.

Appendix 1: Methodology

A search was conducted on Medline, Embase, PsycINFO, TRIP, NHS Evidence Special collections (public health and mental health) and Cochrane – limiting to English language and 2005 onwards. The full Medline search strategy is listed below:

1. *obesity/ or *obesity, abdominal/ or *obesity, morbid/
2. *Overweight/
3. *body mass index/
4. (obes* or overweight or body fat or body mass index or bmi).ti.
5. 1 or 2 or 3 or 4
6. *Mental Disorders/
7. *mood disorders/ or *depressive disorder/
8. *Anxiety Disorders/
9. *Stress, Psychological/
10. *Adaptation, Psychological/
11. Mentally Ill Persons/
12. (mental health or mental* ill* or mental disorder* or depress* or stress or distress).ti.
13. *body image/ or *weight perception/
14. (selfesteem or self esteem).ti.
15. body image.ti.
16. (wellbeing or well-being).ti.
17. 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16
18. 5 and 17
19. ((obes* or overweight or body fat or body mass index or bmi) adj3 (mental health or mental* ill* or mental disorder* or depress* or stress or distress or self-esteem or self esteem or body image or wellbeing or well being)).tw.
20. 18 or 19
21. limit 20 to "reviews (2 or more terms min difference)"
22. limit 21 to english language
23. limit 22 to human
24. limit 23 to yr="2005 -Current"

We also examined data from two population surveys relevant to mental health and obesity. The Health Survey for England (HSE) collects data on measured height and weight, and provides an indicator of possible mental health problems in adults using the General Health Questionnaire and a Strengths and Difficulties Questionnaire for emotional and behavioural problems in children. The Adult Psychiatric Morbidity Survey collects data on the prevalence of both treated and untreated psychiatric disorders including common mental disorders and provides estimated Body Mass Index (BMI). However, results of the analysis were difficult to interpret reliably due to methodological issues including sampling and potential confounding factors, and these have not been included.

Appendix 2: Mediating factors

Table 1: Mediating factors relating to obesity and mental health disorders in adults

Mediating Factors	Obesity as a cause of mental health disorders	Mental health disorders as a cause of obesity
Behavioural	• Dieting or weight cycling has been found to be related to depression, with repeated diet failure and episodes of binge eating being particularly deleterious on mood. There is also evidence that the experience of being on a diet may in itself worsen mood due to calorific reduction.[4]	• The adoption of an unhealthy lifestyle, such as insufficient physical activity and unhealthy dietary preferences,[1] particularly comfort foods rich in fats and sugars to improve mood are common among depressed and anxious patients. Activation of the endocannabinoid system, which increases appetite and may simultaneously alleviate depression, is likely to reinforce this eating behaviour. • The use of food as a coping strategy for emotion regulation has the potential to cause overweight or obesity in those experiencing negative mood.[4] • Research suggests that binge eating occurs in response to negative mood, which sets the stage for a cycle of weight gain and further negative mood.[4] • Depression has been shown to predict attrition from weight-loss programs, as it may prevent people from engaging in the meal planning and physical activity necessary to lose weight.[4]
Biological	• There are a number of biological links that may cause obesity to be associated with common mental health disorders, although these links remain. They include: • increased rates of chronic disease such as cardiovascular diseases and diabetes and functional impairment from these conditions[4] • bodily pain as a consequence of obesity[13] • increased risk of diabetes and increased insulin resistance which could cause alterations in the brain1 • sleep problems associated with obstructive sleep apnea[58] • reduced participation in physical activity due to obesity or obesity-related chronic illnesses.[4]	• Whilst it is recognised that anti-psychotic medications for the treatment of severe mental illness such as schizophrenia are linked to weight gain,[12] it is less clear cut for medications used for common mental disorders. Weight gain might be in part a result of side effects from commonly used medications for depression.[1] For example, tricylic antidepressants may result in weight gain whilst selective serotonin reuptake inhibitors may result in weight gain or weight loss.[7]

