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NARRATIVE REVIEW

Does it matter if I am overweight? 2. Some psycho-social consequences.

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Abstract

Objective: The objective of this narrative review is to consider the impact of various levels of obesity upon psycho-social health. ***Methods.*** Information obtained from Ovid/Medline and Google Scholar through to September 2018 was supplemented by a search of the author's personal files. ***Results.*** Overweight and obesity predispose to a variety of significant practical and psycho-social problems. At school, there are issues of bullying, exclusion from sports, a poor self-image, adverse teacher evaluations and academic grades. Adults also face many issues in their daily life such as the finding of appropriate clothing, difficulties in travel and the use of public seating, medical discrimination, and reduced employment and marital prospects. Taken together these cause a reduced quality of life, with an increased risk of anxiety and depression, and a propensity to suicide attempts. ***Conclusions.*** The adverse psycho-social consequences of an excessive body weight are a significant handicap, and they offer further ammunition that can be exploited by fitness professionals as they encourage participation in and adherence to weight-control programmes. **Health & Fitness Journal of Canada 2018;11(3):22-66.**

Keywords: Anxiety; Depression; Employment prospects; Marital prospects; Medical discrimination; Quality of Life; Social adjustment; Sports participation; Suicide.

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Introduction

Among the many significant handicaps imposed by an excessive accumulation of body fat, we nay note biomechanical and physiological disadvantages, psycho-social issues, and an increased risk of various diseases. A companion article has previously examined the adverse effects of obesity upon biomechanics, body physiology and performance measures (Shephard, 2018). We will here examine some of the psycho-social consequences of an excessive body fat content (Table 1), leaving to the final segment of this trilogy a discussion on the long-term health consequences and significant co-morbidities of obesity.

Many of the problems encountered by those who are obese could be considered in part as a criticism of the social attitudes that are prevalent in current society. Nevertheless, they are an unpleasant reality that faces the fat person on a daily basis. In general, it is convenient to discuss the psycho-social issues faced by obese children separately from the problems of obese adults, but a number of the difficulties that we shall discuss can arise at any point in the life course.

Table 1: Some of the adverse psycho-social consequences of obesity.

- Problems at school (bullying, exclusion from sports, poor academic evaluations)
- Issues in adult daily life- choice of clothing, travel and public seating, sports participation
- Medical discrimination;
- Poor employment prospects
- Problems of social adjustment, poor marital prospects
- Reduced Quality of Life;
- Psychiatric problems (anxiety, depression, suicide)

Table 2: Handicaps faced by obese children when attending school.

- Bullying and teasing from fellow-students
- Social isolation
- An inability to participate in sports and a lack of other forms of physical activity
- Daytime sleepiness
- A poor self-image and low self esteem
- Above average absenteeism from school
- An adverse attitude of teachers
- Poor academic grades
- Anxiety, depression and suicidal thoughts

Problems encountered at school

Children who develop substantial obesity face many negative and closely inter-related consequences in the classroom (Table 2). Issues include including bullying and teasing from fellow-students, social isolation, an unwillingness or inability to participate in sports and other forms of physical activity, daytime sleepiness, a poor self-image and a low self-esteem, above average absenteeism from school, an adverse attitude of teachers, and poor academic grades, coupled with anxiety, depression and suicidal thoughts. We will now explore each of these issues in a little more detail.

Bullying, teasing and social isolation. Numerous papers attest to the above average risk of teasing and bullying experienced by obese children (Table 3), whether the format is physical, verbal, relational or cyber-bullying (van Geel et al., 2014). As might be expected, such problems increase exponentially in proportion to the severity of obesity, being worst in those with a body mass beyond the 95th percentile for their age group. Neumark-Sztainer et al. (2002) (Table 3) found that the odds ratios for frequent weight teasing reported by such individuals were 3.53 in girls and 6.74 in boys, relative to children of normal body mass. Meta-analyses have shown odds ratios for bullying and teasing averaging 1.19 in 14 studies of those who were over-weight, and 1. 51 in 16 studies of those who were obese (van Geel et al., 2014). Somewhat surprisingly, only about a half of the affected children said that they were bothered by weight teasing (Neumark-Sztainer et al., 2002). However, such actions can lead to a dislike of school in those who are sensitive (Kohlmann et al., 2018), with an increased likelihood of absenteeism and an adverse impact upon self-image and overall mood state. Bullying and teasing may also encourage undesirable methods of attempting to lose weight including anorexia nervosa, and it may lead to a variety of psychiatric disorders (Lampard et al., 2014; Libbey et al., 2008), sometimes with suicidal thoughts (Lian et al., 2017; Neumark-Sztainer et al., 2002}. There may also be binge-eating in response to teasing, with a risk of further weight gain in those who are already obese (Neumark-Sztainer et al., 2002). Bullying sometimes begins at quite an early age, but it becomes progressively worse as a child moves into adolescence (Kohlmann et al., 2018); it may not only affect immediate psychiatric health, but also to dissatisfaction with body image during adulthood.

One cross-sectional study of 213,596 European adolescents aged 11-15 years found that about a quarter of all students experienced chronic bullying during their school career; others have set the prevalence of being bullied as high as 45% of boys and 36% of girls. Over 41% of those who perceived that they had been bullied were on their own cognizance overweight or obese (Lian et al., 2018); risk ratios of encountering bullying while at school were 1.40 for those who were overweight, and 1.91 for

Table 3: Relationship between weight status and risk of teasing, based on data of Neumark-Sztainer et al., 2002).

Weight status	Frequent teasing	Ever teased by peers	Ever teased by family
Girls			
<15th percentile	44.0%	48.4%	24.2%
Average weight	18.7%	21.2%	23.6%
85th-95th percentile	28.5%	31.4%	33.7%
>95th percentile	45.3%	63.2%	47.2%
Boys			
<15th percentile	36.6%	40.5%	13.8%
Average weight	13.0%	13.7%	11.0%
85th-95th percentile	22.3%	26.3%	16.5%
>95th percentile	50.2%	58.3%	34.0%

those who were obese.

Despite such evidence, there remains a need for longitudinal studies to confirm how far obesity precipitates bullying, rather than the converse. There is indeed some data suggesting that weight-based teasing during adolescence leads to a further increases in body fat content as the student becomes older, with this trend sometimes continuing through into adulthood (Feeg et al., 2014; Neumark-Sztainer et al., 2002; Puhl et al., 2017; Sutin et al., 2016). By way of example, Australian children who were bullied about their weight at the age of 6 years showed an above average gain of body weight between the ages of 6 and 15 years (Sutin et al., 2016). Likewise, a study of 1830 U.S. adolescents found that weight-based teasing was associated with obesity 15 years into adulthood (Puhl et al., 2017) There remains a need to clarify the relative importance of perceptions of obesity vs. actual obesity (Kohlmann et al., 2018); some girls perceive themselves as obese when in fact their weight is within the normal range. Finally, there is a need to explore the possible influence of co-variates; in particular, a low socio-economic status, a poor diet and membership of specific social and ethnic groups seem important determinants of whether an adverse social environment precipitates obesity. Thus, Thapa and Kelvin (2017) found that an association between obesity and bullying persisted into adolescents of both sexes, irrespective of dating violence or sexual minority status; they noted that the odds ratio was 1.74 for the main student body, but odds of 1.97 were found for sexual minority groups, and 3.32 for victims of sexual violence. Likewise, Johns et al. (2017) found that among the female adolescents questioned in the 2015 Youth Risk Behaviour Study, the odds ratio for the bullying of heterosexual obese students was 1.34, but that values of 2.73 were found for overweight sexual minority students.

In adolescent boys, the relationship between body mass and self-image seems to be U-shaped. Bullying may result not only from being overweight, but also from being poorly muscled and thus substantially below the average weight for age (Kohlmann et al., 2018).

Social isolation. Given the teasing and bullying, one would anticipate that the obese child or adolescent would become socially isolated from fellow pupils. A limited amount of literature confirms the social isolation of the obese student, relative to those of normal body mass. This perception of social behaviour at

school was seen when 9-year old children were shown various blank silhouettes of their classmates, they rated those with obese figures as likely to have fewer friends than those of slimmer build (Hill and Silver, 1995). At least three reports show this perception carried into practice. A survey of 504 11-year old children found that those who were obese were less likely than their classmates to be nominated as "friends," and more likely to receive "dislike" nominations (de La Haye et al., 2017). Likewise, Strauss and Pollack (2003) questioned 17,557 adolescents aged 13-18 years, noting that those who were overweight had an average of 3.4 friendship nominations, as compared with 4.8 for those of normal weight; the overweight students were also more likely to have a total absence of friendship nominations (odds ratio 1.71), were less likely to be nominated as best friends, and more prone to have a perception that they were excluded from social events (Table 4). Finally, a group of 458 U.S. 5th and 6th grade children who were shown pictures of other students reported to Latner and Stunkard (2003) that they would be less likely to play with someone if they looked fat. A similar enquiry had been conducted some 40 years previously, and unfortunately it appeared that the dislike of the fat students had increased by 41%.

Table 4: Influence of obesity upon the likelihood of friendship for adolescents (based on data of Strauss and Pollack, 2003).

Measure	Normal body mass	Overweight children
Nominations as immediate friend (n)	4.55	3.38
Nominations as extended friend (n)	20.4	14.6
>5 friendship nominations	40	28
>2 best friend nominations	26	18

Inability or unwillingness of obese students to participate on sports teams and overall low levels of habitual activity. A number of authors have commented on the cross-sectional associations found between obesity and low levels of habitual physical activity in children and adolescents, although this is by no means a universal finding. Wilks et al. (2011) found only a limited relationship between habitual physical activity and adiposity in their systematic review of this question. Likewise, a meta-analysis of 50 reports (3 on pre-schoolers, 37 on children and 10 on adolescents) found that 48 of these studies were of acceptable quality, and in only 11 of the 48 studies was there a clear association between obesity and sedentary behaviour (Cliff et al.al., 2016). Indeed, Collings et al. (2015) found a small and clinically insignificant positive association between the baseline volume of physical activity at an intensity >2 METs and the gain in body fat mass over a 2.5-year follow-up of 728 adolescents initially aged 15 years.

