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Assessing the Quality of the Height and Weight Data in the HILDA Survey

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Introduction

While the HILDA Survey is not primarily a survey about health, the fact that the survey is portrayed to sample members as a study about life in Australia means that health cannot be ignored. And indeed health measures have been collected since the very commencement of the study. Nevertheless the set of measures included in wave 1 was extremely brief, mostly comprising measures of disability and the limitations that such disabilities impose, the subjective health scales that comprise the SF36, and very crude indicators of a small number of health-related behaviours (exercise, smoking and alcohol consumption).

In recent years more consideration has been given to expanding the health related content. As part of this strategy, questions on height and body weight were included for the first time in wave 6, with the expectation that they will become a regular feature of the HILDA Survey.

The principal intent here is to provide the necessary data to enable the construction of a measure of healthy body weight; the body mass index (BMI).

BMI

BMI is an arithmetic derivation of an individual's height and weight – weight (kgs) divided by height (metres) squared – and is widely used as an indicator of nutritional status and healthy body weight, in part, because data on height and weight is frequently collected in health surveys, including large population surveys such as the National Health Survey (NHS) conducted every five years by the Australian Bureau of Statistics (ABS).[1]

As a measure of ideal body weight, however, it is well known that the BMI is far from ideal. Most importantly, it does not distinguish between muscle mass and fat mass. Similarly, as observed by the ABS (2006), BMI scores can be affected by body build, the distribution of body fat (rather than just the level) and some health conditions (e.g., osteoporosis, pregnancy).

BMI, however, has a major advantage over other potential measures of ideal body weight – it is relatively easy to collect the necessary data, though as we will see, not necessarily without considerable measurement error.

Far superior data would be provided by a measure of body fat percentage. Obtaining accurate measures of body fat percentage requires equipment that cannot easily be implemented in a household interview. More feasible are skin-fold tests using calipers. Nevertheless, conducting such tests requires special training, is very time intensive (and hence costly) and is very invasive. For a panel survey, and especially one where the sample at the time of recruitment was not informed of the likelihood of undergoing any form of physical testing or measurement, this could potentially be a major contributor to panel attrition. An alternative technique involves taking circumference measurements (typically at the waist, hips and/or neck). This, however, is still both quite time intensive and highly invasive and so was considered as not feasible within the HILDA Survey.

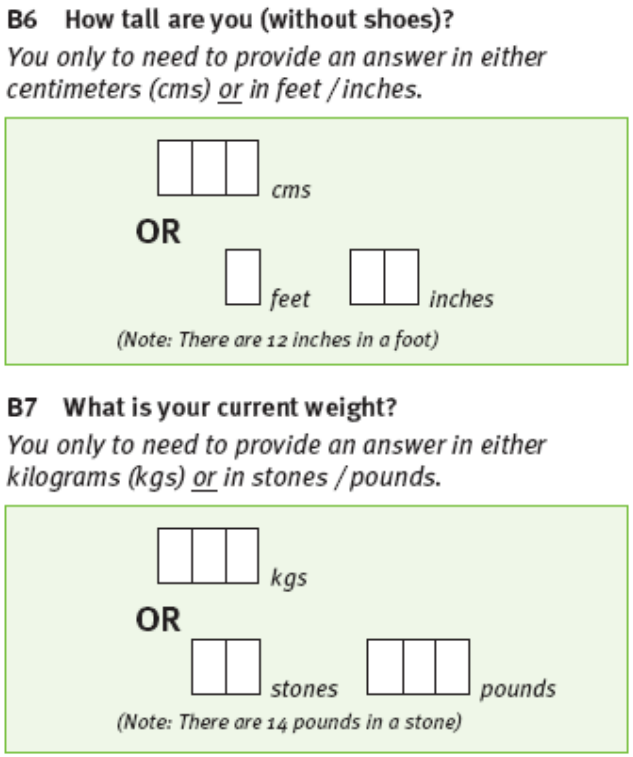
Only the collection of height and weight data was considered feasible for HILDA.

[1] The index is sometimes referred to as the Quetelet index after the 19th century Belgian astronomer who is usually credited with first recognizing that in adults of normal build, weight is proportional to the square of height (see Keys et al. 1972).

Measurement of Height and Weight in the HILDA Survey

Like the NHS, no attempt is made in the HILDA Survey to take actual measurements of height and weight of respondents during the survey. Instead, all information is self-reported. But unlike the NHS, data on height and weight are not collected as part of a personal interview. Instead, the relevant questions were included in the self-completion questionnaire which, as the name suggests, is usually completed without any assistance from the HILDA Survey interviewers.