	• possible side-effects from medications that can sometimes cause depression, for example atenolol[10] • activation of inflammatory pathways[1] • abnormal concentrations of hormones of the hypothalamic-pituitary-adrenal axis[1,7]	
Psychological	• Evidence suggests that obesity is associated with an increased risk of poorer perceived health. Individuals may believe that they are unable to engage in certain activities, or they will not be able to have a long and fulfilling life.[4] • Obese individuals are more likely to be dissatisfied with their body shape and size.[4] Thinness is a beauty ideal in both Europe and the US, so being overweight or obese may contribute to body dissatisfaction and low self-esteem that increases the risk of depression.[1] Some obese people report social anxiety, whereby they are embarrassed to go out because they may not 'fit' into a chair in a restaurant or an aeroplane, for example. Being obese reduces their self-esteem and the effect on their social life leaves them isolated and vulnerable.[10] • Body image concern, in particular, may contribute to obesity causing depression in younger women.[11] Weight perception and body esteem also vary across cultures, age and ethnic group.	• Negative thoughts: depressed individuals may have low expectations of their ability to lose weight, which may affect any weight loss attempts.[4]
Social	• Obese people, especially those who perceive themselves as overweight, often experience weight-related stigma and discrimination. There is much evidence to suggest that obese individuals can face repeated discrimination and mistreatment on a regular basis from strangers, acquaintances and intimates and that this can negatively affect mood over time.[4] • Weight bias has been found to contribute to maladaptive eating behaviours among obese individuals and is likely to increase vulnerability to depression, low self-esteem, low self-worth, guilt and poor body image.[56] • Poverty, disability, racial or cultural discrimination may also lead to some obese people experiencing a 'layering' of stigma.[59]	• Some studies have found that depressed individuals may have reduced support from family and friends, which can make it harder to adhere to a weight loss program.[4] • A large body of epidemiologic data show that diet quality follows a socioeconomic gradient. Whereas higher-quality diets are associated with greater affluence, energy-dense diets that are nutrient-poor are preferentially consumed by persons of lower socioeconomic status and of more limited economic means.[60]

Table 2: Mediating factors relating to obesity and mental health disorders in children

Mediating factors	Obesity as a cause of mental health disorders	Mental health disorders as a cause of obesity
Behavioural	• Lower levels of physical activity and unhealthy diets associated with obesity have been recognised as risk factors for common mental health disorders in children. For example, a qualitative study of 10–12 year old overweight Scandinavian children found that whilst they yearned to be part of a community, they spent a lot of time alone eating, watching television, playing computer games and taking care of pets. They were aware of healthy lifestyles, but did not manage to implement them in practice, with unhealthy sleeping, eating and exercise habits. Peer victimisation was also found to be a predictive barrier to physical activity.[61] • Any withdrawal from the usual patterns of socialisation in childhood may be expected to influence energy balance as activity gives way to inactivity.[34] One study found that overweight children who were criticised during physical activity were less prone to enjoy sports than their peers and reported reduced physical activity levels.[62] • In obese children, loss of control in eating has been associated with higher anxiety, more depressive symptoms and lower body esteem.[22] Overweight children have also been found to experience more eating-disordered behaviours than normal weight children.[63] • A study of Australian children found that obese children had significantly lower perceived athletic competence than their normal weight peers. The mechanics of moving a larger body may be a contributing factor, as may be the attitudes of teachers or embarrassment which is enhanced if performance is poor in the eyes of peers.[38]	• Depression could lead obesity, if a child lacks the energy to exercise or is immobilised by stress.[64]
Biological	• Obesity may disrupt the normal hormonal pathways. However, research has shown that only 10% of child obesity cases seen are caused by systemic medical conditions, such as genetics or hormonal causes.[37]	• It is possible that weight gain might be influenced by medications for depression, as in adults.

