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How tall am I again? A longitudinal analysis of the reliability of self-reported height

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A B S T R A C T

Self-reported height measures are increasingly being included in large-scale surveys in order to measure BMI. There have been concerns about the validity of self-reported measures but there remains little understanding of why respondents may not give accurate height reports. We examine whether a lack of knowledge could be a contributing factor, by investigating the reliability of self-reported height over time and across countries. We use longitudinal data from four large-scale longitudinal surveys conducted in Australia, United States, United Kingdom, and Europe (14 countries) where survey respondents were asked to report their height over multiple time periods to measure the extent of consistency of height reports across time. The overall level of inconsistent reporting of height is largest in Australia and Europe. Individuals with lower levels of education were significantly more likely to give two height reports that differed by 5 cm or more. Across all countries, inconsistent reporting with large height differences between waves was also more common among those in older populations. The findings point to subgroups of the population exhibiting a lack of knowledge regarding their own height.

1. Introduction

Due to public health concerns about overweight and obesity, it has become increasingly commonplace for large national social surveys to include self-reported anthropometric questions on height and weight. Self-reported measures are inexpensive, non-invasive, and do not require an interviewer to be physically present or have any special equipment to take the measurements. However, while self-reported measurements are cost-effective and easy to collect, there have been concerns about their validity. Validity studies comparing self-reported and measured height and weight find that on average people tend to overestimate their height and underestimate their weight (Maukonen et al., 2018). While overestimation of height tends to be small, there are groups of people where the difference is substantial and for these groups self-reported measures can lead to biased estimates of BMI (Hodge et al., 2020). This is particularly the case because as BMI is defined as the ratio of weight to height squared, the underreporting of weight and the over reporting of height magnifies the error compared to the situation where both measurements were over or underreported (Ng, 2019).

The two main explanations put forward in the validity studies literature to explain why people may self-report a height that is not accurate or valid, are social desirability bias, or lack of knowledge. Few studies have directly investigated the extent to which people have a lack of knowledge about their height, or whether they engage in socially desirable answering, but rather these explanations are inferred from patterns in the way different groups respond in surveys.

Social desirability bias is thought to be a cause for height misreporting, particularly the over-reporting of height. This theory rests on the premise that individuals have an accurate knowledge of their height and deliberately misreport it in an effort to conform to social norms and make a good impression (Burke & Carman, 2017). Most research on social desirability of anthropometric measures has focused on weight, and little is known about the degree to which social desirability affects reporting of height. Evidence for a tendency to give socially desirable answers is often implicitly suggested when shorter people are more likely to over report their height. One study in the United States made such a finding where very short individuals overstated their height by a larger margin than those of average or tall stature (Burke & Carman, 2017). However, it is also possible that shorter people are more likely to overestimate their height because they are less aware of their height and simply respond with what they believe is an 'average' height.

While social desirability remains a popular explanation for misreporting of height, few studies have directly tested for social desirability bias in height reporting. Those that have, have found no evidence of it (Brestoff et al., 2011). A Spanish study by Gil and Mora (2011) investigated whether a person's own height in comparison to an 'ideal' height would affect the accuracy of their height reporting and found no indication of social desirability bias for height, although it did exist for weight. Similarly, Yoong et al. (2013) and Kkeli (2020) conducted experiments where participants were split into two groups. In both groups

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participants were asked to self-report their height and weight. However, prior to the self-reports one group was told that their height and weight measurements would then be measured by the interviewer, and one group was not informed. If the informed group gave more accurate self-reports this would indicate an element of social desirability bias as it would prove that the participants know their height and will be more accurate reporters knowing these reports will then be independent verified. Neither study found any indication of a difference in the accuracy of self-reported height between the informed and uninformed.

Another possible explanation for misreporting is simply lack of knowledge regarding one's own height. Most adults do not tend to measure their own height, or have their height measured regularly (Larson, 2000). Kkeli (2020) found that in a sample of university students in Cyprus, 1.2% had measured their height in the last week compared to 41.6% who had measured their weight in the preceding week. Occasions when a person's height might need to be reported, or measured, include when applying for a passport or drivers licence (depending on country), for medical forms, or to be fitted for clothing. The lack of frequent height measurement is likely to translate to an overall lack of knowledge. For example, a study in the United States found that women who visited a physician annually were more accurate in their reporting of height suggesting (Craig & Adams, 2009).