Among articles reporting such an association, we may note an early comparison between 129 obese and 142 normal weight Finnish children also found a negative association between obesity and habitual physical activity as determined by the 3-day physical activity records of the children and their parents (an odds ratio 0.88)(Fogelholm et al., 1999). Likewise, in a study of 2200 European adolescents, skin-fold and bioimpedance assessments of body fatness were negatively associated with accelerometer estimates of habitual physical activity, particularly vigorous physical activity (>6 METs)(Jiménez-Pavón et al., 2013). Finally, despite their earlier findings for older adolescents,

Collings et al. (2017) reported that in 410 children with an average age of 7.6 years, the volume of daily physical activity at an intensity >2 METs was inversely associated with their fat mass index.

The immediate temptation is to infer that an inadequate level of habitual physical activity has given rise to obesity, and this is probably an important factor. However, there is also growing evidence from longitudinal research that other correlates of obesity, ranging from teasing about personal appearance to deliberate exclusion from sports and gymnastic programmes by teachers, has sometimes acted in the opposite sense (Richmond et al., 2014). Thus, as already noted, a longitudinal study of 728 adolescents found that baseline habitual physical activity had a small but statistically significant positive influence upon the gain of body fat over 2.5 years of observation (Collings et al., 2015). Likewise, a 7-10 year longitudinal study of 202 children recorded accelerometer data for 7 days per year, measuring body fat content by dual energy x-ray absorptiometry; the percentage of body fat observed in any given year predicted a child's level of physical activity over the ensuing 3 years, and the level of physical activity was actually less predictive of ensuing changes in body fat content (Metcalfet al., 2011)(Table 5).

Some of the negative effects of obesity upon the level of habitual physical activity arise from the biomechanical, physiological and performance-related issues discussed in the first section of this review (Shephard, 2018). There are also issues of teasing about personal appearance in sports clothing, as discussed above, and often interest in sport is curtailed because of the child's self-perceived lack of physical competence (Griffiths et al., 2010). Further, overweight children are unlikely to be selected to play on most sports teams, and because of fears of injury they may be actively discouraged from participating in gymnastic activities, thus increasing their risk of not reaching an appropriate level of daily physical activity. Thus, an Australian study of obese children found that their lack of habitual physical activity was quite closely correlated with their lack of motor skill proficiency (Morgan et al., 2008); in boys, object control proficient accounted for 25% of the variance in daily moderate physical activity.

The low levels of activity found among many obese children may in part be considered as a criticism of school physical activity programmes, which until recently have emphasized participation in high profile sports at the expense of teaching a variety of lifetime physical skills, some of which (such as swimming) might appeal to overweight pupils.

Daytime sleepiness. The association between obesity, sleep apnoea and daytime sleepiness was outlined briefly in the first part of this review (Shephard, 2018). Drowsiness and daytime sleeping

Table 5: Relationships between body fat content and changes in moderately vigorous physical activity (MVPA) over the age span 7 - 10 years. Based on the findings of Metcalfe et al. (2011).

- MVPA at age 7 yr vs. body fat % at age 10 yr r = -0.15
- Body fat % at age 7 yr vs. MVPA at age 10 yr r = -0.25
- MVPA at age 7 yr vs. delta body fat at age 10yr r = -0.01
- Body fat at age 7 yr vs. delta MVPA at age 10 yr r = -0.17

are handicaps at all ages, but are particularly troublesome for school pupils and their teachers. There are obvious dangers for teenagers and adults when operating a motor vehicle or mechanical equipment, and for this reason some jurisdictions have made it a medico-legal requirement for physicians to report daytime sleepiness (Boehlecke, 2007). As will be explored further below, obesity is by no means the only cause of excessive daytime sleepiness (Panossian & Veasey, 2012); indeed, it may account for no more than 50% of cases (Table 6).

As with a number of other issues, the direction of causality between obesity and daytime sleeping is not entirely clear. Short sleeping hours and daytime sleepiness could cause obesity, rather than the converse (Miller et al., 2018; Sekine et al., 2002; Wu et al., 2017), as emphasized in several reviews (Chen et al., 2012; Li et al., 2017; Taheri, 2006). There also appears to be an association between poor quality sleep (particularly a lack of REM sleep) and the development of obesity (Pachecoet al., 2017), and it may indeed be that in this regard the quality of sleep is a more important issue than its duration (Fatima et al., 2016).

The primary problem has sometimes been thought to be a night-time obstruction of the airways caused by pharyngeal obesity. However, a multiple regression analysis of data for 16,583 U.S. adults completed by Bixler et al. (2005) suggested that excessive daytime sleepiness reflected more the effects of metabolic disturbances and depression than the direct disturbances of sleep by breathing difficulties, with daytime sleepiness being an early manifestation of obesity-induced depression (LaGrotte et al., 2016). Examination of data for 506 U.S. kindergarten-5th grade children reached similar conclusions; excessive daytime sleepiness (as reported by a teacher or parent) was correlated more closely with obesity, asthma, and parent-reported depression of the child than with obesity-induced sleep apnoea (Calhoun et al. 2011).

Table 6: Potential causes of daytime sleepiness.

- Obstructive sleep apnoea
- Narcolepsy
- Idiopathic hypersomnia
- Rare primary insomnias, e.g. Kleine-Levin syndrome
- Inadequate hours of sleep
- Shift work
- Disturbed circadian rhythm, e.g. travel
- Depression
- Medications, e.g. anti-histamines
- Medical problems (e.g. cerebral trauma, stroke, cancer, encephalitis)

A poor self-image and a lack of self-esteem. It is widely recognized that obese children tend to have a poor self-image and a low self-esteem, with impaired social functioning and a reduced quality of life (Danielsen et al., 2012; Griffiths et al., 2010). This reflects a reaction to frequent teasing and bullying, societal biases against the obese (Kornilaki, 2015; Puhl and Latner, 2007), and a self-recognition of physical and social handicaps. However, the impact of such factors upon self-image depends in part on cultural norms, for example, there may be a greater acceptance of moderate childhood obesity among the Chinese than in Western cultures (Marsh et al., 2007).

A study of otherwise healthy Australian adults aged 20-84 yr suggested that an obesity-induced lack of self-esteem had the potential to impair the performance of all cognitive tests, including indices of attention, memory, and academic performance (Gunstad et al., 2007). Agarwal et al. (2013) examined

first-year Indian medical students; there was not much severe obesity in this sample, but there was no evidence that a BMI >25 kg/m^2 had a negative effect on physical self-concept or cognition. The authors of this report hypothesized that in this group the positive effects of academic achievement were enough to cancel out any negative effects of an excessive BMI.

In terms of the directionality of any observed associations, there is some possibility that a poor overall self-image could lead to carelessness about personal appearance, with obesity being one manifestation of this. However, most of the published reports, even when cross-sectional in type, have worked from the hypothesis that obesity caused the poor self-esteem, rather than the converse. In support of such directionality, one review found that in 6 of 8 studies participation in a weight-loss programme improved self-esteem (French et al.,1995). Likewise, Jelalian and Mehlenbeck (2002) noted that in a small sample of 16 U.S. adolescents who reduced their body mass by an average of 6.7 kg through participation in a 16-week weight-management programme showed gains in perceptions of physical self-worth, personal appearance and romantic appeal.

A substantial number of reports from various parts of the world have confirmed the positive relationship between obesity and a reduced level of self-esteem in children and adolescents (Table 7), although for reasons that are unclear, a substantial fraction of obese students manage to avoid such negative perceptions (Franklin et al, 2006). Many observers have used instruments such as the Perceived Competence for Children Scale to look at evaluations of self-worth. A comparison of 139 obese with 150 non-obese Belgian children aged 9-12 years noted that the former all had poorer overall scores on this instrument, with lower evaluations in the spheres of physical activity, social competence and competence at school (Braetet al., 1996). In Australia, completion of the *Self Perception Profile for Children* by a group of 2813 adolescents aged an average of 13.3 years again showed that those who were obese had lower evaluations of their physical appearance, athletic ability and global self-worth than children of normal body mass. Danielsen et al. (2012) applied the same measure to 5185 Norwegian children aged 10-13 years, finding that a higher percentage of overweight and obese children had low scores in the domains of scholastic competence (7.8 vs. 3.1%), social acceptance (8.0 vs. 3.0%), physical competence (20.9 vs. 8.1%) and perceived appearance. (16.5 vs. 4.9%). Again using the *Self-Perception Profile for Children scale*, Strauss (2000) did not find a difference of scores between of responses between the obese (BMI > 95th percentile) and those of normal weight in pre-adolescent children aged 9-10 years, but over a 3 year follow-up the obese lost self-esteem relative to those with a normal body mass (significantly so in Hispanic and "white" girls.

Others, using different instruments to rate self-worth, reached essentially similar conclusions. A small study from Crete noted that obese 11-year old children had low scores not only for global self-worth, but also for perceptions of social and athletic acceptance and physical appearance (Kornilaki, 2015), A survey of 2569 Portuguese adolescents also found that obesity was associated not only with a lower overall self-image, but also specific perceptions by the affected students that they were less athletic, agile,

Table 7: Published reports examining the relationship between obesity and self-image.

