Obesity and the Longevity Myth

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Abstract

There is a general view that the so-called ‘obesity epidemic’ may dampen the long-term impacts of increasing life expectancy. This paper demonstrates that conclusions based on an individual’s body mass index alone risks missing some of the more subtle health issues relevant to public policy debates and projections of mortality and morbidity.

It is clear that morbidly obese people suffer worse health and mortality outcomes than normal weight people. There is however, evidence that the mortality impact of weight follows a U-shaped curve, i.e. mortality is higher for underweight and normal weight people than people who are classified as marginally overweight. As weight increases, there is a significant increase in mortality. There is also evidence that, for some medical conditions, being overweight or obese reduces mortality. Physical activity is also a very important predictor of mortality and may actually be a superior predictor of mortality than the individual’s body mass index. This paper collects the results of various recent research reports that have analysed the impact of obesity on mortality and morbidity. The paper will conclude with a discussion of public policy issues raised by challenging the generally held view that being overweight is bad.

Keywords: Obesity, Longevity, Lifestyle, Mortality, Morbidity, Life expectancy, exercise.

Executive Summary

There has been much recent publicity about the so-called ‘obesity epidemic’. The message we hear is generally that the fatter we are the worse are the health outcomes. Measures of obesity attempt to measure body fat. All measures of body fat have their drawbacks. This paper refers primarily to the Body Mass Index (BMI). The BMI index is the person’s weight in Kilograms divided by the square of their height in metres. The various BMI categories are arbitrary based on relative levels of BMI of a population between 1971 to 1974. Whilst the measure has a number of biases it is considered the most robust measure and there is significant available data categorised by BMI.

The proportion of Australians overweight or obese by the BMI measure has increased from around 35% in 1990 to around 63% in 2012 and there is little prospect that this trend will reverse. Suggestions are that 90% of humans are predisposed i.e. genetically, to being obese (Obesity Australia 2014). The ready availability of high calorie processed foods and our sedentary lifestyle has meant that obesity is becoming the norm.

There does appear to be a link between increasing mortality and obesity. At high levels of obesity there appears to be a significant deterioration in life expectancy and health. There are however no clear conclusions as to cause and effect of potential worse health outcomes. In fact, recent research is indicating that people
Obesity and the Longevity Myth

who are marginally overweight have better health outcomes than normal or underweight people. Further, being overweight or obese tends to improve medical outcomes for some conditions.

A recent US study concluded that (National Research Council 2011):

- Being in the overweight category [ie the BMI overweight category as compared to the obese categories] does not increase mortality risk
- Each increase of 5 units of BMI above 30 increases the mortality by 30%
- BMI has its largest risk for adults under age 50 and decreases for each year after age 50
- Older adults are at greater risk of dying if they are at the extreme of BMI scales

The difficulty in drawing too many conclusions from aggregate data is that there is significant underlying heterogeneity in the data between BMI categories. The following list illustrates some other underlying factors that may be confounding the conclusions. Some of these factors do have statistical foundations but others are surmised to demonstrate the potential broad range of influences that could exist.

- People in last stages of cancer or generally in poor health do also tend to be underweight.
- People of normal weight may participate in higher risk pursuits than overweight or obese people for example cycling, open water swimming, motorsports or other high performing athletes who may take higher risks than the population average.
- Overweight or obese old people are more likely to be the survivors of overweight and obese younger people; there is therefore a survival bias.
- Overweight people who are very sick or have accidents may have more body reserves to survive trauma.

An important conclusion from the research is that the level of physical activity of a person seems to be a very good predictor of life expectancy, potentially a better predictor than BMI.

Public policy needs to be informed by the facts. For anybody interested in attempting to predict mortality or morbidity it is clear that BMI may not be an effective rating factor other than at the extremes. Further, in developing public policy initiatives to tackle the so called ‘obesity epidemic’ the focus may be best placed on preventing obesity at younger ages, whilst promoting increased physical activity at all ages.

**Introduction**

A new term has recently entered our vernacular, ‘the obesity epidemic’. The popular press have been sensationalising the impact of this so-called epidemic and there are many talking heads from various health organisations stressing that obesity is the single largest health risk for Australians.
They are correct, but the story is more complicated than it may appear in the headlines. This paper will investigate the impact of obesity on mortality and, to a lesser extent, morbidity.

First, to the major claims being made. The following are a list of claims made in a recent Four Corners program on obesity. As stated on the ABC web site, Four Corners “is Australia’s premier television current affairs program”.

