Use of self-report to monitor overweight and obesity in populations: some issues for consideration

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Abstract
Objective: To examine the validity of self reported height and weight data reported over the telephone in the 1997 NSW Health Survey, and to determine its accuracy to monitor overweight and obesity in population surveys. Method: Self-reported and measured heights and weights were collected from 227 people living in Western Sydney, who had participated in the NSW Health Survey 1997. Results: Self-reported (SR) weights and heights led to misclassification of relative weight status. BMI, based on measured weights and heights, classified 62% of males and 47% of females as overweight or obese, compared with 39% and 32%, respectively, from self-report. Conclusions: Caution should be used when interpreting SR height and weight data from surveys, because BMI derived from these is likely to underestimate the true prevalence of overweight and obesity. Implications: SR data have a place in nutrition monitoring because they are relatively inexpensive and easy to collect. However, classifying people into weight categories on the basis of accepted cutpoints, using SR heights and weights, yields inaccurate prevalence estimates. Periodic sub-studies of the validity of SR heights and weights are needed to indicate the extent to which the validity of SR is changing.

Keywords
report, consideration, monitor, overweight, obesity, populations, self, issues

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Conclusions: Caution should be used when interpreting SR height and weight data from surveys, because BMI derived from these is likely to underestimate the true prevalence of overweight and obesity.

Implications: SR data have a place in nutrition monitoring because they are relatively inexpensive and easy to collect. However, classifying people into weight categories on the basis of accepted cut-points, using SR heights and weights, yields inaccurate prevalence estimates. Periodic sub-studies of the validity of SR heights and weights are needed to indicate the extent to which the validity of SR is changing.

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Overweight and obesity is a significant public health problem in Australia and regular monitoring is important to assess how the prevalence is changing in the population and vulnerable sub-groups, in order to monitor and target preventive intervention programs.

Obesity is often measured in population surveys as Body Mass Index (BMI) (weight (kg)/height (m)²), calculated from self-reported heights and weights. Self-reported (SR) data is less expensive and easier to collect than measured weights and heights, however the validity of self-reported heights and weights may vary with gender, age, height, weight and weight status. Knowledge of the nature and magnitude of reporting error associated with SR heights and weights will be useful in planning and interpreting surveys in which heights and weights are self-reported rather than measured.

A recent report assessed the accuracy of SR weight and height from the National Nutrition Survey (NNS) 1995. The investigators found that BMI, based on measured weights and heights, classified 64% of males and 47% of females as overweight or obese, compared with 52% and 36%, respectively, from self-report.

Another Australian study evaluated measures of self-reported weights and heights and their use in the determination of BMI in population surveys from data collected in the 1989 National Heart Foundation Risk Factor Prevalence Survey (NHF RFPS). The mean differences between SR and measured data reported in this study were small: height was over-estimated by men by an average of 1.1 cm, by women by an average of 0.5 cm; and weight was under-estimated by women by an average of 0.4 kg and by men by an average of 0.2 kg. Models for adjusting BMI calculated from SR data were derived to provide closer approximations to measured BMI, however these models may have little current applicability because the extent of under and over-reporting appears to be greater in more recent surveys.
Previous investigators have recommended that the validity of SR heights and weights be monitored by measuring heights and weights at regular intervals, since SR data may vary over time. It is also important to evaluate the accuracy of SR heights and weights for each mode of survey administration. It is likely that SR data from respondents who know they will have measured heights and weights taken will differ from SR data where there is no imminent collection of measured heights and weights (as occurred in the NHF RFPS). In addition, SR data from face-to-face interviews (the methodology used in the National Health Surveys) are likely to be different from telephone surveys or self-administered questionnaires where there is no expectation of assessment and where the participant can not be viewed by the interviewer.

The aim of this study was to assess the accuracy of SR weights and heights reported over the telephone in the 1997 NSW Health Survey.

Methods

Sample

The sample frame comprised the NSW Health Survey (NSW HS) Western Sydney Area Health Service (WSAHS) (n=972). All participants of the NSW HS WSAHS were asked if they were willing to be contacted for this study. Of these, 433 (43.5%) agreed to be contacted and 227 actually participated in this study (52% of those who agreed to participate).