Author	Sample	Findings	Comments
Braet and Mervielde (1996)	Children aged 9-12 yr, 139 obese, 150 non-obese	Obese had low scores for self-worth, activity, social and school competence	Perceived competence scale, child behaviour check list
Danielsen et al. (2012)	5185 children aged 10-13 yr	Low scores in overweight, obese: Scholatic competence 7.8 vs. 3.1% Social acceptance 8.0 vs. 3.0% Athletic competence 20.9 vs. 8.1% Physical appearance 16.5 vs. 4.9%	Self-perception profile for children
Franklin et al. (2006)	2813 Australian children aged 11.3 yr	Obese had low global self-worth, perceptions of appearance & athletic competence	Self Perception Profile for Children
Jelalian and Mehlenbeck (2002)	16 children aged 13-16 yr	Gains of self-worth, physical appearance and romantic appeal with weight loss	Weight loss programme, average 6.7 kg
Kornilaki (2015)	11 yr old children, 53 normal, 40 obese	Global self-worth score 3.34 vs. 3.07	Harter self-perception scale. Also adverse effects on ratings of social and athletic competence, physical apppearance
Marsh et al. (2007)	763 Chinese children aged 8-15 yr	Global self-esteem not related to obesity	Cultural difference in Chinese
Mendiratta (2014)	229 Indian children aged 10-16 yr	Self-esteem vs. BMI: r = -0.13 (boys), -0.36 (girls)	Rosenberg self-esteem scale
Mirza et al. (2005)	113 Hispanic American children aged 10-18 yr	Self-esteem normal 9.3. overweight 8.8 obese 8.0	Hare area-specific self-esteem scale
Ortega et al .(2015)	292 Spanish students aged 13.1 yr	Self-esteem vs. BMI : r = - 0.36 (boys), - 0.16 (girls)	Rosenberg Self Esteem scale
Peralta et al. (2016)	2569 Protuguese students aged 13.3 yr	Obese students had low global self-worth, perceived themselves as less athletic, less agile, less fast, less fit	Lintunen's scale
Strauss (2000)	1820 U.S. children aged 9-10 yr, followed for 3 yr	Decrease of self-esteem in obese (significant for Hispanic and "white" girls)	Self-Perception Profile for Children
Wu et al. (2017)	4918 Canadian Grade 5 students	Low global, self and social perceptions in obese students	Harvard Youth and Adolescent Questionnaire
Xue-Yan et al. (2016)	1410 Chinese primary school students	Low self-esteem 15.9% normal, 20.9% overweight, 23.5% obese	Self esteem scale

fast and fit (Peralta et al., 2016). Multivariate analysis of data for 1410 Chinese primary school students (Xue-Yan et al., 2016) showed odds ratios for

Table 8: Overall absenteeism from school for normal (N), overweight (Ow) and obese (Ob) students.

Authors	Sample	Absence (days/yr, % of classes or odds ratio)	Comments
Baxter and Hardin (2011)	920 U.S. 4th grade students	3.0%(N), 2.5%(Ow), 2.9% (Ob) (ns effect)	Objective data
Bonilla (2011)	116 students with abdominal pain	1.53(N), 2.88(Ob)	Parental interview, children with abdominal pain
Carey et al. (2015)	45,255 U.S. children aged 7 yr	6.1%(N), 5.9%(Ow), 9.8%(Ob)	Questionnaire
Datar and Sturm (2006)	4668 U.S. kindergarten students	8.0(N), 9.0(Ow grade 3), 9.5 (Ow kindergarten & grade 3)	Teacher questionnaire
Datar & Sturm ((Datar & Sturm, 2006)	5452 U.S. grade 3 students	6.2(N), 6.5(Ow grade 3), 6.8 (Ow kindergarten & grade 3)	Teacher questionnaire
Duncan et al. (2017)	3113 U.S. adolescents, age 12-19 yr	0.99(N), 1.41 (Ow)	Questionnaire, *perceived* weight status
Echeverría et al. (2014)	93,151 U.S. adolescents, 10-17 yr	1.0(N), 1.50(Ow), 1.69(Ob)	Questionnaire, risk of missing >11 days of school
Geier et al. (2007)	1069 U.S. grade 4 students	10.1(N), 12.2 (Ow)	Objective data
Kesztsyüs et al. (2013)	1888 German grades 1 & 2 children	6.84(N), 9.05(Ob)	Objective data
Li et al. (2012)	age 6-11 yr	3.67(N), 3.96(Ow), 3.71 (ns; but effect on absences >2 days)	Questionnaire (absence for illness or injury)
Li et al. (2012)	age 12-18 yr	3.86(N), 3.80 (Ow), 4.70 (Ob) (ns)	Questionnaire (absence for illness or injury)
Nigg and Amato, (2015)	334 Hawaiian students aged 14.8 yr	BMI vs. sick-days, r=0.02 (ns)	Questionnaire
Pan et al. (2013)	3470 U.S. adolescents, aged 12-17 yr	3.4(N), 4.4(Ow), 4.5(Ob)	Questionnaire
Rappaport et al. (2011)	165,056 US students, grades 1-12	1.0(N), 1.01 (Ow), 1.01-1.11 (Ob)	Objective data
Shore(Shore, Sach et al. (2008)	572 U.S. 6th & 7th grade students	6.4(N), 7.1(Ow), 8.6(Ob)	Objective data
Wijga et al. (2010)	3960 8-year old Dutch children	1.0(N), 1.28(Ow), 1.82(Ob)	Parental questionnaire

poor self-esteem ratings of 2.60 in those who were overweight, and 3.74 for those who were obese; respective percentages with low self-esteem were 15.9% if of normal weight, 20.9% if overweight, and 23.5% if obese. Satisfaction with academic performance was also negatively related to obesity (odds ratio 0.22).

In Canada, a survey of 4918 grade 5 students found that those classed as obese were more likely to report both low self- and social-perceptions relative to their classmates (respective odds ratios of 1.55 and 1.29), again with a poor global self-image (odds ratio 1.42)(Wu et al., 2015). A study of 292 grade 8 and grade 9 Spanish students again demonstrated higher levels of self-esteem in those with a healthy body mass than in those who

were obese, with an average correlation of -0.25 between BMI and self-esteem as assessed on the Rosenberg scale. This effect was reported as larger in boys (r = -0.36) than in girls (r = -0.16) (Ortega Bercera et al., 2015). However, the sex difference seems to depend on the milieu; thus, a similar-sized study of 229 Indian students aged 10-16 years, using the same (Rosenberg) instrument found that the adverse effects of a BMI >25 kg/m^2 were greater in girls (r = -0.36) than in boys (r = -0,19) (Mendiratta, 2014).

Above average absenteeism from school. Given the increased risk of teasing and bullying from fellow students, a dislike and/or an inability to engage in physical activity options, periods of minor illness from obesity-related health conditions, and the frequently negative attitudes of teachers, it is not surprising to find a positive association between obesity and poor school attendance (Taras and Potts-Darema, 2005)(Table 8).

At the time of the review by Taras and Potts-Darema (2005), only one research group had apparently looked directly at this issue. Schwimmer et al. (2003) had noted that 106 severely obese children and adolescents (average BMI of 34.7 kg/m^2) who were referred to the obesity clinic at a Children's Hospital in San Diego on average missed significantly more school days than the general population; during the month preceding their evaluation they had missed classes on an average of 4.2 days, much of this absenteeism presumably being related to their illnesses.

The dearth of information noted by Taras and Potts-Darema, (2005) was quickly remedied in the ensuing decade. A recent review by An et al. (2017) identified 13 studies of this question; 10 investigations were cross-sectional and 3 had a longitudinal design; they involved samples of 24,861 and 3,113 students, respectively. Only 4 of the studies had access to objective school records of absenteeism. Most of the remainder relied on parental reports of school attendance. Nevertheless, 11 of the 13 articles noted a significant positive association between the 2 variables; relative to pupils with a normal body mass, the odds of being absent from school frequently were 27% and 54% for overweight and obese students, respectively.

Although, the magnitude of differences in school attendance between the obese and those of normal weight are statistically significant, it is important to underline that they are usually quite small. For example, Datar and Sturm (2006) found kindergarten absences rising from an average of 8.0 to 9.5 days, and Grade 3 absences from 6.2 to 6.8 days in those children who were obese. Likewise, the records of home-room school teachers for 1069 grade 6 students in Philadelphia (Geier et al., 2012) showed that during the second semester of the academic year obese students were absent an average of 12.2 days, compared with 10.1 days for those of healthy body mass; thus, obesity explained only 11% of the variance in school attendance. Pan et al. (2013) studied 3470 U.S. adolescents who were participating in the National Health Interview Survey, and again although there was a statistically significant effect from body fatness, this was quite small; each year, students with a healthy body mass were absent an average of 3.4 days, the overweight were away for 4.4 days, and the obese for 4.5 days. Possibly, it is more useful to consider differences in the number of students who are frequently absent from school. In the study of Pan et al. (2013), a high proportion of students missing >4

Table 9: Comparison of minor health issues between normal weight, overweight and obese children (based on the data of Wijga et al. 2010).

Health Issue	Normal weight	Overweight	Obese
RAND SF-36 score	28.0	27.3	26.5
GP contact during last 2 months (%)	20.1	18.9	33.3
School absence for illness during last 2 months (%)	26.8	33.0.	35.3
Flu or serious cold during last 12 months (%)	11.8	22.9	23.5
Throat infection during last 12 months (%)	4.8	6.2	5.9
Ear infection during last 12 months(%)	8.8	9.3	13.7
Bronchitis during last 12 months (%)	2/3	2.2	11.8

days/ of class per year were obese. Rappaport et al. (2011) examined records for 165,056 students in the Philadelphia region. They also found only a weak relationship between obesity and school attendance; however, they emphasized that this was most noticeable in severely obese individuals, (BMI> 99th percentile), where absences were 11% greater than in normal weight students. Finally, Baxter et al. (Baxter et al., 2011) found no significant relationship between School Board records of 4th Grade attendance and BMI.

Zhang et al. (2018) and Duncan et al. (2017) argued that absenteeism was correlated more closely with perceived than with actual overweight. In their studies, excessive absences were seen in ~12% of those who perceived their weight as normal, and 13.9% of those who were actually obese, but in 16.0% of those who perceived themselves as being over-weight.

Li et al. (2012) examined data for 1387 children and 2185 adolescents. In their survey, the questionnaire that was used asked about absence from school "for illness or injury;" rather than overall absences; once again, the *average* figure was unrelated to obesity, but the odds ratio of finding *severe* absenteeism (defined as >2 days absence per month) was 2.27 for those children who were overweight and 3.93 for those who were obese. However, no effect, even upon severe absenteeism, was seen in the adolescents.

Increased illness. In obese students, the loss of instruction occasioned by a dislike of school and avoidable absences tends to be compounded by absences attributable to an increased incidence of both minor and more serious illnesses (Riley et al., 2003). In a sample of 3960 8-year old Dutch children, obesity was associated with a significant increase in a number of minor health problems (Tables 9 and 10), and these led to a 30% increase in absences from school (Wijga et al., 2010). Moreover, many of the chronic illnesses that plague the obese adult have their beginnings in childhood; thus, time is lost in hospital visits for testing and therapeutic advice, particularly in connection with diabetes mellitus, cardiovascular risk factors, steato-hepatitis and gall-stones (Janovski, 2001). The obese frequently suffer also from psychological and psychiatric problems (below), and are at an increased risk of asthmatic episodes. Six well-designed investigations have all noted an increased risk of asthma, wheezing and coughing with obesity, particularly in girls (Riley et al., 2003; Schacter et al., 2003), and in one of these studies the asthma attacks developed in parallel with the onset of obesity in children who were not previously obese (Castro-Rodriguez et al., 2001). However, some investigators have

Table 10: Factors leading to an increased risk of medically-related absenteeism in the obese child.