We i.e. Australia are a “nation of fatties” we are “fighting the battle of the bulge” “exercise alone won’t win the war” “30 years ago just over 30% of Australians were overweight or obese, it is now 2/3rds” “we are supposed to be living longer, some health experts predict that we may see younger generations dying younger than their parents for the first time in human history” “overweight or obese people are wiping up to 6 years off their lives”.

“Obesity is the leading cause of preventative death and disability in the country and in the world” and “poor diet kills far more people in Australia than smoking does”

There is still significant debate as to the description of obesity and the so-called ‘epidemic’. In their report No Time To Weight, Obesity Australia is calling for the various medical colleges to formally recognise obesity as a disease as this is essential to “reducing the stigma around obesity and... key to increasing community engagement in practices and policies that reduce obesity rates” (Obesity Australia 2014 page 5). There is also significant debate around the measures and categorisation of obesity and what is considered as ‘overweight’. The next section discusses the definition of obesity.

It is generally accepted that obesity is a health issue. There is significant evidence that will be discussed in this report that obese people suffer worse health outcomes than non-obese people. There is however conflicting evidence about the impact that being overweight has on longevity. It appears as though being overweight has different implications for mortality and morbidity depending on, amongst other things, age, ethnicity and the individual’s level of fitness.

This paper will touch briefly on the public policy issues related to obesity. Public policy needs to be informed by the facts and hence it is important to understand the implications of more people becoming overweight or obese. These implications may affect the person i.e. lower life expectancies, or they could affect the community generally i.e. less productive workforce or increasing health costs. In the case of obesity, there has been a call from various health groups including Obesity Australia for the regulation of fast or junk foods. The Four Corners program referenced above highlighted that “there is a barrage of advertising for heavily processed food targeting younger people including through social media”. “The average supermarket has around 30,000 different foods. Where the intake of vegetables has dropped by 39% in the past 10 years junk food consumption has gone up by many hundred percent”. There has been resistance by Governments generally to introduce regulation on the food industry. Tony Abbott, as health Minister, said in 2005, “this government won’t regulate what people put in their
mammals” (Four Comers). The argument made on Four Comers is that human genetics and the current abundance of processed food mean that people will continue to eat too much unless there are restrictions placed on what can be promoted. The Obesity Australia report claims, “up to 90% of the population [are] predisposed genetically to overweight/obesity”.

**What is Obesity?**

Measures of obesity are effectively measures of body fat. There has developed a relatively robust and broadly accepted measure for obesity, the Body Mass Index (BMI). The BMI is defined as the person’s weight in Kilograms divided by the square of their height in metres.

The following table sets out the precise definitions

<table>
<thead>
<tr>
<th>BMI</th>
<th>Weight Status</th>
<th>More generally known as</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 18.5</td>
<td>Underweight</td>
<td></td>
</tr>
<tr>
<td>18.5 – 24.9</td>
<td>Normal</td>
<td></td>
</tr>
<tr>
<td>25 – 29.9</td>
<td>Overweight</td>
<td>Overweight</td>
</tr>
<tr>
<td>30 – 34.9</td>
<td>Obese class I</td>
<td>Obese</td>
</tr>
<tr>
<td>35 – 40</td>
<td>Obese class II</td>
<td>Obese</td>
</tr>
<tr>
<td>Above 40</td>
<td>Extremely Obese i.e. Class III</td>
<td>Extreme or morbidly obese</td>
</tr>
</tbody>
</table>

Note that the measures of obesity are relatively arbitrary. There is not a linear relationship based on kilos above normal weight.

Many studies simply refer to obese which is obese class I and II. Extreme or morbidly obese are also classified as obesity class III. In the following, when reference is made to ‘overweight’ it is specifically to the above-mentioned BMI definition, i.e. overweight does not mean obese. The following sets out an illustration of the various weight categories (BMI Calculator 2015).
There are weaknesses in the BMI index. The index was originally calculated from analysis of Caucasians “as a way of accentuating the contribution of fat to weight in the numerator” (Wahlqvist 2012 page 471) and the bands were calculated by proportions of the population in the various categories between 1971 and 1974. Since its original formulation the BMI has been used across a broader range of ethnicities and ages. It has been discovered that the BMI does not recognise second order influences on mortality and morbidity contributed by, amongst other things, age and ethnicity. In addition, it is evident that an individual’s BMI may have various causes for example, poor diet, no exercise, genetics, illness etc. Further, people who are particularly muscular may have a high BMI but have low body fat. There is also evidence that there are different types of fat, some more beneficial than others (National Research Council 2011).

