Author’s response to reviews

Title: Morbid obesity in women on the rise: an observational, population-based study.

Authors:

   Julie A Pasco (juliep@barwonhealth.org.au)
   Sharon L Brennan (sharob@barwonhealth.org.au)
   Mark A Kotowicz (markk@barwonhealth.org.au)

Version: 2 Date: 21 February 2013

Author’s response to reviews: see over
21 February, 2013

Dear Mr Silvestre

Re: 1476564654852480


Thank you for the opportunity to submit a revised manuscript. All of the reviewers' comments have been addressed, as detailed in the response to reviewers (overleaf), and we believe the manuscript has improved, as a result.

We hope the revised version will be acceptable for publication.

Regards

Julie Pasco

Corresponding author
Response to reviewers

Referee 1 - Stephanie Tanamas

This study examined the trend in morbid obesity over time and the results suggest that the prevalence of morbid obesity is increasing. This was an interesting paper about a subject that is at present quite topical. The authors have done a good job at presenting and discussing the findings of the paper in a clear manner.

Major revisions: none

Minor revisions: the year of publication for reference 6 appears incorrect. Also the authors should include the full reference for the paper.

Response: Done. Please note that reference 6 is now reference 4.

Referee 2 - David Faeh

I commend you for your effort but have the following concerns:

Major Compulsory Revisions

1. The paper lacks of consistency. E.g., some results are only given in the abstract but not in the table or are not given at all.

Response: Mean BMI values for each time period, as reported in the abstract and results section, are the age-adjusted geometric mean values; the BMI values listed in Table 1 refer to the raw (unadjusted) data. To avoid confusion the raw BMI values have been removed from Table 1.

2. The conclusions drawn by the authors are not supported by the results. Results on mean BMI are only given in the abstract, the table in contrast shows only median BMI with IQR. There is no information on statistical tests used to assess differences in BMI categories. The obtained figures are thus largely over-interpreted. The authors could use logistic regression to examine variation between the two measurement points. This would also allow adjustment for confounders such as education or nationality. A plot of the two BMI distributions could also be helpful.

Response: As stated in response (1) above, mean BMI values reported in the abstract and results section, are the age-adjusted geometric mean values whereas the BMI values listed in Table 1 refer to the raw (unadjusted) data. To avoid confusion the raw BMI values have been removed from the Table. Thank you for suggesting that we use logistic regression to examine the variation between the two measurement points. This has now been included. The
regression model has been adjusted for age and socio-economic status; no further adjustments have been made for individual measures, such as education. All of the participants are Australian as that was one of the inclusion criteria, so nationality has not been included in the models. To accommodate addition of the logistic regression model, the text has been amended as follows:

Methods (statistical analysis) p8 now reads: Differences in the likelihood of morbid obesity during the two time periods were determined using logistic regression models. The outcome was morbid obesity and the exposure variable of interest was the period of assessment; models were adjusted for age and SES tested as a confounder. This method enables a comparison of the likelihood of morbid obesity between women of the same age and SES in the different time periods. In the statistical models, interaction terms were tested as effect modifiers and retained in the model if p<0.05.

Results p9 now reads: The odds for morbid obesity were 76% greater in 2004-8 compared to 1994-7 (OR = 1.76, 95%CI 1.12-2.78). This association was sustained after adjusting for SES (data not shown) and found to be consistent across SES categories.

3. Moreover it may be wrong to infer a trend based on only two measurement points. Would it be possible to add measurements before 1993 and/or after 2008?

Response: No data are available before 1993 (pre-recruitment) and full data sets after 2008 are not yet available.

4. Considering socioeconomic status is important. However, it is not clear why and how the authors come to the conclusion that increase has occurred in all SES strata.

Response: The interaction term SES*time period was not significant in the model, so the increase in mean BMI and the increase in the likelihood of morbid obesity was thus consistent across the SES strata. If the interaction term had been significant in the model, this would indicate that the relationship between BMI, or prevalence of morbid obesity, and time was non-uniform across SES strata.

5. There should be more information on the two populations, e.g. sampling procedure, distribution.

Response: The Commonwealth electoral roll was the sampling frame used for selecting the random sample of participants. The sample was stratified by age so that there were at least 100 in each age 5-year age group 20-69 years and 200 for ages 60-69 years and 80+. The text has been modified to include these details as follows:
At baseline, an age-stratified sample was recruited so that there were approximately 200 individuals were recruited for each 5-year age-group 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64 and 65-69 years, and approximately 200 individuals for each of the age groups 70-79 years and 80 years and older.

6. It is impossible to interpret the SMR. What was the endpoint? Which disease have been considered? Which were the SMR of the other BMI classes? What is the unit? Incidence? Per person years? If no further information can be provided, the SMR should be dropped because it is not in the focus of the paper, i.e. change in prevalence.