- Early onset of chronic illnesses seen in obese adults (diabetes mellitus, cardiovascular risk factors, steato-hepatitis and gallstones)
- Related tests and evaluations
- Psychological and psychiatric problems
- Asthma and wheezing
- Chronic inflammation
- Orthopaedic problems
- Skin disdorders, e.g. keratosis
- Increased anaesthetic morbidity

argued that the greater frequency of asthmatic symptoms in the obese simply reflects the greater energy that they must expend when performing standard tasks, or are a consequence of fat-related changes in chest biomechanics.

In terms of the risks of chronic disease in obese children, those who were over the age of 3 years with a weight >120% of expected values had a more than 2-fold increase in the risk of developing type 1 diabetes mellitus (Hypponen et al., 2000); they also showed an increased level of systemic inflammation as evidenced by blood levels of C-reactive protein (Visser et al., 2001), and an increased risk of orthopaedic abnormalities such as a bowing of the femur and tibia (Dietz, 1998) and a slipping of the femoral capital epiphysis (Janovski, 2001; Valerio et al., 2014). Obesity also seems to predispose to skin disorders such as keratosis (Jabbour, 2003).

Finally, in the event that an obese child requires anaethesia, there is a small increase in the risk of respiratory problems relative to children of normal body mass (Nafiu et al., 2007; Veyckmans, 2008), with increased difficulty in laryngoscopy and post-operative overnight stays in 2% vs. 0.2% of patients.

Adverse attitude of teachers. As children progress through school, their source of behavioural reference gradually transfers from their parents to other authority figures such as teachers and coaches, and the attitude of such leaders has an ever-growing impact upon the student's self-image and behaviour. Teachers face the sometimes difficult task of trying to avoid a negative bias towards children who are obese, while encouraging such students to reduce their weight and engage in greater physical activity, without precipitating eating disorders (Cliff and Wrught, 2010). Despite the best efforts of Faculties of Education, at times, they do show evidence of bias against those who are obese. This bias may be implicit and/or explicit, and it may reflect as much a positive attitude towards thinness as a negative attitude towards obesity. Nevertheless, it has been shown to distort judgments concerning the language proficiency and overall intelligence of students (Glock et al., 2016), as well as their ability to participate in physical activity programmes.

Implicit bias seems to be more prevalent than an explicit bias (Walte et al., 2013). A study of 47 physical education teachers and 149 physical education majors from Iowa (Fontana et al., 2013) used three measures of anti-fat discrimination to demonstrate a strong anti-fat bias in both groups of educators. A comparison of 177 non-specialist and 62 Health and Physical Education specialist trainees demonstrated that anti-fat biases were particularly strong in this group, with poor expectations of obese students in terms of reasoning ability and cooperation (Lynagh et al., 2015). Teachers involved in health and physical education programmes have

been conditioned to a fear of fat (Cliff and Wrught, 2010). Thus, they regard obese students as less tidy, more emotional and less likely to succeed than their classmates (Neumark-Sztainer et al., 1999), with many undesirable traits (Table 11). Many other investigators have had similar findings. An evaluation of 167 students attending a sport and physical education faculty in England showed uniformly negative perceptions of "fat" children (Peters and Jones, 2010).A comparison of 180 physical education with 164 psychology students found stronger anti-fat biases in the physical education group (O'Brien et al., 2007). A survey of 105 physical educators showed poor expectations of physical and social interaction abilities in students who were obese (Greenleaf and Weiller, 2005). Further, these negative attitudes are often present even before a teaching career is begun (Greenleaf and Weiller, 2005; Neumark-Sztainer et al., 1999; O'Brien et al., 2007; Peters and Jones,, 2010). Although physical educators seem the worst culprits, negative attitudes sometimes extend to teachers in other disciplines, and even to school principals (Price et al., 1987; Walter et al., 2013).

Specific interventions have now been developed that can improve the attitudes and approach of educators (Hague and White, 2005). Many are open to learning, but unfortunately as yet too few teachers have received training in optimal ways to approach obese students (Patte and Leatherdale, 2016). A survey of 240 educators found that 48% had observed weight-related bullying of students, and a large majority also supported policies requiring the school-based health curriculum to include material on the prevention of eating disorders (94%), and weight-bullying (92%); they would also welcome staff training (89%), and necessary changes in the school curriculum (89%) (Puhl et al., 2016).

Somewhat surprisingly, teacher attitudes towards obese students were found to be unrelated to the fatness of the teacher (Neumark-Sztainer et al., 1999).

Table 11: Teacher perceptions of obese students (based on survey of (D. Neumark-Sztainer et al., 1999).

- Eating used to compensate for a lack of love or attention
- Obesity reflects a biological disorder
- Obesity is caused by over-eating
- Obesity is caused by inadequate exercise
- Obese students eat more than their classmates
- Obese students have poor eating habits
- Obesity is rarely caused by lack of willpower
- Obese students may be addicted to food

Poor academic grades. The positive association between a high level of habitual physical activity and a good academic performance is now widely acknowledged (Trudeau and Shephard, 2009). Conversely negative effects might be anticipated from a low level of physical activity and accumulation of either an overall excess of body fat or its visceral component (Kamijo et al., 2012), providing an objective measure of a child's overall adaptation to the school environment. Possible specific factors having a negative effect upon academic achievement could include teasing, bullying and a poor self-image, absenteeism due to either dislike of school or illness, the negative expectations of school staff, and socio-economic covariates of obesity (Table 12).

Krukowski et al. (2009) demonstrated a strong positive association between weight-based teasing and poor academic performance in a sample of 1200 Arkansas school students; introduction of

Table 12: Potential reasons for poor academic achievement in obese students.

- Teasing, bullying and poor self-image
- Increased absenteeism (dislike of school, increased illness)
- Negative expectations of academic staff
- Socio-economic co-covariates (e.g. socio-economic status, race)

evidence of teasing into a multiple regression model accounted for 24% of the adverse grades that were associated with a BMI >85th percentile. On the other hand, a study of pre-service teachers found them, somewhat surprisingly, rating the case reports of obese students more highly than reports from those of normal body mass (Muller et al., 2017).

A review of nine reports found that overweight and obesity was linked to poor academic grades in all of these investigations (Taras and Potts-Datema, 2005). However, the issue does not seem to be entirely resolved. Another systematic review looked at 23 cross-sectional and 11 longitudinal studies of the issue. Although at first inspection 11/23 cross-sectional and 4/11 longitudinal studies showed a significant adverse effect of obesity upon academic grades, the authors concluded that after controlling for socio-economic status, parental level of education *and* the habitual physical activity of the student, the negative effect of obesity upon academic grades generally became unclear (Santana et al., 2017). But given the likely inverse relationship between habitual physical activity and obesity, the correction of the data for levels of habitual activity remains a questionable statistical tactic.

Individual reports point to a broad-ranging negative effect upon the learning process. Shi and Li (2015) found that among Australian children from grades 3, 5 and 7, those who were obese scored 16 points less in reading, 17 points less in grammar, 17 points less in spelling, 24 points less in writing and 20 points less in numeracy, with the adverse effects (particularly on numeracy) accumulating to become most marked in grade 7. Kamijo et al. (Kamijo et al., 2012) made a cross-sectional study of 126 children aged 7-9 years, measuring body fat by dual x-ray absorptiometry and competence in reading, spelling and arithmetic by a "wide-range achievement test." In their study, both BMI and the objective assessment of body fat content were negatively associated with academic achievement after application of a multiple regression analysis that controlled data for socio-economic status. Davis and Cooper (2011) also demonstrated negative associations between body fatness and scores for both mathematics and reading ability in a sample of 170 children aged 7-11 years. The association persisted after making a multiple regression analysis that adjusted for the level of parental education; however, they concluded that a specific visceral orientation of the excess fat deposition was not important to this conclusion. In contrast, Raine et al. (2018) reported that in a sample of 90 children aged 8-9 years, the negative effect of body fat was specifically correlated with a visceral rather than a subcutaneous accumulation of adipose tissue; it was argued that a visceral deposition of fat had a negative effect upon the executive function of the brain (Huang et al., 2015).

Anxiety, depression and suicidal thoughts. The foregoing discussion shows that obesity has a negative effect upon many factors influencing the quality of life in a child. This is also true for an

adolescent or an adult. It is thus convenient to consider questions regarding the psychiatric status of the obese jointly for all age groups, although we should recognize that some of the immediate precipitants of psychological disorders vary with age. In addition to the bullying and teasing that have a particularly marked impact upon children and adolescents, there are adverse effects from negative social stereotypes and discrimination in employment, and an excessive body mass imposes many limitations of lifestyle, ranging from a curbing of physical activity options to a restricted choice of clothing. There may also be cumulative adverse effects from frequent episodes of nocturnal apnoea and a chronic loss of sleep (Forhan and Gill, 2013), compounded by various dietary restrictions and chronic medications that may have been imposed in an attempt to curtail appetite (Puhl and King, 2013; Taylor et al., 2013).

It is thus hardly surprising that obesity has been linked to an increased risk of anxiety, depression and suicidal thoughts. However, as with a number of issues surrounding obesity, the findings are not altogether consistent, and it is thus important to look at both mediator variables (Nemiary et al., 2012) and at the direction of any relationships that are demonstrated. Depression could potentially give rise to obesity, as well as the converse, a point that has been made in several studies. One report showed that weight bullying at the age of 6 was associated with an excessive gain of weight between the ages of 6 and 15 years, whether fat accumulation was assessed from BMI or by waist circumference (Sutin et al., 2016). A prospective study of 9374 U.S. adolescents from grade 7 through 12 (Goodman and Whitaker, 2002) found that an initially depressed mood was linked to an increased risk of subsequently attaining a BMI >95th age-related percentile (odds ratio 2.05), and a study of children who sustained a major depression between the ages of 6 and 17 years (Pine et al., 2001) found that they had a significantly higher average BMI than their peers (26.1 vs. 24.2 kg/m^2) 10-15 years later. Mamman et al. (2016) compared the odds of obesity leading to depression (1.40) and the converse (1.70); their meta-analysis pointed strongly to a bidirectional relationship, a view also supported by the systematic review of Mühlig et al. (2016).