Other potential measures of fat are waist to hip ratio (WHR ratio) or a direct measure of the percentage of fat in the body.

Notwithstanding some of the difficulties, this paper will use BMI as the primary measure of obesity level. There is significantly more data available scaled on BMI and the underlying heterogeneity that exists in the BMI exists to a similar extent in the WHR ratio and fat percentage measures.

**The Obesity Epidemic**

There has been a significant increase in the average BMI of Australians in line with a global increase. The following chart shows actual and projected increases in the proportion of people who are overweight and obese by country (Obesity Australia 2014 page 7).

![Chart showing increasing proportions of overweight and obese people by country](chart.png)

The following chart shows the changing proportions of Australian children who are overweight and obese (Obesity Australia 2014 page 8).
It is claimed in the Obesity Australia report (Obesity Australia 2014 page 13) that a driver of the increase in obesity is the interplay between genetics and the environment. The claim is that genetically, 90% of people are predisposed to be overweight or obese. A combination of our genetics, our current sedentary lifestyles and easy access to calorie dense and processed foods has driven more people to be obese.

**Obesity and longevity**

The comments made on the Four Corners program highlighted above give the impression that there is a direct correlation between increases in BMI and increases in mortality. In fact, the actual impacts of weight on mortality are complex and sometimes counter intuitive.

This paper focuses primarily on the impact that weight has on longevity. Weight also has an impact on health and health costs and these impacts will be mentioned but not discussed in detail.

The Obesity Journal published an article in February 2010 looked at years of lost life (YLLs) associated with overweight and obesity. This study grouped the numbers by age, gender, race, and smoking status. The authors concluded, “being overweight does not increase mortality risk and sometimes decreases it, although the effect usually is not statistically significant either way. The excess mortality risk is noticeable for Class 1 obesity and rises sharply as BMI increases” (Finkelstein 2010).

The National Research Council (US) Panel on Understanding Divergent Trends in Longevity in High-Income Countries undertook an analysis in 2011 to investigate if the increasing obesity rates in the US relative to the rest of the world explained why the US had been falling in the world rankings for level of life expectancy. The study noted that increasing average weight of a population tended to lead to negative health consequences for example, diabetes, heart disease, high blood pressure and certain types of cancer.
Obesity and the Longevity Myth

After reviewing the research, the study concluded that (National Research Council 2011):

- Being in the overweight category does not increase mortality risk
- Each increase of 5 units of BMI above 30 increases the mortality by 30%
- BMI has its largest risk for adults under age 50 and decreases for each year after age 50
- Older adults are at greater risk of dying if they are at the extreme of BMI scales

There are limitations in the analysis of mortality and BMI. For example, at older ages BMI is not necessarily as good a measure of fat content of a body than at younger ages. Older adults are more likely to have suffered from diseases that may affect body fat or muscle proportions in different ways. In addition, obese older adults will be the survivors of obese younger adults. There will therefore be a survival bias in the resulting mortalities.

The study also indicates “that U.S. life expectancy at age 50 in 2006 was reduced by 1.28 years for women and by 1.61 years for men as a result of obesity”. Interestingly there is also evidence that mortality risk from obesity is declining in the US potentially from improvements in the treatment of some obesity related diseases.

The study concludes, “differences in the prevalence of obesity continue to explain about 20–35 percent of the shortfall in U.S. life expectancy relative to countries with superior levels”.

A difficulty in analysing the impact of obesity on mortality is that obesity itself does not cause death; it is diseases associated with obesity that affect health and mortality. A recent study focused on those people who died of Obesity Related Disease (ORD) (Chang 2013). The study is based on a sample that contained 61,873 individuals, representing a population of 93,853,798 U.S. non-smoking adults. Among the sample, 38% were male, 75% were white, and 16% were black. Almost 80% of the sample had a high school degree. 4,017 deaths were identified.

The study concluded that “adults who belonged to overweight and class I obese classifications had lower mortality rates, [i.e. from ORD’s] while adults who belonged to underweight, class II and III obese classifications had higher mortality rates than normal-weight people, other things being equal”.

Looking at ORD’s only, the study concludes that mortality exhibits a U shape with the lowest mortality rate in the overweight category.

Further the “study suggests that the ORDs included … – coronary heart disease, hypertension, diabetes, and stroke – increased chances of dying and decreased life years by 0.2 to 11.7 years depending on gender, race, BMI classification, and age.
The life years lost associated with ORDs was more pronounced for younger, black, male, and more obese adults than for older, white, female, and less obese adults.