There are four main ways to investigate whether lack of knowledge contributes to inaccurate self-reporting of height. The first is to ask people directly if they know their height. A recent study in Papua New Guinea found that knowledge about height was worse than knowledge about weight. In the study by Saito et al. (2020), 74% of participants had no knowledge of their height, compared to a lower 58% having no knowledge of their weight. In high income countries, it is often assumed that people will have knowledge of their height although this assumption has rarely been interrogated.

The second indication that invalid height reports are due to lack of knowledge is indirect inference based on findings that people with certain characteristics are more likely to give invalid answers. For example, the common finding in validity studies that that older people are more likely to overestimate their height (Neermark et al., 2019; Tuomela et al., 2019) is often suggested to be the result of older people not being aware of age-related height loss that they may have experience (Taylor et al., 2006). There may also be a relationship between education levels of knowledge of ones height, with validity studies finding that those with lower levels of education are more likely to overestimate their height (Palta et al., 1982; Łopuszańska et al., 2015).

The third manifestation of lack of knowledge is end digit preference. When survey respondents encounter difficult-to-measure or unfamiliar quantities, they often provide rounded estimates in their responses. Respondents will often intentionally or unintentionally round up (for height), or round down (for weight) anthropometric measures to values ending in 0 and 5 (Gorber & Tremblay, 2010). Rounding preferences also appear to depend on cultural background, with people whose native language is of the Romance, Greek, or Semitic family being much more likely to have a preference for 0 or 5 when reporting their height, compared to those of Germanic or Slavic language background (Bopp & Faeh, 2008). An Australian study on self-reported height and weight validity also points to the importance of whether the respondent use the metric versus the imperial system. Respondents who reported their height in metric measurements were more likely to round their height to end in 0 or 5 (41%), compared to respondents reporting height in feet and inches who had 0 or 6 as the final measurement (18%) (Taylor et al., 2006). However, while end digit preference may signal lack of knowledge it can also be related to social desirability bias, especially if there is a tendency to round up.

The fourth indication that individuals do not have an accurate idea of what their height is based on the consistency of their answers when asked multiple times. Unlike weight which can fluctuate over time, after finishing puberty and before reaching old age, a person's height remains relatively stable over time. Age-related changes in muscles, joints and bones, including osteoporosis and spinal disc degeneration mean that people experience height shrinkage as they age. However, unless there is a serious medical condition, height loss is gradual, although the rate of loss increases with age. Based on a review of longitudinal studies of height loss, Sorkin et al. (1999) estimated that between age 30 and 80, cumulatively the average man loses approximately 5 cm and the average woman just over 6 cm, with the loss occurring more rapidly from age 70. Other studies have found greater changes in certain populations, with an average loss between age 30 and 70 being 8.2 cm for men and 7.2 cm for women in the United Arab Emirates (Baynouna et al., 2009). Due to the gradual nature of the loss of height, if people are asked to report their height at two different time points we would expect the self-reported measure to be stable and not change over time.

To date very little is known about the consistency of self-reported height. To analyse the reliability of height reports, data on self-reported height must be compared from the same individuals for at least two time points. Two studies that did this found a high level of consistency with an absolute difference across their two time points of just 0.5 cm (Lin et al., 2012) and 0.1 cm (Perez-Cueto & Verbeke, 2009). However, in these studies the two time periods when the participants were asked to report their height were only one month, and three weeks apart, respectively, which would increase the chance that respondents would remember what they had reported at the previous time and therefore give more consistent answers. Olbrich et al. (2022) also examined reliability and found that inconsistent reporting can also be traced to error-prone interviewers.

While social desirability and end-digit preference would be associated with validity of height reports, if reports are inconsistent over time, this would point to a more prominent role played by lack of information or knowledge. Respondents exhibiting social desirability bias, or end-digit preference when self-reporting height would be predicted to engage in this behaviour consistently if the survey instrument was the same over time. However, if people's report of their height changes over time this would signal a lack of knowledge.