The psychiatric impact of obesity also depends on the individual's self-perception of body form; thus, a study of young Korean adolescents showed that males who under-estimated their body weight, and females who over-estimated it were both at increased risk of depression (Byeon, 2015).

Anxiety. A negative effect of obesity upon anxiety has not always been observed (Table 13). Thus, Chung et al. (2015) found no evidence of a propensity to either anxiety or depression among the obese members of a sample of 157 overweight and 145 healthy 1st and 4th grade children in Taiwan. They regarded their findings as anomalous, and speculated that the absence of effect might reflect a greater tolerance of obesity in the Asian culture than in the western world. Some other reviews have also failed to find strong and consistent relationships between obesity and anxiety (Pulgarón, 2013; Friedman and Brownell, 1995). However, a systematic review of 2 longitudinal and 14 cross-sectional studies (Gariepy et al., 2010) found an overall risk ratio of 1.4 for anxiety the obese, this disadvantage being

Table 13: Cross-sectional studies looking at the relationship between obesity and anxiety.

Author	Sample	Time of reference for anxiety	Odds ratio relative to normal weight
Barry et al. (2008)	40,790 U.S. adults aged >18 yr	Past year	1.6
Baumeister et al. (2007)	2347 German adults, aged 18-79 yr	Past year	2.1
Becker et al. (2001)	1496 German adult women aged 18-24 yr	Lifetime	2.6
Bruffaerts et al. (2008)	21,425 Europeans aged > 18 yr	Past year	1.1
Hach et al. (2007)	4181 German adults aged 18-65 yr	Lifetime	1.2
Hailstrom and Noppa (1981)	800 Swedish women, aged 38-54 yr	Current	1.2
Herpertz et al. (2006)	302 Germans aged 18-65 yr	Current	2.1
Mather et al. (2009)	34,900 Canadians aged >15 yr	Past year	1.2
McClaren et al. (2008)	3882 Canadians aged 18-64 yr	Past year	1.2
Patten and Liu (2007)	6578 Canadians aged 18-64 yr	Past 6 months	1.7
Scott et al. (2008)	7435 New Zealanders aged >16 yr	Past year	1.4
Simon et al. (2006)	9125 U.S. aged >18 yr	Past year	1.3
Zhao et al. (2009)	177,074 U.S. aged >18 yr	Lifetime	1.2

seen in both men and women. Unfortunately, longitudinal data were insufficient to determine the direction of the relationship, and indeed the odds ratio in the available longitudinal reports differed widely, between 1.16 in the study of Bjerksett et al. (2008) to 6.27 for Kazen et al. (2008).

Among the cross-sectional studies, Britz et al. (2000) studied psychiatric disorders in 30 female and 17 male adolescents, all of whom were extremely obese (BMI averaging > 42 kg/m$^{2)}$; 13/30 females and 6/17 males had an anxiety disorder, and all except 4 stated that obesity preceded their anxiety. Using the Hospital Anxiety and Depression Scale, Tuthill et al. (2006) found high levels of anxiety in 56% of 253 obese patients who were attending a medical clinic; problems were more frequent in women than in men.

Depression. Depression is also a frequent concomitant of obesity (Table 14). A review of 24 studies (4 longitudinal, 20 cross-sectional) found the longitudinal studies consistently showing an effect of obesity upon the risk of depression, although the association was less consistent in cross-sectional data. The meta-analysis of Luppino et al. (2010) was based on 15 longitudinal studies and it found that obesity at baseline gave an unadjusted risk ratio of 1.55 for the subsequent development of depression; the corresponding figure for those who were overweight was 1.27. A more recent review (Yagnik et al., 2014) found 51 studies of students <19 years of age, 19 of which were prospective cohort investigations, and one of which was a

randomized controlled trial; in 15 of the 19 prospective trials, obesity led to depression, and depression preceded the appearance of obesity in only 3 of the 19 trials. The authors commented that depression was a more likely consequence of obesity in girls than in boys, and that depression could be initiated not only by actual obesity, but also by perceptions of an excessive body mass. Britz et al. (2000) obtained detailed commentary from a small group of adolescents with extreme obesity; 14 of 30 females and 6 of 17 males reported depression, and only 2 members of this group thought that depression had preceded their obesity.

A systematic review of (mainly) cross-sectional studies from the US suggested that there was an association between obesity and depression in women but not in men; however, associations were not seen in reports from other parts of the world (Atlantis and Baker, 2008). Certainly, some small studies have failed to find a relationship between obesity and depression. For example, Horton (2008) found no relationship in a group of 29 children from grades 3-5 who had completed the Childhood Depression Inventory, and Schooling et al. (2015) saw no relationship between infant or early childhood obesity and depression as an adolescent in a substantial sample of 5000 children from Hong Kong. Merikangas et al. (2012) also failed to find a statistically significant overall association between obesity and major depressive disorder in an analysis of data from the 2001-2004 National Health and Examination Survey, although the odds ratio for an effect in male subjects reached a level of 2.7.

Nevertheless, quite a number of cross-sectional studies have agreed with the longitudinal data. Libby et al. (2008) found that in 46 male and 84 female adolescents, depression was related to teasing about weight, with an odds ratio of 2.42 for the number of sources of teasing, and 1.66 for the frequency of teasing. Tuthillet al. (2006) found evidence of depression in 48% of 253 patients attending a medical obesity clinic. And analyzing data for 44,800 U.S. adults from the 2001 Behavioral Risk Factor Survey, Heo et al. (2006) commented that a BMI >25 kg/m^2 was associated with an increased risk of sustained depressive moods; 1 in 7 of obese young women and 1 in 14 of obese young men were affected by this type of mood disturbance.

Suicide. A self-inflicted death is a relatively objective statistic, but ideas of suicide are a little more difficult to quantitate; in general, obesity seems to contribute more to suicide ideation than to completed suicides. Although a systematic review of 15 prospective trials found a risk ratio of 1.50 for suicidal ideation in obese individuals (Amiri and Bhenezhad, 2018), on the other hand, a study from Germany found that the number of actual suicides was lower among the obese than in the general population (Klinitzke et al., 2012). A review by Pereira et al. (2016), likewise, found an inverse association between obesity and completed suicides.

A study from Minneapolis examined 4742 boys and 5201 girls in grades 7, 9 and 11; it noted that relative to those with a normal body mass, obese girls were 1.73 times more likely to have contemplated suicide in the past year; obese boys also faced social problems, but this did not lead to any significant increase in suicidal thoughts (Falkner et al., 2001). Likewise, in Norway, suicidal thoughts were more common in girls than

Table 14: Longitudinal studies examining the impact of obesity upon the risk of depression.

Author	Sample	Definition of obesity	Findings
Al Mamum et al. (2007)	1802 14yr old Australians, 7 yr follow up	Perceived overweight	Higher D scores as adults if perceived overweight
Anderson et al. (2007)	776 children, initially aged 9-18 yr, followed 20 yr	BMI >95th percentile	Hazard ratio 3.9 in females, 1.5 (ns) in males
Boutelle et al. (2010)	496 adolescent girls followed for 3 yr	BMI >95th percentile	Obesity predicts future depressive symptoms but not clinical depression in women
Frisco et al. (2013)	5243 US female adolescents, aged 13-18 yr, 6-7 yr follow-up	International guidelines of obesity for adolescents	Not overweight to becoming obese, odds ratio for developing depression 2.26
Hasler et al. (2004)	20 yr follow-up of 591 young adults	BMI >25 kg/m^2	Odds ratio of being or developing overweight 2.10
Herva et al. (2006)	8451 adolescents, 17 yr follow-up	BMI >95th percentile	Odds ratio of Hopkins D score >2 in past week: Men 1.97 Women 1.55
Mustillo et al. (2003)	991 children, 9-16 yr old. 8 yr follow-up	>95th percentile of norms for children	Chronic obesity associated with depressive disorders in boys only
Roberts et al. (2000)	2298 adults aged >50 yr, 1yr follow-up	BMI>85th percentile	Odds ratio of >5 depressive symptoms on DSN-12D 1.73
Roberts et al. (2002)	1739 adults aged >50 yr 5 year follow-up	BMI > 30 kg/m^2	Odds ratio of >5 depressive symptoms on DSN-12D 1.48
Roberts et al. (2003)	1886 adults aged >50 yr 5 year follow-up	BMI > 30 kg/m^2	Odds ratio of >5 depressive symptoms on Prime MD list 1.79
Sanchez-Villegas et al. (2013)	91,798 females, followed from age 10 yr for 12 yr	Silhouette assessment of body shape	Odds ratio for prevalence of obesity 2.59

in boys, and were significantly associated with being overweight at ages 13-15 years; baseline anxiety and/or depression gave the heavier students an adjusted odds ratio of 1.9 for developing suicidal thoughts (Strandheim et al., 2014).

An analysis of data from the US Youth Risk Surveillance System (1999-2007)(Dave and Rashad, 2009) once again found that the influence of body mass upon thoughts of suicide was greater in girls than in boys; In girls, it raised suicide ideation by 6.1%, suicide attempts by 3.6%, and serious suicide attempts by 0.5%. Another analysis of data from the 2007 Youth Risk Behavior Survey (Swahn et al., 2009) showed that after adjusting for appropriate co-variates, both perceived (odds ratio 1.45) and actual overweight (odds ratio 1.31) were associated with an increased risk of suicide attempts by students in grades 9-12.

Particularly in boys, the risk of suicide may be increased if they are significantly underweight. Thus, findings in 338 undergraduates (Zuriomskiet al., 2017) pointed to a U-shaped relationship

between suicide attempts and BMI, with increased risks at BMI levels <18.5 and >28.0 kg/m^2.

Issues facing obese adults in daily life

The adult who is obese faces many practical problems in daily life, ranging from an appropriate choice of clothing to lack of adapted seating on public transport, inadequate access to public facilities and problems when trying to participate in sports. All of these hassles reduce the quality of life relative to a person of normal body mass.

