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Is Obesity a Chronic Disease?

Sarah Price and Joseph Proietto

There is disagreement about whether obesity should be considered a disease. Obesity is inconsistently referred to as a 'condition', a 'lifestyle disorder', a 'risk factor for disease', and even a 'disease' itself. These descriptions appear in both the popular press and scholarly articles and likely reflect the diverse and often conflicting views about obesity.

The World Health Organization (WHO) does consider obesity a serious problem. In a report published in 2000, the WHO said obesity is 'now so common that it is replacing the more traditional public health concerns, including under-nutrition and infectious disease, as one of the most significant contributors to ill health.' In June 2013, the American Medical Association (AMA) formally classified obesity as a disease — this was the first country in the world to do so.

The Australian government recognises that overweight and obesity are associated with several chronic disease states. It even considers obesity one of Australia's leading health concerns. But it currently stops short of labelling obesity a disease.

In order to determine if obesity is a chronic disease, we need to examine a definition of 'disease'. We then need to systematically assess the evidence about obesity, and determine if obesity does or does not fit this definition.

The *Merriam-Webster Medical Dictionary* defines a disease as:

> An impairment of the normal state of the living animal or plant body or one of its parts that interrupts or modifies the performance of the vital functions, is typically manifested by distinguishing signs and symptoms, and is a response to environmental factors, to specific infective agents, to inherent (genetic) defects of the organism or to combinations of these factors.

Does obesity fit this definition of a disease?

Let's take the first part of the definition — 'An impairment of the normal state of the living animal … that interrupts or modifies the performance of vital functions'.

Obesity is responsible for around 8% of the total burden of disease in Australia. In a non-smoking adult population, obesity is responsible for 7.1 years of lost life in men and 5.8 years in women, when compared to normal weight counterparts.[1] No organ in the body is spared from damage caused by excess fat.

Type 2 diabetes

Obesity is the main driver for the current epidemic of Type 2 diabetes (T2D). As weight increases, there is increasing insulin resistance.[2] This means that the pancreas has to make more insulin in order to maintain normal blood glucose levels. Fat tissue not only increases the demand for insulin, it also secretes toxins that cause the insulin secreting beta-cells to fail.[3] T2D can occur at any BMI, but there is a sharp increase in risk of T2D when BMI exceeds 30 kg/m2.[4]

Lifestyle interventions have an impact on the likelihood of the development of T2D. A 5% loss of body weight in those with impaired glucose tolerance reduces fasting and post-meal glucose readings and reduces the risk of development of T2D by 58%.[5] In those with pre-existing T2D, a 2.5–5.0 kg weight loss will result in a reduction in HbA1c of 0.5%, regardless of the method of weight loss.[6]

Cardiovascular disease

Even in the absence of additional risk factors, obese individuals are at increased risk of cardiovascular disease. Obese persons are six times more likely to have high blood pressure than lean individuals.[7] Increased blood pressure increases the risk of stroke and ischemic heart disease. Ischemic heart disease and stroke risk is also increased by the altered lipid profile (high triglyceride, low HDL) and the pro-inflammatory state seen in obesity.

There is strong evidence that prolonged moderate weight loss of 5–10% has a beneficial effect on cardiovascular status, even if the person remains in the overweight or obese BMI range. Lifestyle interventions resulting in weight loss of approximately 5 kg is associated with a reduction in systolic blood pressure (5.1 mmHg) and diastolic blood pressure (2.4 mmHg).[8] Greater weight losses can result in greater improvements in blood pressure. Lifestyle interventions have a variable effect on lipids, but large reductions in body weight, such as achieved after bariatric surgery, are associated with resolution of hyperlipidemia in a significant proportion of individuals.[9]

Sleep

Obstructive sleep apnea (OSA) is characterised by repetitive pauses in breathing during sleep due to obstruction in the upper airway. In adults, OSA is seen in around 40% of obese subjects and around 70% of the morbidly obese.[10] Weight loss assists in the management of OSA and related symptoms such as daytime sleepiness. This, in turn, has a positive impact on mood and wellbeing.[11]