The relevant questions read as follows:



The decision to include the height and weight questions in the SCQ component as distinct from the interview component was made partly because of concerns about adding to the length of the interviews (bearing in mind that some respondents might opt to actually weigh themselves in response to the question on weight) and partly because of concerns that some respondents might be embarrassed or even offended by being asked questions about their weight, with possible adverse consequences for future sample attrition.[2]

Reporting Bias

It is well recognized that self-reported height and weight data are likely to be affected by social desirability biases. Specifically, height tends to be overstated and weight understated. This was demonstrated by the ABS when it compared self-reported data from the 1995 NHS with measurements collected by trained nutritionists in the 1995 National Nutrition Survey (NNS), which was conducted in conjunction with the NHS (ABS 1998). The net effect of

[2] Such concerns are less important for cross-section surveys, such as the NHS, where survey participation is typically a one-off event.

reporting biases was to overstate height by 2.1 cm for men and by 1.2 cm for women, and to understate weight by 1.8 kg for men and by 2.5 kg for women.

Arguably such biases might be expected to be even worse in self-administered surveys than in interviewer-administered surveys. That is, the presence of an interviewer acts as a check on the extent to which a respondent might be prepared to exaggerate or lie.

On the other hand, a self-administered survey provides respondents with more time to actually measure themselves. Further, and perhaps more importantly, persons who are embarrassed by their weight might be more inclined to refuse to answer in the presence of an interviewer.

In summary, among those that do respond we expect greater reporting bias among HILDA Survey respondents than among NHS respondents. However, we also expect people to be more likely to provide answers in the HILDA Survey, and given it is the obese who are most likely to refuse to respond, this will have an opposite effect on the distribution of BMI scores.

Measurement Problems

Even without reporting bias, the data will still be affected by considerable measurement error. This can arise because of a tendency for respondents to round, because of respondent uncertainty about their body measurements, especially if they are not in the habit of regularly measuring themselves, or because of reporting errors. The latter problem is likely to be especially problematic given the self-administered mode, and is exacerbated by the need to allow respondents the option to provide answers in either metric or imperial units.

Data Editing / Cleaning

While respondents were asked to provide their height and weight in either metric or imperial units, some respondents provided both (453 cases for height and 73 cases for weight). The rules adopted for which measurement to take were based on the empirical evidence from the dataset for which age groups were more likely to use the metric or imperial units. Table 1 shows that weight was almost always reported in kilograms but the propensity to report height in centimetres rather than feet and inches varied by age. Those aged 45 years and over were more likely to report height in feet and inches and those aged under 45 years were more likely to report their height in centimetres. As a result, the rules adopted in constructing the height and weight derived variables were as follows:

- If stones and/or pounds were provided along with kilograms, the kilograms response was used.
- If feet, inches and centimetres were provided, then the response in feet and inches for people aged 45 and over was used, but for people aged 44 or younger the centimetres response was used.
- If feet and centimetres were provided, but the inches field was left blank, the response in centimetres was used.

The high and low values of height and weight were inspected via a two stage process. The first stage involved a visual inspection of the scanned images of the SCQ to ensure the data had been entered correctly and the second stage involved setting unrealistic values to missing.

Table 1: Proportion reporting height and weight using the metric or imperial units, by age

	Weight		*Height*	
Age group	*Metric (%)*	*Imperial (%)*	*Metric (%)*	*Imperial (%)*
15-19	99.7	0.3	78.1	21.9
20-24	99.4	0.6	76.5	23.5
25-29	98.9	1.1	75.7	24.3
30-34	97.8	2.2	72.9	27.1
35-39	96.3	3.7	68.1	31.9
40-44	94.2	5.8	59.8	40.2
45-49	91.9	8.1	46.5	53.5
50-54	91.4	8.6	37.0	63.0
55-59	88.7	11.3	29.6	70.4
60-64	83.4	16.6	23.5	76.5
65-69	80.5	19.5	26.1	73.9
70-74	72.3	27.7	22.2	77.8
75-99	62.4	37.6	16.2	83.8
Total	90.7	9.3	51.7	48.3

The SCQ images were inspected for cases that met one of the following criteria:

- height less than 120cms or more than 210 cms;
- weight less than 40 kgs or more than 200 kgs; or
- a height and weight combination that led to a BMI of less than 15 or more than 50.

Once the data at the extremes had been verified against the scanned images, extremely unlikely values were replaced with the missing value code for implausible values (-6). The cut-off points beyond which the responses were set to implausible values for height and weight are provided in Table 2. In addition, responses of more than 12 inches in the inch box were also set to -6.