In this paper we use longitudinal data from four large scale surveys conducted in Australia, United States, United Kingdom, and Europe (14 countries) where survey respondents were asked to report their height over multiple time periods to measure the extent of consistency of reporting of height. By looking at the reliability of measures over time, we can gain insight into the possible explanations for lack of consistency. If self-reported height reports are inconsistent over time, with respondents reporting different heights across different times, this would suggest a lack of knowledge on behalf of the respondent regarding how tall they are rather than social desirability bias. By testing the reliability of height reporting over time, and across countries, we hope to better understand the impact of geographic location on self-reporting of height. We use data from different countries to test whether answer patterns in terms of consistency are similar across countries or if there are cultural or societal differences in the way people report height.

2. Materials & methods

We use four large-scale longitudinal surveys, from Australia, United States, United Kingdom, and Europe (14 countries) to examine and compare the reliability of height reports across two points in time. Our samples include any respondent aged 20 or over who participated in at least two waves of each respective survey. Data from these surveys has not previously been used to examine the longitudinal reliability of self-reported height.

2.1. Household, Income and Labour Dynamics in Australia (HILDA)

The Household, Income and Labour Dynamics in Australia (HILDA) survey is a household-based panel survey that started in 2001. It has several different components, including individual interviews with members of households aged 15 and over, as well as a self-completion questionnaire which contains more sensitive questions. Height data has been collected in the self-completion questionnaire component in every year since 2006 (Wave 6). The question allows respondents to record their height using either centimetres or feet and inches. We use data from respondents who participated in wave 18 and wave 20 conducted in 2018 and 2020.

2.2. Panel study of Income Dynamics (PSID)

The Panel Study of Income Dynamics (PSID) is a longitudinal panel survey of American families that began in 1968. Height data for the reference person was included in the questionnaire for the first time in 1986, and then was not collected again until 1999 at which point it was collected in every second wave. We use data from the reference person in 2015 and 2017.

2.3. British household panel survey (BHPS)

The British Household Panel Survey (BHPS) was a large-scale household panel survey that began in 1991. Data on height was collected in Wave 14 and Wave 16 conducted in 2004 and 2006.

2.4. Survey of health, Ageing and Retirement in Europe (SHARE)

SHARE is a cross-national longitudinal survey focusing on health, ageing and retirement in Europe. The first wave was conducted in 2004/5 with people aged 50 and over living across 12 countries. Given that the SHARE sample is older than the sample from the other surveys, we would expect overall height misreporting to be higher in SHARE. For longitudinal respondents, height data was collected in the first wave they appeared and then was not asked again until wave 5 (2013) and 6 (2015) when the question was repeated due to an administrative error. For respondents who were interviewed in wave 1, height was not meant to have been asked again. However in waves 5 and 6 the question was accidently included. We include people who participated in wave 5 and wave across all 14 countries that took part in SHARE during those waves.

For all surveys, except for HILDA the question on height was asked directly to the respondent by the interviewer. HILDA is the only survey where the survey respondents fill in the height information themselves.

As shown in Table 1, the surveys differ in mode type, as well as whether or not the question on height is asked in imperial or metric format. For each survey we corrected obvious data entry errors. For example, if data was collected in centimetres and the respondent said 1.65 we multiplied this by 100 to convert from metres to centimetres. The average height of respondents differed by country and sex.

2.5. Dependent variable

Our main outcome of interest is the difference or consistency in height reporting across the two time points of each survey. We start by examining the absolute difference in height across the surveys. We then create a binary dependent variable with a value of 1 if the respondent reported two heights that differed by 5 cm or more, and 0 otherwise. A cut-off of 5 cm was chosen for the dependent variable because this represents a substantial difference regardless of the person's actual height.[1] While age related changes in muscles, joints and bones including spinal disc degeneration and osteoporosis lead to height loss, this occurs at a gradual rate and a real loss of height of 5 cm across one or two years between surveys would be considered extreme.