Joint disease

Obesity puts additional strain on weight-bearing joints, particularly the hips, knees and lower back. This increases the rate of joint degeneration and frequently results in osteoarthritis. This is not purely a mechanical issue. Increasing evidence suggests that the inflammatory effects of obesity increase the rate of joint deterioration.[12] The knee joints are the joints most commonly affected by

obesity, with a 4–5 times increase in the rate of osteoarthritis. Weight loss of around 6 kg is associated with a reduction in knee pain. The benefits of weight loss are maximised by muscle strengthening exercise.[13]

Cancer

Excess body weight is an important risk factor in some cancers. The World Cancer Research Fund and American Institute for Cancer Research state that there is convincing evidence that overweight/obesity is a risk factor for colorectal, pancreatic, postmenopausal breast, endometrial, kidney (renal cell) and esophageal cancer. There is probable evidence for gall bladder and premenopausal breast cancers.[14] Further, observational data suggests that obesity is an independent prognostic factor for cancer recurrence. It is currently uncertain if weight loss reduces the risk of these malignancies.

Reproduction

Infertility currently affects one in seven couples. Obesity is thought to play a role in around 50% of these cases.[15] If assisted reproductive technology such as IVF is required, high BMI is associated with a lower success rate.[16] And even if pregnancy is achieved, obese women have a higher rate of complications during pregnancy. These complications affect both mother (gestational diabetes, gestational hypertension/pre-eclampsia, requirement for a caesarean delivery delivery) and baby (large for gestational age baby, preterm delivery, birth trauma).[17]

Liver

Fat infiltration in the liver, secondary to excess fat around the abdomen will cause, in a susceptible subset of obese individuals, non-alcoholic steatohepatitis (NASH), which in a further subset can lead to cirrhosis of the liver and, in some, hepatocellular carcinoma. The prevalence of obesity is now so high that the most common cause of liver cirrhosis is no longer alcohol or viral hepatitis but obesity.[18]

Mood

There is an association between body weight and mental health disorders. Obese individuals are more likely to have depression and/or anxiety, and the prevalence of these disorders increases as BMI increases. Weight loss is associated with varying impacts on mood disorders, self-esteem and quality of life. Interestingly, some studies suggest that lifestyle changes result in improved mood and quality of life even if no weight is lost.[19] This is particularly the case in adolescents and older adults.

It can be concluded that obesity fits the first part of this definition of disease.

The second part of the definition is: 'typically manifested by distinguishing signs and symptoms'

WHO describes obesity as 'abnormal or excessive fat accumulation that presents a risk to the individual's health.' It is defined on the basis of body mass index (BMI). This is calculated as a person's weight (in kilograms) divided by height (in metres, squared). A BMI of 20–25 kg/m^2 is defined as the normal for an adult. A BMI of 25–30 kg/m^2 is defined as overweight and a BMI of $>30kg/m^2$ is defined as obese.[20]

However, the BMI is only one of many methods used to describe the amount of fat mass a person has in proportion to total body mass. Hip and waist circumference is a useful method of describing body fat distribution. This is significant as body fat around the waist includes visceral fat, which is strongly associated with metabolic abnormalities such as high cholesterol, high blood pressure and type 2 diabetes. Body fat around the hips and thighs is subcutaneous fat, which is less strongly associated with these metabolic disturbances.[21]

Obesity can also be defined by the percentage of body fat for a certain weight. Around 18–24% body fat is regarded as normal for men whereas around 25–31% is described as normal in women.[22] This method is useful for determining the contribution

of fat and muscle to body weight. For example, an elite sportsperson may have a high BMI but a very low percentage of body fat. This is because they have more lean tissue such as muscle.

All of these measurements can be adjusted for the age, gender and ethnicity of the individual. While each individual measure of obesity is crude, a combination of several body composition methodologies allows a relatively accurate assessment of excessive fat mass. Excess body fat mass is the 'distinguishing sign' that defines obesity.