Choice of clothing. Both men and women who are overweight tend to be embarrassed when they visit a clothing store, and they often experience difficulty in finding garments that will fit them. The few stores that retail extra-large sizes of clothing often charge premium prices for their products, although they usually argue that this is warranted because they must use greater quantities of fabric, and extra time is taken by seamstresses when introducing special shaping, and adding darts and pleats. The clothing that is available in large sizes also tends to be unattractive (Rutherford-Black et al., 2000). Particularly for women, the choice of outerwear is limited to a few basic styles that seek to conceal the obesity. The purchase of clothing suitable for sport or swimming is generally avoided, because of embarrassment at the required exposure of obese skin surfaces (Reddy-Bestand and Hammon, 2015). A final clothing-related issue is that some companies require an employee to wear a company uniform, and this may not be available in a size that an obese person can wear.

There has been a recent trend to the introduction of plus-sized fashion models and larger sizes of attractive clothing, but some scientists and sociologists have criticized this initiative on the grounds that it "normalizes" obesity and may possibly contribute to the growing percentage of adults who are failing to perceive that their weight is excessive (Muttarak, 2018).

Problems encountered when traveling. As detailed in an earlier review in this series (Shephard, 2019), the obese traveler faces a number of embarrassing constraints, whether their journey is made by car, bus or by plane.

Private cars. Added body weight increases the petrol consumption of private cars, causing about a 2% decrease in efficiency for every additional 50 kg that is carried (Jacobson and McLay, 2006; Li et al., 2011). Weekly fuel consumption is further increased by the tendency of the obese to use a car for short trips that could be covered on foot or by bicycle (Jacobson et al., 2011). Vehicle seats also may not be of adequate size for an obese individual, and seat belts may pull the body into dangerous positions. Rear-seat passengers, in particular, are at greater risk of injury than those with a normal BMI (Reed et al., 2013; Wang et al., 2015). On the other hand, in some types of crash, additional body fat may reduce the risk of pelvic fractures (Bansalet al., 2009).

Aircraft. In long-distance aircraft, the seat belts may be of insufficient length to accommodate an obese person, and their body width may not fit between the standard armrest separation of 17-19 inches; thus, the airline must either give the passenger a second seat or require him or her to buy one. In small aircraft, seats may arbitrarily be reassigned for a heavy person in order to balance load

distribution within the aircraft, and flight reservations may need to be cancelled entirely because permitted load factors are exceeded. When calculating the allowable number of passengers per aircraft, Transport Canada currently assumes respective body weights for male and female travelers of 200 and 165 lbs in summer months, and 206 and 171 lbs in the winter.

Any adverse effect from a reduction of aircraft seating capacity is compounded by the effects of the added weight of obese clients upon a plane's fuel consumption. Each gallon of aviation fuel enables an average aircraft to carry 7.3 tons of passengers over 1 cargo-mile. Thus, the increased prevalence of obesity of the U.S. population between the years 1990 and 2000 increased the annual fuel costs of U.S. airlines by 2.4% (Dannenberg et al. 2004).

The mechanical strength of passenger seats in the event of a crash is a further concern. Aircraft seats are currently designed to withstand a force of 14 g when carrying a person who weighs 170 pounds, but will offer proportionately less protection to a person who has a greater weight than this standard.

Problems when using public facilities. Obese people face many of the issues noted for aircraft and car travel when using other public facilities. Theatres, restaurants and cabs offer seats that are too narrow, and possibly of insufficient strength, and there is likely to be inadequate space in revolving doors, public toilets and the aisles of planes, trains and stores. Sometimes, the practical difficulties that are experienced by the obese have led to the filing of formal law-suits under the "Americans with disabilities" act of 1990 (O'Hara, 1996). Such actions have met with a degree of success in terms of employment, but they have been less effective in extending the range of public accommodations.

A point of continued discussion in such cases is whether obesity should indeed be considered as a disability. However, there seems increasing public support, at least in the U.S., for legislation to eliminate discrimination against those who are obese (Puhl et al., 2016).

Problems in sports participation. An obese person is unlikely to be picked by a coach as a member of a sports team, and the increased mechanical costs of physical activity plus a poor thermal tolerance (Shephard, 2018) also discourage an obese person from participating in most forms of personal physical activity. Negative motivation is further enhanced by an unwillingness to display a bloated in figure in scanty sports clothing or swimwear. In consequence, the obese individual loses both the companionship often found in sports teams and the enjoyment of physical activity in the open air and countryside.

The impact of weight stigmatization in limiting physical activity seems a more potent force in women than in men (Sattler et al., 2018). Negative vibes are received from peers, family, the general public and health and fitness professionals (Robertson and Vohora, 2008; Schwartz et al., 2003). Fitness professionals tend to brand obese individuals as lazy, particularly if they themselves have never experienced any problem with weight control (Robertson and Vohora, 2008). Their implicit bias is well-documented (Chamblis et al., 2004; Dimmock et al., 2009 ; Fontana et al., 2013; O'Brien et al., 2007). Dimmock et al. (2009) demonstrated the "anti-fat" responses of fitness professionals both to

"neutral" pictures of fat silhouettes and to pictures of fat people exercising on a treadmill; nevertheless, they found no evidence of an explicit bias. Another study of personal trainers in Iowa also detected an implicit bias, but again did not see any differences in the amount or type of advice that was explicitly offered to obese and slim clients (Fontana et al., 2018).

Medical discrimination against the obese. Surgeons are often very reluctant to operate upon those who are grossly obese, because of the increased risk of the operation itself and of post-operative complications. However, antipathy to the obese seems widespread throughout the medical profession.

A survey of some 620 American primary care physicians (Foster et al., 2003) discovered that they shared many of the stereotypes of obesity that were current in the general population. They regarded such patients as weak-willed and lazy, with many other negative characteristics (Table 15). Moreover, they rated obesity as more difficult to treat than most of the other medical problems that they dealt with. However, the conclusions from this survey were weakened by a low response rate.

In Texas, a study based on the responses of 122 physicians (Hebl and Xu, 2001), likewise, found that while doctors would order more laboratory tests for obese patients than for normal weight patients, they would also spend significantly less time with them in the consulting room, and viewed them more negatively on 12 of 13 indices. Further, these negative attitudes engendered expectations of poor treatment that led to a mistrust of doctors, an avoidance of necessary care, and poor adherence to prescribed treatments (Phelan et al., 2015). Schwarz et al. (2003) commented that these negative attitudes extended even to doctors specializing in the treatment of obesity, as well as research workers and students in the exercise sciences (Chamblis et al., 2004; Puhlet al., 2015).

One objective measure of differences in the treatment offered to obese patients is seen in the odds ratio for having received a mammography within the past 2 years; use of this diagnostic procedure was substantially reduced in obesity (respective odds ratios Class I obesity, 0.93, Class II obesity, 0.90, and Class III obesity 0.79)(Marutheret al., 2009).

Reduced employment prospects of the obese individual. Before World War II, it was common practice for unemployed labourers to stand before dock and factory gates, waiting to be hired, and if any of them happened to be fat, their

Table 15: Characteristics of obese individuals, as perceived by 620 American primary care physicians (mean scores and percentages of ratings 5-7 on a 1-7 Likert scale). Based on data of Foster et al. (2003).

Patient characteristic	Mean evaluation of obese patients	Percent of obese patients rated as 5-7
Awkward (graceful)	4.8	61.7
Unattractive (attractive)	4.7	53.2
Ugly (handsome)	4.6	49.5
Non-compliant (compliant)	4.6	50.8
Weak-willed (strong willed)	4.5	41.0
Lazy (industrious)	4.2	29.7
Sloppy (neat)	4.2	34.7
Unpleasant (pleasant)	3.4	9.0
Dishonest (honest)	3.4	3.4

chances of finding employment were slim. In Canada and the U.S., such discrimination has now, in theory, been corrected by Human Rights legislation, with establishment of the Equal Employment Opportunities Commission in the U.S. and the Human Rights Commission in Canada (Shephard, 2018b); legally, exceptions are only allowed where a particular level of physique and physical fitness is a bona-fide occupational requirement (Gumieniak et al., 2011). However, this requirement is not easy to enforce, and in practice there remains good evidence that job prospects are still much better for the slim worker than for someone who is obese, with a resulting loss of human capital. Those who are markedly obese generally continue to make less than their full potential contribution to society. It has thus been argued that there is a need to strengthen legislation against weight-based discrimination in terms of recruitment, wages, continued employment and other working conditions (Schallenkamp, et al., 2012).

Recruitment. Handicaps of an obese person during a job interview commonly include a lower sense of self-esteem and a lower level of educational attainment (Geier et al., 2007; Gortmaker et al., 1993; Kaestner et al., 2009; Sabia, 2007). Obese men had poorer school attendance records, and more commonly had dropped out of school than their peers of normal body weight. Likewise, relative to their normal weight peers, women who were obese had completed 0.3 fewer years of schooling; had lower household incomes, and were more likely to be living below the poverty line.

Empirical data demonstrates bias irrespective of either the type of job (for example, contact with the public as a sales representative or office work as a data analyst) or the sex and personality characteristics of the rater (Table 16)(Pingitore et al., 1994).

Problems at recruitment are particularly severe for women seeking work as fitness professionals (Table 17), with well-qualified individuals being

Table 16. Evidence of a weight bias at the time of employee recruitment, as seen in the interview ratings for jobs as a sales person or data analyst, as reached by raters with differing personal characteristics (based on data of Pingifore et al. 1994).

Type of Job	Men		Women	
	Normal weight	Overweight	Normal weight	Overweight
		Female raters		
Low schema	78.8	78.5	88.6	71.9
Sales person	89.9	73.4	90.3	79.7
Data analyst				
High schema				
Sales person	90.8	70.6	88.2	73.6
Data analyst	86.1	78.3	94.2	75.1
		Male raters		
Low schema				
Sales person	89.0	73.3	80.0	74.7
Data analyst	89.2	66.3	83.8	84.2
High schema				
Sales Person	83.6	84.0	82.3	77.7
Data analyst	92.4	85.4	84.7	72.8

Table 17: Influence of being overweight on the probability of being hired as a female fitness instructor. (Based on the data of Sartore and Cunningham, 2007).

