Does the misreporting of adult body size depend upon an individual’s height and weight? Methodological debate

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In a paper published four years ago in this journal1 we included an assessment of factors influencing the accuracy of self-reported anthropometry in the elderly. The analysis was based on 257 surviving members of the Boyd Orr Cohort aged 56–78 years with both self-reported (questionnaire) and measured values recorded for their weight, height, and leg length.

As well as comparing self-report and measured values using Bland-Altman plots2 we also carried out a multivariable linear regression analysis to investigate factors associated with the difference between self-reported and measured anthropometry (‘misreporting’). The factors examined in these models were age, gender, social class, and other anthropometric values. We also investigated the extent to which mis-reporting was associated with the magnitude of the measured values of stature or weight. For example, we were interested in whether overweight individuals reported their weight less accurately and were more prone to under-reporting. To assess systematic error, the difference between reported and measured anthropometry was used as the dependent variable. To assess random error the difference was again used, but the sign of the difference was removed—so large negative errors were given the same weight as large positive errors and factors associated with inaccuracy, rather than systematic error, can be assessed.

It has been pointed out to us that due to the phenomenon known as mathematical coupling (MC), findings from these analyses may have been incorrect. In the presence of measurement error, the difference between two measures on the same subject will be correlated with the true value of that measure, even in the absence of any true association.2,3 This phenomenon is more familiarly known as regression to the mean (RTM, for a description see Kirkwood and Sterne4), although MC can occur without RTM. Our findings that an individual’s height, leg length, weight, and body mass index (BMI) were associated with the probability of them misreporting their values for these measures may therefore have been biased.

To investigate how this phenomenon may have influenced our conclusions we have conducted new analyses. To make negligible the effects of MC we included a term for the mean of the self-report and measured anthropometric values in the model rather than the measured value alone. Such an approach

### Table 1: Factors associated with systematic and random error in the self-reported measure

<table>
<thead>
<tr>
<th>Factor</th>
<th>Systematic Error</th>
<th>Random Error</th>
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<tbody>
<tr>
<td><strong>Height</strong></td>
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<tr>
<td>Men (coefficient 0.94; 95% CI: −0.05, 1.94; P = 0.06) and lighter people (coefficient −0.03; 95% CI: −0.07, 0.00; P = 0.07) are more likely to over-report height</td>
<td>Men (coefficient 0.80; 95% CI: −0.07, 1.67; and P = 0.07), older individuals (coefficient 0.10; 95% CI: −0.01, 0.22; P = 0.07) and lighter people (coefficient −0.03, 95% CI: −0.06, 0.00; P = 0.07) are more likely to misreport their height</td>
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<tr>
<td><strong>Leg length</strong></td>
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<td>Lighter individuals are more likely than heavy people to over-reporting their leg length (coefficient −0.09; 95% CI: −0.14, −0.04; P &lt; 0.01)</td>
<td>Heavier individuals (coefficient −0.07; 95% CI: −0.12, −0.03; P &lt; 0.01) and men (coefficient 1.28; 95% CI: 0.02, 2.54; P = 0.05) are more likely to misreport their leg length</td>
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<tr>
<td><strong>Weight</strong></td>
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<tr>
<td>Heavier individuals are more likely than light people to under-reporting their weight (coefficient −0.04; 95% CI: −0.08, −0.01; P = 0.02)</td>
<td>Manual social class (coefficient 0.87; 95% CI: 0.11, 1.63; P = 0.03) and heavy (coefficient 0.02; 95% CI: 0.00, 0.05; P = 0.09) individuals are more likely to misreport their weight</td>
<td></td>
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<tr>
<td><strong>Body mass index</strong></td>
<td>No associations</td>
<td>Manual social class (coefficient 0.38; 95% CI: 0.02, 0.74; P = 0.04) individuals are more likely to misreport their BMI</td>
</tr>
</tbody>
</table>

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makes use of the special circumstances whereby the effects of MC are negligible under the null hypothesis of no association between ‘difference’ and ‘mean’.

The findings from this analysis are presented in the Table below. Factors are listed if they are associated ($P < 0.10$) with the difference between self-report and measured values.

There is still evidence that heavier individuals are more likely to under-report and/or mis-report their weights, but the precise pattern of association in these analyses differs from those we reported in our paper and a number of the associations between subject’s measured values and the difference between reported and measured values—those in which the effects of mathematical coupling are likely to be present—are no longer seen.

As illustrated by this re-analysis and letter’s published in this edition of the journal, a better understanding of approaches for taking account of MC is required.

Acknowledgement

We would like to thank Jonathan Sterne for comments on this analysis.

References

1 Gunnell DJ, Berney L, Holland P et al. How accurately are height, weight and leg length reported by the elderly and how closely are they related to measurements recorded in childhood. Int J Epidemiol 2002; 29: 546–64.