Measurement

The NSW HS WSAHS was surveyed between September and October 1997. Participants of the NSW HS, were asked over the telephone “How tall are you without shoes?” and “How much do you weigh without clothes or shoes?”. Data collection for the validation study occurred between November 1997 and March 1998. Measurements were taken at community health centres nearest participants’ homes, using WHO protocols for measuring height and weight.

Data analysis

A deduction of 1kg was made to measured weight to account for light clothing worn by participants during weighing (since SR weight was without clothes). Waters used this correction in the validation study of the 1989 NHF RFPS. Reporting error was calculated as SR minus measured data. Over-reporting indicates that SR is greater than measured data. Under-reporting indicates that SR is less than measured data. The data were analysed using the SAS System for Windows version 6.12. Chi-square tests were used to compare categories. T-tests and one-way ANOVAs were used to compare reporting error between groups. The mean difference between SR and measured data and the 95% limits of agreement were used to determine the level of agreement between SR and measured data.

BMI cut-points used to determine relative weight categories were: underweight BMI<20, normal BMI 20-<25, overweight BMI 25-<30, and obese BMI ≥30. These cut-points are used in the National Nutrition Survey (NNS), except the lower cut-point of BMI 18.5-20 has not been included in normal weight in this study as the number of people with a BMI <18.5 was too small for meaningful analyses (n=5).

Results

Sample characteristics

Participants in the study consisted of 94 male and 133 female subjects aged 16-85 years, from Western Sydney. Characteristics of participants did not differ significantly from non-participants with regard to gender, employment status, and SR height, weight or BMI. Compared with non-participants, participants tended to be older (mean age 43 and 47 years, respectively), born in Australia, of English speaking background and had a higher educational attainment (p<0.05).

Height, weight and BMI differences

The mean differences between SR and measured weights and heights were relatively small (height in males 2.0 cm, in females 0.8 cm; weight in males –1.4 kg, in females –3.0 kg). However, the combined effect of over-reporting of height and under-reporting of weight on calculated BMI was substantial (see Table 1). Based on measured data, 62% of males and 47% of females were classified as overweight or obese, compared with 39% of males and 32% of females who were so classified from SR data.

Fewer than one-quarter of participants accurately reported their height to within 1 cm of their measured height. A greater proportion of males (64%) over-reported their heights compared with females (45%). Nearly 20% of males over-reported their heights by more than 5 cm. Older participants tended to over-report their heights to a greater extent than younger participants (for example, mean difference 65+ years 3.9cm; mean difference 25-34 years 0.1cm; p=0.0004), and shorter females tended to over-report their

| Table 1: Relative weight categories based on self-reported and measured heights and weights. |
|-----------------------------------------|-------------------------------|-------------------------------|-------------------------------|-----------------------------------------------------------------------|
| Relative weight category                | Self reported % (n) | Measured % (n) |
|                                        | Males | Females | Males | Females |
| Underweight (BMI<20)                    |       |         |       |         |
| Males                                   | 6 (6) | 14 (18) | 5 (5) | 7 (9)   |
| Females                                 | 14 (18)|         | 7 (9) |         |
| Normal weight (BMI 20–<25)              |       |         |       |         |
| Males                                   | 55 (52)| 54 (72)| 33 (31)| 46 (61)|
| Females                                 | 54 (72)|         | 46 (61)|         |
| Overweight (BMI 25–<30)                 |       |         |       |         |
| Males                                   | 28 (26)| 18 (24)| 47 (44)| 26 (35)|
| Females                                 | 18 (24)|         | 26 (35)|         |
| Obese (BMI ≥30)                         |       |         |       |         |
| Males                                   | 11 (10)| 14 (19)| 15 (14)| 21 (28)|
| Females                                 | 14 (19)|         | 21 (28)|         |
heights to a greater extent than taller females (mean difference for females ≤ median height 1.5 cm; females > median height 0.1 cm; \( p = 0.01 \)).

Fewer than a third of participants (29%) accurately reported their weights to within 1 kg of their measured weights. A greater proportion of females (29%) under-reported their weights by more than 5 kg compared with male participants (14%). Overweight and obese participants tended to under-report their weights to a greater extent than those of acceptable weight or underweight (\( p = 0.0001 \)). Heavier males and females tended to under-report their weights to a greater extent than lighter males and females (males ≤ median weight –0.1 kg, males > median weight –2.8 kg, \( p = 0.0031 \); females ≤ median weight –1.7 kg; females > median weight –4.5 kg, \( p = 0.0019 \)).