The following chart shows the patterns of life lost associated with obesity related diseases. These are for people at least overweight i.e. excludes normal weight and underweight classifications.

In interpreting this chart, it is important to recognize that normal and underweight people also suffer from ORD’s and hence they have life years lost from ORD’s. As will be discussed below, life years lost from ORD’s for some ages can be higher for underweight and normal weight people than for overweight people.

The following chart shows years of life lost from ORD’s based on age for the population surveyed. The 95% confidence intervals are shown.
The following chart shows the hazard ratios for each BMI category. These are based on 'normal weight' classification. To illustrate, overweight people have a 90% lower mortality from ORD’s than normal weight people.

![Chart showing hazard ratios for BMI categories]

Whilst the focus of this paper is on the impact of obesity on life expectancy, there are also health issues associated with obesity. A recent study in the Asia Pacific Journal of Clinical Nutrition indicated that there is a strong link between obesity and disability for example joint disease, mental health, learning and back ailments (Wahlqvist 2012). The study noted that there are indications of a vicious cycle of obesity and disability from early life. As the obese person ages they are more likely than non-obese people to suffer from obesity-related health problems, for example, diabetes and cardiovascular and respiratory disease.

Whilst the research discussed above shows a U shaped relationship between BMI and mortality there is clear evidence that health expenditure increases on either side of normal BMI range (Wahlqvist 2013 page 472). In the aged, it appears as though medical expenditure increases with increasing BMI, even though there may be little adverse association with mortality (Wahlqvist 2013 page 472). In effect, increasing BMI in the aged requires higher medical costs to achieve the same mortality outcomes.

**Explanations of the obesity paradox.**

This section investigates possible explanations for the apparent obesity paradox. This section considers three potential explanations, namely

1. Weaknesses in the BMI measure.
2. Potential protective aspects of obesity.
3. Physical activity as the mortality predictor rather than BMI.

**Weaknesses in the BMI measure**
Studies that have identified the so-called obesity paradox have attempted to provide an explanation. It is clear that the heterogeneity of deaths by BMI depending on age, ethnicity, gender and lifestyle overlay the impact of pure obesity related deaths. In particular, “[t]he obesity paradox may be partly explained by the lack of the discriminatory power of BMI to differentiate between lean body mass and fat mass” (Hainer 2013). Further, “many obese patients demonstrate not only increased fat mass but also increased muscle mass. Elderly patients with heart failure, who exhibited high BMI and had improved survival, had a better nutritional status than those with lower BMI. BMI and triceps skinfold thickness did not predict mortality, while a larger mid-arm muscle area, as a protective factor, did” (Hainer 2013).

Whilst there are shortfalls in the BMI, it also needs to be recognised the analysis discussed above indicates that the obesity paradox also seems to exist if other measures of obesity are used for example Waste to Height measures. Further, studies that have only reviewed ORDs also confirm the existence of the obesity paradox. On balance, therefore the BMI is still considered as an efficient measure of obesity across a population. However, the relationship between BMI and mortality may vary depending on the sample examined and how other variables are taken into account.

Smoking is an example of another health behaviour that is related to obesity. It is usually related to lower weight, and giving up smoking can produce weight gain. The study notes that “[o]besity has a greater effect on years of life lost for men than for women and for whites than for blacks, and its effects are similar for smokers and non-smokers, with smoking adding greatly to the mortality risk for all groups” (National Research Council 2011).

**Potential protective aspects of obesity**

There is evidence that the human body does tend to change levels of various chemicals in response to the individuals weight and that some of these changes in obese people may improve mortality. Whilst there is extensive medical research in this area, there are no clear indicators or generalised conclusions that can be drawn. It appears as though there are many specific medical conditions where survival may be positively impacted in people who are overweight or obese. The following illustrate some specific studies into mortality and weight correlations.

A recent study undertaken in Australia and published in the journal Intensive Care Medicine (Al-Soufi 2013) investigated the association between body weight and hospital mortality of adult patients supported with veno-venous extracorporeal membrane oxygenation (VV ECMO is the provision of support to patients whose heart and lungs are not functioning and hence assistance is required to oxygenate
the blood). The study concluded, “[u]nivariate analysis identified increased body weight to be associated with a reduced risk of death”.