Body build	Level of qualification	Overall rating	Person-job fit	Hiring recommendation
Thin	Qualified	5.1	5.8	5.7
Overweight	Qualified	3.6	3.4	3.1
Thin	Not qualified	4.6	3.8	3.7
Overweight	Not qualified	3.6	2.2	2.4

rejected relative to those with similar or lesser levels of qualification because they are overweight (Sartore and Cunningham, 2007).

Wage differentials. It might be anticipated that the obese would fare less well than their normal weight peers in terms of the wages that they earn, but some studies of this question have used only the BMI as their marker of obesity, and unfortunately this index confounds the favourable attribute of muscularity with the potentially negative attributes of obesity (Johansson et al., 2009; Kinge, 2017). In some physically demanding occupations, additional muscle can increase earning capacity, whereas an excess body fat has a tendency to decrease it (Wada and Tekin, 2010). A further consideration is an attractive personal appearance; a study by Caliendo and Gehrsitz (2016) suggested that the main impact of appearance was upon the income of women in white-collar employment.

Johansson et al. (2009) used the more reliable measure of waist circumference to define the impact of obesity upon the wage-earning capacity of Finnish workers. They found that using this criterion, obese men were at a 5.5% disadvantage relative to their peers of normal weight. If BMI was used as the criterion, overweight women were still at a 4.7% disadvantage, but heavier men actually reaped a wage premium of 5%. Most published reports have shown some negative impact of obesity, but the relative effects on male and female employees have been quite variable. Bozoyan and Wolbring (2011) estimated that a 10 kg increase of body fat content was associated with an annual wage loss of 1498 Euros in women, and 1037 Euros in men. Greve (2008) found in a study of 8000 Danes that whereas there was no significant effect of body mass on the salaries earned in public sector jobs, in the private sector (where measures against discrimination are probably less effective), salaries tended to an inverted U-shaped relationship with body mass in men, and in women a 22 kg greater than normal body mass was associated with a 4.4% lower salary. LaRose et al. (2016) observed a rather similar differential in Canada; obese women showed handicaps of 4% in hourly wage rates and 4.5% in annual income, whereas men showed a statistically non-significant negative effect of 2%. Another report from Canada found no such penalty in women, but in men, a 1-unit increase of BMI was associated with an 0.7% reduction in wages (Chu and Ohinmaa, 2016). In the United States, the effect was larger, with Cawley (2004) reporting that a 9% wage disadvantage was associated with 30 kg of body fat in "white" females (the equivalent, in

economic terms) of 1.5 years of additional education, or 3 more years of work experience. A second report from the U.S. found no effect in men, but as little as a 1-unit increase of BMI in women was associated with a 1.8% penalty in hourly wages (Han et al., 2009, 2011). Finally, Swedish data suggested an obesity penalty of at least 6% in men, but no significant effect in women (Dackehag et al., 2015).

Continued employment. Morris (2007) found a significant negative effect of obesity upon the likelihood of continued employment in British middle aged men and women, and Lindeboom et al. (2010), also working with British data, reported a similar trend. In any given year, obese British adults were 4-6% less likely to be employed than their peers of normal body mass (Kinge, 2017).

Other handicaps. The obese person is likely to be assigned to less pleasant tasks than a worker of normal body build, to receive fewer opportunities for promotion, to be the subject of more disciplinary actions and to have a greater likelihood of being fired if there is a contraction of the labour force (Randle et al., 2012). The obese person is also several percent more likely to face premature retirement and/or extended disability than the average worker (Renna and Thakur, 2010).

Secular changes in the nature and physical demands of work. A further issue, yet to be explored, is how far the status of an obese person in the labour market is being modified in the face of secular trends in the structure of work such as automation and robotics.

Reverse causality. As in a number of other aspects of obesity, there is finally a need to consider the issue of reverse causality. A meta-analysis of 21 studies from the U.S., Canada and the U.K. (Koim and von dem Knesebeck, 2018) found some evidence that a low income was associated with the subsequent development of obesity (odds ratio 1.27), although in their analysis the ratio was no longer statistically significant after allowing for a possible publication bias.

Marital prospects of the obese

Although a substantial body fat content was viewed as an indicator of health, economic success and sexual potency in some traditional societies (McGarvey, 1991), in modern North America, obesity is seen as reducing marital prospects, particularly for women. Extreme slenderness is regarded as the key to successful romantic relationships (Averett et al., 2008; Paxton et al., 2005), and there is a surprising consistency of the weight standards judged as needed to achieve physical attractiveness across modern cultures (Buss, 1998). Women themselves describe excess body weight as a barrier to physical and emotional intimacy (Williams and Merten, 2013). There are some confounding influences influencing analysis of amorous relationships, particularly the trend for those in the marriage market to watch their weight very carefully, and the influence of a stable marriage upon eating habits; in particular, some studies have shown that married men are fatter than those who are unmarried (Sobal et al., 1992). Nevertheless, an excess body mass can also reduce the marital prospects of unmarried men. Thus, a Swedish study of 486,559 men found that the odds of an obese man of being married at the age of 40 years was only 0.49 relative to a man of normal body mass.

Extreme obesity finally has a negative effect upon sexual performance, with repercussions for the individual's mood state and quality of life (Laumann et al., 1999).

Obesity and Quality of Life

Obesity was not always the subject of social scorn. Indeed, in Neolithic times, a rotund figure was considered a sign of prosperity (Shephard, 2018b). However, Christianity pronounced that gluttony was a sin (O'Hara, 1996). Some of Renaissance society still looked favourably upon those who were overweight, but in the Victorian and Modern eras, a condemnation of excess weight reappeared (Shephard, 2018b). The end result of a combination of adverse social attitudes and the many practical hassles faced by an obese person in daily life is a generally acknowledged reduction in their quality of life, with the magnitude of this effect being dependent upon the degree of obesity (Table 18), along with personal perceptions of body build (Latner et al., 2014), levels of physical and muscular fitness (Morales et al., 2011) and the age of the individual (Sirtori et al., 2012). Information on relationships between the extent of obesity and the overall quality of life is limited, but the impact upon the health-related quality of life has received more substantial documentation (Fontaine and Barofsky, 2001), using a variety of measures such as the HRQOL and SF-36 instruments (Kolotkin et al., 2001). However, the quality of life is likely adversely affected in a broad range of domains, including physical ability, self-esteem, sexual life, and function in public life and the work-place (Kolotkin et al., 2001); presumably, a wide-ranging quality of life assessment would indicate a larger impairment in the quality of life than that detected by a unique focus upon health-related problems.

Unfortunately, the adverse effects of obesity upon the quality of life have been increasing in recent years; Jia and Lubetkin (2010) estimated that whereas in 1999, obesity accounted for 0.020 of all losses of quality-adjusted life years (7.5 days per year), this loss had risen to 0.046 by 2008 (17.2 days per year, or 2.8 years over a 60 year life span). Incidentally, the more recent figure exceeds the loss of quality-adjusted life-years attributable to cigarette smoking. Moreover, the number of quality-adjusted life years lost is strongly and inversely correlated with the extent of leisure-time physical activity (Jia and Lubetkin, 2010a). The impact of obesity upon the quality of life also seems greatest for those in the lowest economic strata of society, probably reflecting the difficulties that they find in compensating (for instance, by greater use of a personal car for travel) and also their more limited access to treatment for secondary health problems (Klinge and Morris, 2010).

There is plainly a need to control for the effect of co-morbidities and other co-variates when assessing the impact of obesity on the quality of life, but even after doing so Busutil et al. (2017) found a strong residual effect on the health-related quality of life in Spanish adults. Specifically, obese study participants had increased odds of reporting problems of mobility (11.8%), difficulties in self-care (2.2%), restriction of usual activities (4.3%) and pain/discomfort (7.4%). In all, quality of life (on a 0-100 scale) was reduced by 2 points with moderate obesity, and 4 points with severe obesity. The impact was greater in women than in men, and was particularly noticeable in those who were 65 years and older. Vasijevic et al. (2008) evaluated 2826 Belgrade adults using the SF-36 scale; in

Table 18: Studies examining relationship between obesity and quality of life.

Author	Sample	Methodology	Findings
Busutil et al. (2017)	18,682 Spanish adults	Euroqol 5D 5L questionnaire, BMI	Score on analogue scale reduced by 2/100 points (moderate obesity) or 4/100 points (severe obesity) after controlling for co-morbidities
Castres et al. (2010)	69 French adults	SF-36, BMI	Obesity associated with impairment of physical aspects of SF-36, effects increasing with severity of obesity
Döring et al. (2015)	31,182 Swedish adults	Euroqol 5D, BMI	Scores reduced by 1.9/100 (overweight), 3.9/100 (obese); wt gain over 8-year follow-up further worsened scores
Janicke et al. (2007)`	96 overweight adolescents	Pediatric QOL inventory, BMI	Parent distress and peer victimization influence deterioration in QOL
Jia & Lubetkin (2005)	13,646 U.S. adults	PCS-12, MCS-12, EQ 5D, EQ VAS, BMI	Scores 4.0. 1.0, 0.073 and 4.8 points lower in severe obesity
Keating et al. (2011)	2890 Australian youth aged 14.6 yr	AQoL 6D, BMI	Overweight and obesity sacrifice 1.8%, 5.8% of healthy life years
Kortt & Dollery (2011)	18,411 Australian adults	SF-36 converted to health utility score, , BMI	Cross-sectional data show negative effects of obesity on utility scores (0.019 in men, 0.034 in women); not seen in longitudinal data, reasons unclear
Pimenta et al. (2015)	60 Brazilian adults	WHOQOL, BMI	Overweight associated with overall reduction in QOL, & in physical, psychol, social and envir. domains
Pratt et al. (2013)	112 U.S. youth	PEDS QL4.0, BMI	Reduction of BMI, gain of quality of life over weight-reduction programme
Swallen et al. (2005)	4287 U.S. Youth	Self-reported gen. health, phys. health, emotional health, school functioning	Odds ratio poor physical health 2.17 (overweight), 4.40 (obese), but effects on psychol. health & school function small
Vasijevic et al. (2008)	2826 Belgrade adults	SF-36, BMI	Obesity had greater impact of physical than on psychological health

their study, obesity had a greater impact upon the physical than on the psychological domains of the SF-36 scores. Castres et al. (2010) again demonstrated that in a small sample of French adults, obesity was associated with poor scores on the SF-36 test, affecting the physical, but not the mental components of this scale. Kortt and Dollery (2011) calculated health utility scores from SF-36 data in a sample of 18,411 Australian adults; they estimated from their cross-sectional data that obesity had a negative effect of 0.019 in the men, and 0.034 in women, but for reasons yet to be explained this effect was not seen in longitudinal data.