The final component of the definition of obesity is: 'and is a response to environmental factors, to specific infective agents, to inherent (genetic) defects of the organism or to combinations of these factors'

While often labelled a lifestyle disease, obesity in fact results from a complex interplay between genetics and the environment. The evidence that obesity has a genetic basis is overwhelming. There is a high intra-pair correlation of body weight (0.7) in identical twins irrespective of whether they are reared together or reared apart.[23] If a group of identical twins are overfed for a period of time, some gain weight and some do not; however, the twin pairs track together.[24] Adults who have been adopted in early childhood have a strong correlation of body weight to their biological mother ($p < .0001$) and their biological father ($p < .02$). In contrast, there is no correlation in body weight with the adoptive parents who fed them.[25]

The body has a powerful negative feedback system to prevent excessive weight gain. The most powerful inhibitor of hunger, the hormone leptin, is made in fat! Thus, a period of increased energy intake results in excess fat deposition, which will result in increased leptin production, leptin suppresses hunger and increases energy expenditure. This slows down weight gain. Thus, poor lifestyle alone can cause a 6–7 kg weight gain only. To become obese, it is necessary to have some genetic difference that makes the individual resistant to the action of leptin.

It has only been over the past two decades that a number of the genes associated with obesity have been described. Rare cases of leptin deficiency or of mutations in the leptin receptor[26,27] illustrate the impact of reduced leptin action. The most common genetic defect in European populations so far described, leading to severe obesity, is in mutations in the melanocortin 4 receptor (MCR4). This defect can explain severe obesity in approximately 6–7% of cases.[28] Other genes have been discovered that can cause milder increases in weight; for example, variants of just one gene (FTO) can explain up to 3 kg of weight variation between individuals.[29] Small variations in weight due to variations in single genes, over a large number of genes, can explain significant weight variation between individuals.

It is important to recognise that genes do not directly cause weight gain. Rather, genes influence hunger and satiety. In an environment with either poor access to food or access to only low calorie food, obesity may not develop even in persons with a genetic predisposition. However, when there is an abundance of food and a sedentary lifestyle, greater hunger and reduced satiety allows a greater intake of food. This permits the development of obesity.

More than 90% of the population is genetically predisposed to obesity.[30] Since the 1980s, there has been a rapid rise in the prevalence of obesity. This cannot be explained by classical genetics alone. Genes do not mutate at such a rapid rate. There is increasing evidence that the development of obesity may also be influenced by epigenetic changes that occur in early life. This refers to factors in the external environment that turn genes 'on' or 'off' rather than changing the sequence of the genes. It is likely that these changes to the genes occur primarily during pregnancy or the first few years of life and then become fixed. For example, if a mother is malnourished during early pregnancy this results in changes to the genes involved in the set points for hunger and

satiety for the developing child. These changes may then become fixed, resulting in a tendency to obesity in the offspring.[31]

Obesity is caused by genetic predisposition in the context of an obesogenic environment.

Obesity meets each of the three main points in the definition of a 'disease'. We must therefore conclude that obesity is a disease.

Why is obesity a *chronic* disease?

To understand why obesity is a chronic disease it is necessary to understand the regulation of body weight. Weight is regulated in the hypothalamus, a 'primitive' part of the brain situated on the undersurface in the mid line. The arcuate nucleus, a small group of nerves within the hypothalamus, contains two classes of nerves. One type of nerves (NPY or AgRP) cause hunger when activated, while the other type of nerves (POMC) take hunger away. These nerves project their signals to other areas of the brain and are in turn regulated by circulating hormones. There are at least ten circulating hormones that modulate hunger. Of these, only one has been confirmed as a hunger inducing hormone (ghrelin) and it is made and released by the stomach. In contrast, nine hormones suppress hunger, including CCK, PYY, GLP-1, oxyntomodulin and uroguanylin from the small bowel, leptin from fat cells, and insulin, amylin and pancreatic polypeptide from the pancreas.[32]

After weight loss, regardless of the method of weight loss, there are changes in circulating hormones involved in the regulation of body weight. Ghrelin levels increase[33] and levels of multiple appetite suppressing hormones decrease.[34,35] There is also a subjective increase in appetite. It has been shown that even after three years, these hormonal changes persist.[36,37] This explains why there is a high rate of weight regain after diet-induced weight loss.

Given that the physiological responses to weight loss predispose to weight regain, obesity must be considered a chronic disease. Data shows that those who successfully maintain weight after weight loss remain vigilant and constantly apply techniques

to oppose weight regain.[38] These techniques may involve strict diet and exercise practices and/or pharmacotherapy. Further research is needed to find weight maintenance techniques that are effective and well-tolerated.

Why is it important to define obesity as a disease?