Psychological	• Low self-esteem is associated with overeating and weight gain in adolescents.[65] For example, a longitudinal study of children aged 9–10 in the US found strong relationships between obesity and changes in global self-esteem during early adolescence. It also found that children experiencing decreasing levels of global self-esteem showed elevated levels of sadness, loneliness and nervousness and were also most likely to engage in high-risk behaviour such as smoking and alcohol consumption.[66] One small study of normal and overweight/obese 8–9 year olds in Belfast found that being exposed to impoverished environments in addition to being overweight was associated with lower self-esteem for some children.[67] • Clinical samples of obese children generally show lower self-esteem than community samples,[23,45] possibly due to the fact that those who are seeking treatment are more adversely affected psychologically by their obesity or that they feel personally unable to control it.[27] The negative relationship between obesity and self-esteem appears to be more apparent in girls than boys. It has also been found to strengthen with age from pre-adolescence into young adulthood,[34] although a recent systematic review failed to find clear differences between obese children and adolescents.[24] • The link between body dissatisfaction and weight has been documented in many studies. However, it does not appear to be inevitable in obese children and many are not aware that they are overweight.[27] It has been suggested that body dissatisfaction arising from socio-cultural attitudes and norms may have more influence than actual weight.[27] • A recent study of US adolescents revealed a strongly negative and significant relationship between self-perceived weight status and mental health, which was more pronounced among girls and was independent of actual weight status.[57] Similar conclusions were also drawn in a study of Australian adolescents, suggesting that it is the degree of weight and shape concern, rather than the weight status per se, that is associated with psychological problems in overweight children.[47] The perception of being overweight during adolescence has been found to be a significant factor for depression in young adult men and women.[68]	• It is possible that negative thoughts may detrimentally affect weight loss, as in adults

Social	• Obesity is one of the most stigmatising and least socially acceptable conditions in childhood.[26] • Obese children are often subject to social rejection, discrimination and negative stereotyping. Research has found that between a quarter and a third of teenagers report being teased by peers for reasons of weight, with obese girls and thin boys reporting the highest levels of teasing.[69] Weight-related teasing has generally been found to be strongly associated with body dissatisfaction.[27] • Obese children are often stigmatised by their peers in school. Research on children aged 11–16 years in Canada found that overweight and obese boys and girls were more likely to be the victims of verbal, physical, and relational bullying (withdrawing friendship, spreading rumours or lies) than their normal weight peers.[70] Studies have shown that teasing is common in both over and underweight children, with little difference between boys and girls.[34] In addition, while peer-initiated victimisation may lower self-esteem, low self-esteem invites victimisation.[23] • Weight-based teasing in adolescents has also been reported to predict disordered eating patterns including unhealthy weight control methods, frequent dieting and binge eating.[71]	• Psychosocial stressors in the household such as financial strain, maternal BMI, mental and physical problems of the caregiver and neglect.[9] • Being exposed to impoverished environments in addition to being overweight is associated with lowered self-esteem in some children.[67]

Appendix 3: Definitions of mental health and well-being

The World Health Organisation defines mental health as 'a state of well-being in which an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and is able to make a contribution to his or her community. In this positive sense, mental health is the foundation for individual well-being and the effective functioning of a community'.[72]

The most common mental health problems as defined by the National Service Framework for Mental Health are depression, eating disorders, and anxiety disorders:[73]

Depression: A negative mood state which involves a feeling of sadness. A severe depression can reach the criteria for an affective disorder and require treatment. Depression can frequently coexist with and complicate other physical illnesses. The most frequent disorder found in the National Morbidity Survey was a mixed anxiety-depression.

Anxiety: A mood state in which feelings of fear predominate and where the fear is out of proportion to any threat. Frequently associated with physical symptoms which include fast pulse rate, palpitations, sweating, shaking, 'pins and needles'. Anxiety disorders can include simple phobias, fear of a specific object or situation, generalised anxiety disorder, panic disorder, agoraphobia, obsessive-compulsive disorder, or post traumatic stress disorder.

Eating disorders: These disorders include anorexia nervosa and bulimia nervosa. They are disorders that tend to have an early onset in childhood or adolescence and are less frequent in males.

Well-being: This is a term more commonly used in research on children. One study found that well-being for children meant self-esteem, trust and satisfaction and was preserved and improved through exciting relationships and activities. Feeling well was equal to feeling capable, feeling happy and feeling a sense of community.[61]

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Reader Information

Title	Obesity and Mental Health
Author(s)	Mary Gatineau, Monica Dent
Reviewer(s)	Professor Mika Kivimaki, Professor of social epidemiology, Department of Epidemiology and Public Health, University College London Dr Paul Tiffin, Clinical Senior Lecturer & Honorary Consultant in the Psychiatry of Adolescence, The Wolfson Research Institute, Durham University
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