Further “[d]espite the fact that obesity is recognized as a major risk factor in the development of cardiovascular diseases and diabetes, a higher BMI may be associated with a lower mortality and a better outcome in several chronic diseases and health circumstances” (Hainer 2013). The study also concluded, “patients with a body weight in the highest quartile showed a trend toward a reduced adjusted risk of death when compared with those who had a body weight in the lowest quartile”. It was noted that BMI could not be calculated in this study so it is not possible to scale the results and compare with other studies. The study did however refer to other studies that confirmed that overweight and obese critically ill patients exhibited the same or even lower mortality than normal or underweight patients.

To illustrate, there is evidence from people with diabetes that there are pollutants retained in fat tissues that provide protection to obese people that may not be provided to lean people (Wahlqvist 2013 page 472).

A study published by the American Diabetes association in 2013 identifies situations where being overweight or obese reduces mortality, in particular “[d]uring the past decade, there is increasing evidence that patients, especially elderly, with several chronic diseases and elevated BMI may demonstrate lower all-cause and cardiovascular mortality compared with patients of normal weight” (Hainer 2013).

Amongst subsets of the population and medical conditions, obesity seems to provide some protective effects. “Investigations carried out in patients with chronic heart failure show a paradoxical decrease in mortality in those with higher BMI” (Hainer 2013). Further, the study goes on to highlight that there are many other chronic diseases that appear to benefit from the protective effects of overweight and obesity. These diseases include stroke, postoperative complications, in hospital mortality in the intensive care unit.

In cardiac failure, the obese may have more cardiac muscle reserve. In the case of diabetes, fat-soluble pollutants, like certain endocrine disrupters, may be retained in fat tissue and, therefore, be less harmful than in lean individuals (Wahlqvist 2013 page 472).

**Physical activity as the mortality predictor rather than BMI**

It has been mentioned above that exercise and obesity have independent impacts on mortality. The high correlation between reduced physical activity and BMI may in fact be a partial explanation for increasing mortality at high BMI. In effect, exercise may be the key predictor of longevity rather than BMI.

The study investigating the divergent levels of longevity in high-income countries concluded, “[e]mpirically, obese people maintain, on average, lower levels of physical activity” (National Research Council 2011). The study further notes that
Obesity and physical activity have independent effects on mortality. This independence implies that many conclusions about the impact on mortality of higher BMI may in fact just be conclusions about level of physical exercise. A person with a high BMI who is physically active may not exhibit the mortality implicit in some of the investigations linking obesity with mortality.

It has recently been reported that even a small amount of regular exercise can have a material impact on longevity.

The American Journal of Physical Exercise reported that “[t]he links between early death and physical inactivity were observed across all levels of overweight and obesity measures - both in terms of overall BMI and central or abdominal obesity”. The analysis found that even low levels of exercise, i.e. a 20-minute walk per day reduced their risk of early death by 16-30% (Ekelund 2015). This was a large longitudinal study of over 330,000 European men and women with a mean follow up time of over 12 years. The study claims that “[p]hysical inactivity may theoretically be responsible for twice as many total deaths as high BMI (>=30) in this population” (Ekelund 2015 page 6).

Public Policy

The increasing rates of obesity has implications for Federal budgets. Increasing obesity will lead to increasing health. Projecting the impact of obesity is however problematic because BMI or in fact any obesity measure, does not reliably predict relative mortality other than at the extremes.

Part of the public policy problem is that people appear to have adapted their view as to what is normal. Many may consider the BMI definition of overweight now as being normal. Therefore, it is dangerous to conclude that being overweight is not unhealthy when people attribute being overweight with a BMI measure of class II or III obesity. There are also scenarios where increasing BMI may not have an impact on total population life expectancy but will impact materially on health costs. Insurers would be particularly interested in developing rating factors that more accurately predict health and longevity implications of lifestyle and weight.

I will not discuss the broader public policy issue of how people should be expected to take control of their own health outcomes. The anti-smoking campaign seems to have effectively reduced smoking rates. It is not clear what sort of campaign needs to be mounted for people to be made aware of the health impacts of obesity.

It appears as though level of physical activity may have a material impact on mortality. The public policy focus may therefore need to be on promoting physical activity as the primary cause of reduced life span rather than indirectly through issues around diet and lifestyle factors that lead to higher BMI.

Also, it has been shown that, as would be expected, that it is more important to focus efforts on reducing obesity in younger people because it is here where obesity related deaths have the greatest impact.
References


Four Corners. Aired ABC 24 18 October 2014


Obesity Australia. (2014) No Time to Weight http://www.obesityaustralia.org/resources-1/no-time-to-weight