Döring et al. (2015) applied the Euroqol scale to their sample, finding immediate decreases in score of 1.9/100

from overweight and 3.9/100 from obesity; over an 8-year follow-up, further increases in weight were associated with a worsening of scores, although surprisingly a loss of weight over the 8 years did not correct initially poor scores. Again, adverse effects were concentrated on the dimensions of mobility, self-care, usual activities, and pain and discomfort.

Jia and Lubetkin (2005) looked at four measures of health-related quality of life (PCS-12, MCS-12, EQ 5D, and EQ VAS) in a sample of 13,646 U.S. adults. Scores on the four tests were respectively 4.0. 1.0, 0.073 and 4.8 points lower in those with severe obesity, and this disadvantage was seen even in those who were free of the chronic diseases that are commonly associated with obesity.

Are the results in children and adolescents similar? Keating et al. (2011) adopted a utility-based approach, finding that in Australian adolescents, the respective effects of being overweight and obese were the equivalent of sacrificing 1.8% and 5.8% of one's lifespan relative to someone in perfect health (or if equated over 60 years of subsequent life, a total of 1.1 and 3.4 quality-adjusted life years). Such estimates are of a similar order to the losses calculated by Jia and Lubetkin (2010) for adults. Although there is likely to be some increase in the adverse physical health-related effects of obesity as one becomes older, it is also possible that the psychological effects of obesity diminish in later life. In support of this view, Janicke et al. (2007) used a pediatric quality of life scale to examine the effects of being overweight in a sample of 96 adolescents aged 12.8 year; this study found that the impact of obesity was strongly influenced by psychological factors, particularly parental distress and peer victimization; typically, parents rated the child's quality of life more poorly than did the individual concerned. In contrast, Swallen et al. (2005) used 4 scales to examine the impact of overweight on the health-related quality of life a sample of 4287 U.S. youth. As in several of the adult studies already cited, they found that the main impact was upon physical health, with odds ratios for poor scores of 2.17 in those who were overweight and 4.40 in those who were obese. Excess weight was also associated with functional limitations, but obesity had little impact on depression, self-esteem and functioning in school except in the younger students (aged 12-14 years).

Pimenta et al. (2015) used the WHO Quality of Life test to examine the *global* quality of life in a small sample of Brazilian adults. In their study, an excessive body mass was associated with a poor quality of life that affected physical, psychological, social and environmental domains.

Pratt et al. (2013) examined the effects of a weight-reduction programme. In a small sample of U.S. youth, decreases of BMI were associated with increases in the quality of life as indicated by the PEDS QL4.0 scale.

Psychiatric problems in obese adults

Adults who are obese are susceptible to the same problems of anxiety, depression and suicide already discussed for obese children and adolescents. These issues are compounded by persistent negative social attitudes and stereotypes. Unfortunately, obesity seems to be the last acceptable target of discrimination (Puhl and Brownell, 2001) for many people.

As might be expected, the risk of psychiatric problems depends upon the severity of the obesity. Analysis of data from a national survey of alcohol and

related disorders for 41,654 Americans found that the multivariate-adjusted odds ratio for the lifetime development of various psychiatric disturbances was not greatly increased in those who were overweight, but it was significantly larger in those who were obese or morbidly obese (Table 19). A telephone survey of 217,379 adults aged 18-55+ years found a dose-response relationship between depression, values increasing from 6.5% of the sample in those with a BMI <25 kg/m^2 to 23.9% in those with a BMI > 35 kg/m^2. The authors of this report underlined that depression was also associated with low levels of moderate and vigorous physical activity, and a high reported daily energy intake.

The complicating issue of a post-hoc reduction of physical activity due to the

Table 19 : Odds ratio for the lifetime risk of developing various psychiatric conditions in relation to BMI. Based on the data of Petry et al.(2008), from the U.S.National Epidemiological Survey on Alcohol and Related Disorders.

Psychiatric condition	BMI 18.5-24.9 kg/m^2	BMI 25.0-29.9 kg/m^2	BMI 30.0-39.9 kg/m^2	BMI > 40 kg/m^2
Any type of mood disorder	1.00	1.06$^+$	1.56	2.00
Major depression	1.00	1.04$^+$	1.53	2.02
Dysthymia	1.00	1.11$^+$	1.81	1.94
Manic episode	1.00	1.15$^+$	1.55	2.70
Hypomanic episode	1.00	1.33	1.63	1.43
Any type of anxiety disorder	1.00	1.19	1.54	1.97
Any type ofpersonality disorder	1.00	1.09	1.46	1.95

$^+$ Not statistically significant *Odds ratios adjusted for age, sex, education, ethnicity, income, marital status, urban/rural and regional living.

obesity and both current depression and a lifetime history of depression or anxiety (Strine, et al., 2008). The adjusted odds ratios for the presence of obesity were 1.2 for those with lifetime anxiety, 1.6 for those with lifetime depression, and 1.6 for those with a combination of lifetime anxiety and depression. The corresponding adjusted odds ratios for a finding of physical inactivity were 1.0.1.3 and 1.3.

One study of 4641 women aged 40-65 years who were enrolled in a U.S. health insurance plan (Simon, Ludman, & Linde, 2008) found a particularly strong association between body mass and the prevalence of moderate to severe psychiatric disorder was avoided in a 3-decade prospective study of 544 mothers (Kasen et al., 2008). After adjusting for other risk factors, an initial BMI > 30 kg/m^2 at an average age of 27 years was associated with an increased risk of developing a general anxiety disorder (odds ratio 6.27), and a major depressive disorder (odds ratio 5.25). However, this study did not consider physical activity as a variable that could possibly have affected study outcomes.

Another prospective trial (Roberts et al., 2003) followed 2123 subjects aged > 50 years for 5 years. It found that obesity at baseline was associated with a subsequent risk of depression, even after

controlling for the initial mood state of participants and a wide array of co-variates (age, sex, education, marital status, financial status, recent financial strain, life events, social isolation and social support, but again omitting habitual physical activity). However, an initial state of depression did not lead to subsequent obesity in this trial.

A meta-analysis of 15 longitudinal studies covering 58,745 individuals (Luppino et al., 2010). It found that overweight was associated with an increased risk of subsequent depression (an unadjusted odds ratio of 1.27 for overweight, and of 1.55 for obesity). However, this report underlined that although obesity certainly predisposed to depression, depression also increased the risk of becoming obese. It thus remains unclear how far the observed relationships are causal and unidirectional. One important cofounding issue is that many of the anxiolytic and anti-depressant drugs that are in current use have weight gain as a significant side-effect. Social disapproval of those who are overweight may also cause or exacerbate mood disturbances (Petry et al., 2008), and both depression and anxiety may reduce habitual physical activity, which in turn can decrease arousal and lead to the development of obesity.

Discussion and Conclusions

When physicians discuss the negative effects of obesity, their focus is commonly upon the increased risk of developing a variety of chronic illnesses. However, this review highlights the fact that there are also a multitude of negative psycho-social consequences of obesity. The schoolchild faces issues of bullying, exclusion from sports teams, a poor self-image with a lack of self-confidence and poor achievements, hostile reactions from both peers and coaches, and poor academic results. Likewise, adults are confronted by many practical issues in their daily life, such as finding appropriate clothing, fitting into seats on aircraft, in cars and in public buildings, dealing with negative attitudes from colleagues, employers, and even physicians, and adapting to poor prospects in the labour and marriage markets.

Taken together, these adverse psycho-social factors lead to a substantial reduction in the individual's quality of life, irrespective of the effects from any co-morbidities. Those who are obese are thus prone to anxiety, depression and suicide attempts. If a grossly obese person experiences a 17 day loss of quality adjusted life for each of 60 years, as is suggested by the data of Jia and Lubetkin (2010), then this implies in total a 2.8 year decrease in quality-adjusted life expectancy, a greater adverse health impact than many of the chronic diseases that are precipitated by obesity, and indeed greater than that attributable to smoking. Jia and Lubetkin (2010) defined the loss of quality of life narrowly, as the sum of losses from morbidity and premature death, and values would presumably be substantially larger if account was also taken of the psycho-social disadvantages suffered by those who are obese. Plainly, there remains important need to address issues of obesity and inadequate physical activity in public health programmes. One study of adolescents demonstrated a similar large impact to that calculated by Jia and Lubetkin (2010); however, there remains a need to clarify how far the adverse health-related and psychosocial effects of obesity change over the life course.

To date, much of the published research on the psycho-social impact of obesity has been cross-sectional in type,

and where longitudinal studies have also been carried out, conclusions from the two data have not always agreed. There remains some uncertainty as to how far obesity has caused negative psycho-social consequences, and how far individuals have attempted to compensate for pre-existing psycho-social problems by over-eating and becoming obese. This issue needs to be resolved by well-designed longitudinal research. Almost without exception, the criterion of obesity used to date has been the body mass index, and there is a need for research that links negative consequences to more certain and direct indices of body fat content, where a well-developed musculature is not a confounding factor.

A further important question is how far many of the psycho-social problems currently faced by the obese could be resolved by educational and legislative measures aimed at eliminating body mass as a factor in discrimination. There is also a need for practical measures to improve the quality of life for those who are presently obese, irrespective of whether a correction of their obesity proves possible.

Finally, the potential to reduce or eliminate the psycho-social costs of obesity provides an important educational topic that fitness and health-care professionals can use when attempting to motivate those who are presently overweight or obese to engage in and complete weight reduction programmes.

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Author's qualifications

The author's qualifications are as follows: Roy J. Shephard, C.M., Ph.D., M.B.B.S., M.D. [Lond.], D.P.E., LL.D., D.Sc., FACSM, FFIMS.

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