Response: The Standardised Morbidity Ratio (SMR) refers to the prevalence of morbid obesity at the later time period (2004-8) compared to the earlier time period (1993-7). This is an important finding in our study because it describes the increase in prevalence between the time periods and as the 95% confidence intervals do not embrace unity, it demonstrates that the SMR is significant (p<0.05). To clarify this, the text has been modified as follows:

Abstract (results) p2: During this period, the prevalence of morbid obesity increased from 2.5% to 4.2% and the standardised morbidity ratio for morbid obesity was 1.69 (95%CI 1.26-2.27).

- Minor Essential Revisions

The authors may be interested in the following publications


Response: Thank you for these suggestions. The first two suggested papers focus on excess weight and obesity but do not consider morbid obesity (class III obesity) and so have not been included in our manuscript. We have, however, cited the third publication in the text (citation 10) and the reference list altered accordingly. The text now reads:

Discussion p11: The strength of this study lies in the random nature of the study population and that the anthropometric measures used to calculate BMI were measured, rather than self-reported which would increase the potential for misclassification [9, 10].
Discretionary Revisions

Please use the term "normal weight" instead of "ideal weight". Normal weight may not be "ideal", e.g. in terms of mortality risk.

Response: “Ideal weight” has been replaced with “normal weight” throughout the manuscript, as suggested.

Referee 3 - Kathryn Backholer

This is a well written manuscript that examines the change in mean BMI and the prevalence of BMI categories over 10 years (1993-1997 – 2004-2008) in a population of adult women from the Geelong Osteoporosis Study. The question posed by the authors is well defined, however although the aim of the study is regarding morbid obesity, much of the introduction and the results are focused on the whole BMI spectrum. The methods and the data are sound and the limitations of the work are clearly identified in the discussion. I have the following comments that I hope will be of assistance to the authors:

Major Compulsory Revisions

• As stated above, the aim of the study is focused on how the prevalence of morbid obesity has changed over time, yet the introduction is generalised to all obesity and the results encompass the whole BMI spectrum. If the aim is indeed to examine morbid obesity, then the introduction could be tailored to focus on this, rather than the health and economic implications of obesity in general.

Response: The introduction (background) has been altered to focus on morbid obesity and now reads as follows:

The obesity epidemic in Australia is generally monitored by the proportion of the population whose body mass index (BMI) exceeds 30 kg/m² [1]. However, what is not as evident is the growing proportion of those who are morbidly obese. This issue is important as adverse health risks and healthcare expenditure amplify as the level of obesity increases [2]. Obesity-related health expenditure in Australia exceeded $8 billion in 2008, which included expenditure associated with metabolic disease, cardiac disease and surgical complications [3], but it is unclear how much of this expenditure related to different levels of obesity. Service providers are increasingly having to invest in equipment designed to accommodate the morbidly obese. It seems that both direct and indirect costs will amplify as the prevalence of morbid obesity increases.

In Australia, few, if any, studies have described the pattern of morbid obesity in the population. Thus, we aimed to document changes in the prevalence of morbid obesity (BMI>40.0kg/m²) that have occurred over a decade among women living in south-eastern Australia.

To accommodate these changes, the text has been modified in the opening sentence of the Abstract as follows:
Abstract (The obesity epidemic is generally monitored by the proportion of the population whose body mass index (BMI) exceeds 30 kg/m\(^2\) but this masks the growing proportion of those who are morbidly obese.

• Similarly, the authors test for an interaction between age and time period on change in BMI over time. They then conclude in their discussion that the results indicate that the increase in the proportion of morbid obesity was not restricted to particular ages or different SES groups... and that the study showed an increase in the prevalence of morbid obesity across the SES spectrum. However it is not clear to me where/how they have addressed these specific questions. The interactions tests show that the change in mean BMI over the two time periods did not differ across SES or age categories – it does not test how morbid obesity has changed over this time period across SES or age groups. With only 34 and 44 morbid obese individuals in 1993-7 and 2004-8 respectively it is very unlikely that there would be sufficient power to test this. However, the conclusions made should align with the statistical tests conducted and thus the results obtained.

Response: Thank you for these insightful comments. We have now included results derived from a logistical regression model with morbid obesity as the outcome and the time period as the exposure variable of interest; the age-adjusted odds for morbid obesity were 76% greater in 2004-8 compared to 1994-7 (OR = 1.76, 95%CI 1.12-2.78) and an age*time period interaction variable was not significant in the model. The association was sustained after further adjustment for SES, and an SES*time period interaction term was not significant in the model. We thus conclude that the increased likelihood of morbid obesity was consistent across for all ages and across SES strata. The text has been modified as follows:

Abstract (Results) p2: Increases in mean BMI and prevalence of obesity were observed for all ages and across the socioeconomic spectrum.