**Distribution graph**

As an alternative to categorical analysis, SR heights and weights can be examined as continuous data (see Figure 1). BMI based on SR weights and heights at the lower end of the distribution, more closely resembles the measured data (at the 5th percentile, SRBMI 19.5 and MBMI 19.7). The mean and median BMI values for SRBMI and measured BMI are also similar with only approximately one unit BMI difference (mean, SRBMI 25.0, MBMI 26.4; median, SRBMI 24.2, MBMI 25.3). However, as BMI increases, BMI based on SR data shows a greater difference from measured BMI (at the 95th percentile, SRBMI= 34.1, MBMI=36.2).

**Frequency of weighing**

At the time of measurement, participants were asked some additional questions in order to identify information that might lead to improved accuracy of data. Women who weighed themselves at least once a month (compared with a few times a year or less) had a smaller mean difference between SR and measured weight (frequent weighers –2.0 kg, not frequent weighers –4.4 kg, \( p = 0.014 \)). Among men, differences between frequent and non-frequent weighers were not statistically significant.

**Discussion**

**Response rate**

The response rate in this study was poor, with approximately half the possible participants lost at each stage. This is consistent with the poorer response rate of those willing to participate from the Western Sydney sample of the NSW Health Survey (45%) compared with other areas (e.g. 86% Southern AHS; 63% Greater Murray AHS). Other researchers have reported poorer survey participation rates in Western Sydney.¹³

Despite this, there were no significant differences between participants and non-participants for the main outcome variables of interest: self-reported height, weight and BMI calculated from SR data. It therefore seems likely that the results are at least representative of this area, if not representative of other similar low socio-economic areas of NSW.¹⁴ Unfortunately, since non-participants were not measured there is no information on their measured and SR differences.

**Comparability to recent national data**

The main finding of this study, that self-reported weights and heights lead to considerable misclassification of relative weight status, is consistent with recent results of the National Health Survey (NHS) and National Nutrition Survey (NNS).⁶ The proportion of people categorised as overweight or obese from measured data was similar between the two studies. Although misclassification of overweight and obesity from the SR data in the NHS was considerable, it was not as great as in this study (percentage misclassified in the NHS 19% and 23%, and in this study 37% and 32% for males and females, respectively). It is
possible that the greater error in self-reported data from this study reflects the mode of delivery of the SR question; this study asked for SR data using a telephone survey, whereas the NHS asked for SR data in a face-to-face interview.

**How should SR weights and heights be interpreted?**

Given the substantial degree of misclassification of weight categories associated with SR data, do SR questions for weight and height have any use at all, and are there any questions that can be used to improve the likelihood of a more accurate answer?

Monitoring the distribution of BMIs offers an alternative to the weight categories currently used. We have shown that higher BMI values from SR data have less accuracy, but the lower values and the mean and median are comparable to those obtained using measured data. Thus, continuous data may be useful for comparison of SR data over time.

This study also asked about respondents’ frequency of weighing themselves. Women who weighed themselves at least once a month were more likely to report their weight correctly than those who weighed themselves less frequently. It is recommended that future larger studies of SR and measured weights and heights include a question about frequency of weighing to assess the value of this question in distinguishing accurate responses. There may also be value in asking study participants to weigh and measure themselves prior to the self-report, in order to improve the accuracy of the data.

**Conclusion**

Caution should be used when interpreting self-reported height and weight data from surveys. BMIs derived from these are likely to underestimate the true prevalence of overweight and obesity, because the validity of SR data is consistently poorer at higher BMIs. SR data have a place in nutrition monitoring because they are relatively inexpensive and easy to collect. However, classifying people into weight categories on the basis of accepted cut-points, using SR heights and weights, yields inaccurate prevalence estimates. It is not known whether the size of the error varies over time. Periodic sub-studies of the validity of SR heights and weights are needed to indicate the extent to which the accuracy of SR is changing. Between surveys of measured weights and heights, SR data can be described as continuous data in order to reduce the misinterpretation of SR data.

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