Table 2: Cut-off points for setting implausible values for height and weight

	Men		*Women*	
	Lower cut-off	*Upper cut-off*	*Lower cut-off*	*Upper cut-off*
Height	130 cms (4 foot 3 inches)	229 cms (7 foot 6 inches)	110 cms (3 foot 7 inches)	210 cms (6 foot 11 inches)
Weight	35 kgs (5 stone 7 pounds)	300 kgs (47 stone 3 pounds)	25 kgs (3 stone 13 pounds)	300 kgs (47 stone 3 pounds)

Note: Values reported below the lower cut-off point and above the upper cut-off point were set to -6 (implausible value).

In total, the height for 17 men and 34 women and the weight for 6 men and 26 women were set to implausible (there was only one man whose height and weight were both set to -6).[3]

Strictly spreaking, the use of the term ‘implausible’ is inaccurate; there are many recorded instances of people who have measurement outside these ranges. Numerous websites, for

[3] There were a further seven respondents for whom either the imperial or metric height data was set to -6, but as they recorded both types of measures, their height could still be determined.

example, provide photographic evidence of people with weight well in excess of 400 kgs and, at the other extreme, others standing less than one meter in height. Nevertheless, we suspect that most of the extreme values in our data set are the result of reporting errors, meaning that our approach is overly conservative.

Table 3, for example, shows the number of cases remaining in the HILDA Survey data where the recorded values lie outside the extreme height, weight and BMI values reported by the ABS in their comparison of the self-reported and measured data collected as part of the 1995 NHS and NNS. It should be noted, however, that this ABS comparison excluded some cases where the difference between the reported and measured height and weight were too great.[4]

Table 3: Number of HILDA cases beyond the extremes reported in the NHS/NNS comparison, aged 18 and over

	Men				Women			
	NHS/NNS min	No. below	NHS/NNS max	No. above	NHS/NNS min	No. below	NHS/NNS max	No. above
Height	150 cm	8	201 cm	16	124 cm	4	185 cm	24
Weight	38 kg	0	152 kg	16	32 kg	1	128 kg	33
BMI score	15.0	4	45.9	21	14.2	1	51.9	15

The arrival of the wave 7 data will permit some longitudinal checking of the height data and, to a limited extent, the weight data. We will inspect those cases that:

- have been set to implausible in wave 6;
- are at the extreme ends of the distribution in waves 6 or 7; and
- have large differences in height or weight between waves 6 and 7.

We may find, for example, that people reporting being less than 100 centimetres in height in wave 6 actually forgot to include the first digit (i.e., the "1") and so we could adopt a rule to clean these cases. Height differences of more than 5 or 10 centimetres should be resolvable as height is unlikely to change much, other than among the young. Checking the reported weight data across time will be more difficult as weight can legitimately vary by substantial amounts and so it is unlikely that many changes to weight will be made. Users of the HILDA Survey data should thus be aware that the wave 6 data in Release 6 may be modified in later releases following the comparison with the wave 7 data.

[4] In a dataset of 10,765 cases, 21 males and 32 females were excluded because of their reported and measured height differences and 28 males and 38 females were excluded because of their reported and measured weight differences. It is not clear how much overlap exists between these two exclusion groups.

Missing Data

In total, BMI scores cannot be calculated for 14.1 per cent of the wave 6 responding sample. The main reason for this, however, is not refusal to provide data on height or weight, but non-completion of the SCQ. As discussed elsewhere (e.g., Wooden and Watson 2007), most of the SCQ forms are completed on a later date following completion of the interview. While interviewers are all required to make a further call to every household in an effort to collect the completed SCQs, many SCQs are not completed at this time. These respondents are thus asked to return the completed questionnaires by mail, which inevitably leads to some non-response. In wave 6, 9.3 per cent of interviewed respondents failed to complete the SCQs.

If we exclude non-returns, then the proportion of respondents for whom a BMI score could not be calculated, either because no information was provided or because the responses provided were deemed invalid or implausible, falls to about 5 per cent – 4.0 per cent of males and 6.6 per cent of females. Invalid or implausible responses contribute 0.5 percentage points to the missing data for males and 1.0 percentage points for females.

By comparison, in the 2004-05 NHS, the BMI score could not be calculated for 7.0 per cent of males and 12.2 per cent of females due to missing data. As mentioned earlier, we expect that the lower rate of missing data in the HILDA Survey is due to the respondent being more comfortable recording their height and weight in a self-completion questionnaire environment rather than reporting it directly to the interviewer, as was required in the NHS.