There are several reasons why it is critical to recognise obesity as a disease:

1. We are wasting scarce resources attempting to stop the epidemic of obesity using techniques designed to change behaviour.
2. We are making no effort to fund treatment for obesity despite the ill-health it causes.
3. The obese continue to suffer discrimination and humiliation.

We are wasting scarce resources attempting to stop the epidemic with education

The prevalence of obesity and overweight among Australians has steadily increased over the past three decades. Currently around 25% of Australian adults and 7% of Australian children aged 5–12 years old are obese.[39]

There is an erroneous view that obesity is only the result of the recent increase in the availability of energy dense food and the advances in technology that have made obligatory physical activity a thing of the past. This thinking has led governments to believe that obesity is a lifestyle issue and that lifestyle change is all that is needed to correct the problem. In keeping with this idea, funds have been diverted into educational activities (for example, in Australia to the 'Life Be In It' and 'Swap It Don't Stop It' campaigns) and away from treatment of the obese. These campaigns actually reinforce the stigma associated with being obese.

In recent years, there has been increased focus on obesity in the state and federal government health policies. This included

establishing obesity as one of its national health priority areas. Australian government funding has been directed towards social marketing campaigns that target improved lifestyle. The 'Measure Up' campaign ran between 2008 and 2010. It aimed to highlight the link between waist circumference and chronic diseases such as type 2 diabetes and heart disease. Between 2011 and 2013, the 'Swap It, Don't Stop It' campaign showed people how to make small lifestyle changes to improve health. The current campaign called 'Shape Up Australia' is an initiative through which the government partners with organisations that support healthy lifestyle choices.

Evaluation of the effectiveness of these programs is ongoing. However, it is interesting to note that during the 'Life Be In It' campaign, obesity prevalence increased from 7.1% in 1980 to 18.4 % in 2000. Similarly, the Minnesota Heart Study showed that 13 years of intense education made no difference to the rate of increase in obesity.[40] Education alone clearly does not work; nonetheless, the health authorities keep trying.

We are making no effort to fund treatment for obesity, despite the ill-health it causes

Obesity is considered a major driver of illness, being responsible for 8% of the total burden of disease and injury in Australia.[41] As a consequence, obesity consumes a huge proportion of the health-care budget. Access Economics data from 2008 shows that the direct health system cost of obesity was over $2 billion per annum. Other direct costs include carer costs and loss of productivity costs. The total direct costs of obesity are $8.3 billion per annum. However, the cost of a loss of wellbeing is estimated at over $49.9 billion per annum. The total combined cost of obesity in Australia is $58 billion per annum.[42]

Despite this, very few resources have been committed to the treatment of obesity. Although we have local management pathways for weight management, these are not taken up broadly

due to the costs involved. In Australia, most bariatric surgery is performed in the private sector, with very little undertaken in public hospitals. This occurs despite the fact that obesity prevalence is highest in low socio-economic areas that are primarily served by the public health system. Government funding for other forms of obesity treatments are similarly limited.

Obesity needs to be considered 'core business' for health systems. We need more medical professionals focused on obesity management and better training of these people. People who lose weight, even if not sustained, have an improved cardiovascular risk profile compared with those who never lose weight.[43] Obesity management requires a chronic care approach. This requires adequate management pathways, specialised services and adequate allied health support.

The obese continue to suffer discrimination and humiliation

Lastly, we must consider the very human element of obesity. The common perception of obesity as a personal problem or the result of poor lifestyle habits results in discrimination and humiliation. This is particularly true in young people who internalise the stigma associated with obesity. Available research shows that weight stigma is consistently associated with medication non-adherence, mental health, anxiety, perceived stress, antisocial behaviour, substance use and poor coping strategies.[44] The decision to define obesity as a disease may drive a change in public perception about obesity.

Conclusion

Throughout history there have been many phenomena whose causes have appeared to be self-evident, but were in fact wrong. The view that obesity is a 'lifestyle disorder' may appear self-evident, but it is wrong. Scientific evidence tells us that obesity has a genetic basis, it has distinguishing symptoms and signs, and it undoubtedly impairs normal functioning. Obesity entirely meets the definition of a disease. This is important for practical reasons: in today's world of modern medicine, we have unprecedented ability to develop

effective interventions for both management and prevention of obesity. Defining obesity as a disease is the first step in this process.

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