Abstract (Conclusions) p2: These findings reveal that over a decade, there has been an increase in mean BMI among women residing in south-eastern Australia, resulting in a measurable increase in the prevalence of morbid obesity.

Methods (Statistical analysis) p7: The variable of interest was the period of assessment (1993-7 or 2004-8) and the models were adjusted for age and SES tested as a potential confounder. Differences in the likelihood of morbid obesity during the two time periods were determined using logistic regression models. The outcome was morbid obesity and the exposure variable of interest was the period of assessment; models were adjusted for age and SES tested as a confounder. This method enables a comparison of the likelihood of morbid obesity between women of the same age and SES in the different time periods. In the statistical models, interaction terms were tested as effect modifiers and retained in the model if p<0.05.

Results p9: The odds for morbid obesity were 76% greater in 2004-8 compared to 1994-7 (OR = 1.76, 95%CI 1.12-2.78). This association was sustained after adjusting for SES (data not shown) and found to be consistent across SES categories.
Minor Essential Revisions

• Please define morbid obesity in the second sentence of the introduction.
Response: This comment is no longer applicable as the sentence has been removed.

• Reference 2 appears to relate to an article in The Age. Please provide reference to the actual ABS report here.
Response: This reference has now been removed.

• The terms moderate obesity (grade I), severe obesity (grade II) and morbid obesity (grade III) are used throughout. It may be simpler to just refer to grade/class I, II and III obesity. Morbid obesity (class III obesity) in adults can be defined as a BMI of equal to or greater than 40kg/m², or a BMI over 35kg/m² with obesity-related co-morbidities (Talbot et al, MJA, 2005). Simply using grades or classes of obesity would ensure clarity and consistency throughout. At times this is not clear - for example, in the discussion the authors discuss surgery and other gastrointestinal interventions for people with severe obesity - according to their definition this refers to only those with a BMI between 35-40kg/m².
Response: The terms moderate obesity (grade I) and severe obesity (grade II) have been replaced throughout the body of the text with class I and II obesity, respectively, as suggested. After defining morbid obesity as class II obesity in the methods, the term morbid obesity has been retained for ease of reading. With this revised terminology, reference to severe obesity in the discussion relating to surgery and other gastrointestinal interventions, has been retained (because the ambiguity has been removed).

The text in Methods (subjects) p6 and the Talbot reference introduced as citation 5 as follows: An adult with a BMI of 40.0 kg/m² or over is described as being morbidly obese (class III obesity) but the term can also refer to those who have a BMI over 35 kg/m² with obesity-related co-morbidities [5]. We identified morbid obesity using BMI criteria alone. Class II obesity corresponded to BMI 35.0-39.9 kg/m², class I obesity to BMI 30.0-34.9 kg/m², overweight to BMI 25.0-29.9 kg/m², normal weight to BMI 18.5-24.9 kg/m² and underweight to BMI <18.5 kg/m² [6].

• In the first sentence of the discussion it is stated that there has been a shift in the population distribution of BMI, with a mean increase of 4.2%... please clarify
– a mean increase in what?
Response: The first paragraph of the Discussion (p10) has been modified to clarify our meaning as follows:

We report that mean BMI has increased by 4.2% among women during the decade between 1993-7 and 2004-8. A comparison of the prevalence of morbid obesity in 2004-8 with 1993-7 generated a SMR for morbid obesity between 1.26 and 2.27, demonstrating a measurable increase over this ten year time period. Because of the approximate bell-shaped distribution of BMI in the population, a shift of the distribution to higher BMI resulted in a marked proportional increase in the prevalence of the more extreme BMI values. Disproportionate increases in the more extreme categories of BMI have been similarly reported for adults in the USA between 2000 and 2005.

• Please add axis titles on figure 1

Response: Done

Discretionary Revisions

• The authors conclude that because the increase in morbid obesity prevalence was same across SEP groups that population approaches to address the rising rates of obesity may be warranted. However, even if the prevalence of morbid obesity was increasing at a faster pace for the lower SES groups I would argue that a population-wide approach would still be the best option to address this. It is known that individuals from lower SES backgrounds, compared to those from higher SES backgrounds, are less likely to respond to interventions that require behaviour change. Population approaches that change the underlying conditions in which behaviours occur are more likely to affect individuals equally and thus are more likely to reduce the prevalence of obesity for all sub groups of the population, ensuring that inequalities do not widen further.

Response: Thank you for this helpful suggestion. We agree with your sentiment and have modified the text accordingly:

Discussion p10: It is plausible, however, that a larger sample size could show inequity in the rise of morbid obesity between SES groups. Either way, our data suggest that population-wide approaches that change the underlying conditions in which behaviours occur could be warranted to combat rising rates of morbid obesity for all sub-groups of the population.