The Distribution of BMI: Comparisons with the National Health Survey

The (edited) HILDA Survey data on height and weight provides a distribution of BMI scores that compares reasonably well to the data collected by the ABS in the 2004-05 NHS. Nevertheless, as should be clear from Table 4, in the HILDA Survey there is a noticeably greater proportion of obese people (persons with a BMI score greater than 30).

Table 4 compares the weighted distribution of BMI groups in the HILDA Survey against the NHS by both sex and age.[5] In all age and sex groups there is a higher proportion of obese persons in the HILDA Survey sample. This difference is especially pronounced for men aged 55 to 74 and women aged 35 to 64.

Part of this difference between the two surveys is almost certainly due to real changes in the distribution of BMI over time; that is, Australians are getting fatter.[6] Nevertheless, the elapsed time between the two surveys is too short for this to account for more than a small fraction of the observed change.

A large part of the explanation for the measured differences must, therefore, lie either in sampling differences or in measurement error. As noted above, there are more extreme values in the HILDA Survey sample, some of which may be measurement and reporting errors. On the other hand, it also needs to be borne in mind that the rate of item refusal was lower in the HILDA Survey, and we suspect that refusal rates will be highest among persons at the extremes of the height and weight distributions.

[5] People for whom a BMI score could not be calculated have been excluded from this comparison.

[6] Between the 2001 NHS and the 2004-05 NHS, the proportion of obese men increased by 3.7 percentage points and the proportion of obese women increased by 0.1 percentage points (after excluding those not stating height or weight).

Table 4: Comparison of BMI distribution, HILDA Survey and NHS

	HILDA Survey, 2006					*National Health Survey, 2004-05*					*Difference (HILDA-NHS)*			
	Under-weight	*Normal range*	*Over-weight*	*Obese*	*Total*	*Under-weight*	*Normal range*	*Over-weight*	*Obese*	*Total*	*Under-weight*	*Normal range*	*Over-weight*	*Obese*
Males														
18-24	3.0*	64.5	25.2	7.3	100	3.0	61.0	28.7	7.2	100	0.0	3.5	-3.5	0.1
25-34	1.1*	38.8	40.9	19.2	100	0.5*	39.7	42.2	17.6	100	0.6	-0.9	-1.3	1.6
35-44	0.8*	32.1	42.0	25.2	100	0.6*	29.7	47.1	22.6	100	0.2	2.4	-5.1	2.6
45-54	1.0*	27.1	44.6	27.3	100	0.3*	29.2	45.9	24.6	100	0.7	-2.1	-1.3	2.7
55-64	0.9*	23.8	47.5	27.8	100	0.3*	28.2	47.9	23.6	100	0.6	-4.4	-0.4	4.2
65-74	0.7*	29.6	42.4	27.3	100	0.4*	39.1	43.0	17.4	100	0.3	-9.5	-0.6	9.9
75+	2.6*	42.9	39.8	14.7	100	3.7*	45.3	40.1	10.9	100	-1.1	-2.4	-0.3	3.8
Females														
18-24	10.9	60.4	18.8	10.0	100	10.1	62.2	19.6	8.2	100	0.8	-1.8	-0.8	1.8
25-34	4.9	51.5	26.9	16.7	100	4.9	56.3	24.4	14.3	100	0.0	-4.8	2.5	2.4
35-44	2.5	49.0	26.4	22.1	100	3.5	53.5	26.4	16.5	100	-1.0	-4.5	0.0	5.6
45-54	1.7	41.4	28.3	28.6	100	2.0	47.4	30.3	20.3	100	-0.3	-6.0	-2.0	8.3
55-64	2.6*	33.8	33.1	30.5	100	1.6*	40.4	33.9	24.1	100	1.0	-6.6	-0.8	6.4
65-74	3.0*	37.4	35.3	24.3	100	2.7	40.8	34.9	21.5	100	0.3	-3.4	0.4	2.8
75+	3.8*	41.0	38.7	16.5	100	6.8	50.7	29.9	12.6	100	-3.0	-9.7	8.8	3.9

Notes: i) People for which BMI could not be calculated are excluded from the comparison.
ii) The BMI groups are defined as underweight (BMI<18.5), normal range (BMI>=18.5 and BMI<25.0), overweight (BMI>=25.0 and BMI<30.0) and obese (BMI>30.0).
iii) * indicates unreliable estimates (sample size contributing to estimate of less than 20 in HILDA and relative standard errors of 25% or higher in NHS).

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