This cut-off value was also chosen as this would represent more than 2 inches difference for those respondents using the imperial system (1 inch = 2.54 cm). In addition, this cut-off picks up end digit preference for those using the metric system and saying two different close heights which end in 0 or 5, for example 160 cm one time, and 165 cm the other time. A dichotomous dependent variable was used rather than the absolute difference as a continuous variable because our aim was to clearly identify those respondents with a clear lack of knowledge.

2.6. Independent variables

We examine the differences in height across two time points, by sex, age and highest education level. These variables have been shown in validity studies to correlate with the accuracy of height reports. Highest education level was coded in three separate categories as low, medium and high education corresponding to less than compulsory high school, compulsory high school or certificate/diploma, and university level education.[2] Due to the cross-national nature of this study and the difference in availability of relevant data across the surveys we were unable to include additional possible explanatory variables such as frequency of physician visits or ethnicity.

We start by describing the absolute difference in height, and then conduct a logistic regression model to identify the relationship between age, sex, and education level on the likelihood of reporting an absolute height difference of 5 cm or more at different time points.[3] For each survey, analysis is conducted separately.

3. Results

The difference in height across the two time points, for each survey, is shown in Table 2. The overall level of inconsistent reporting of height was largest in Australia and Europe, with respondents reporting an average of 1.56 cm (SD = 3.06) and 1.70 cm (SD = 3.02) difference in height between each wave of the HILDA and SHARE survey, respectively.

For sex, there was no clear pattern across the surveys, and generally sex differences were small. In Australia and the United Kingdom, men had slightly larger height differences across waves, whereas in the United States and the European countries women had larger height differences.

For age, there was a U-shaped relationship. For the surveys which covered the whole age range from 20 and above, we found that those in their 20s had relatively large differences in heights across waves but then differences declined with age until the 70s when they increased again. For example, in the United Kingdom BHPS data, those aged 20–29 reported an average height difference of 1.36 cm, but at ages 40–49 the difference was just 0.94 cm, before climbing up to 2.04 cm among those aged 80 or over.

Across all countries, inconsistent reporting with large height differences between waves was also more common among those with lower levels of education. For example, in the European SHARE data, those

[1] A difference of 5 + cm represents a 3–4% change depending on the initial height. For example, for someone who is 150 cm, adding or subtracting 5 cm would equal 3.3% of their original height. For taller people, the percentage difference would be only marginally smaller. Someone who is 190 cm at one time point, and 185 or 195 at another time point would present a 2.6% difference.

[2] For BHPS and SHARE data, highest education level was available in ISCED97 levels. ISCED97 levels of less than 3 were coded as 'low education', ISCED97levels of 3 & 4 were code as 'medium' education an ISCED97 levels of 5 and 6 were classified as 'high' education. For the US PSID, low education included those who have neither graduated from high school or obtained a GED, medium education those with GED or have finished high school and high education are those who attended college.

[3] Robustness checks were also conducted by changing the outcome variable to a height difference of 3 cm or more, as well as using linear regression treating the dependent variable as a continuous variable. The results were largely the same.

Table 1
Details of surveys and sample size (weighted).

	Household Income and Labour Dynamics in Australia (HILDA)	Panel Study of Income Dynamics (PSID)	British Household Panel Survey (BHPS)	Survey of Health, Ageing and Retirement in Europe (SHARE)
Mode of survey	Paper and pen, self-completion questionnaire	CATI	Face-to-face interview (CAPI)	Face-to-face interview (CAPI)
Sample size (N)	11,865	5,938	11,997	45,683
Years	2018 & 2020	2015 & 2017	2004 & 2006	2013 & 2015
Sex (column %)				
Male	47.6	58.2	44.8	43.7
Female	52.4	41.8	55.2	56.3
Age group (column %)				
20–29	15.3	14.4	14.8	–
30–39	18.3	26.0	20.4	–
40–49	18.2	16.2	19.9	–
50–59	18.1	17.3	17.7	20.5
60–69	15.5	15.4	13.4	36.4
70–79	10.4	6.6	9.7	27.9
80+	4.2	4.1	4.1	15.3
Education level (column %)				
Low	18.5	9.3	25.5	37.1
Medium	35.8	58.2	40.2	38.8
High	45.7	29.9	33.2	23.7
Missing		2.7	1.0	0.4
How answered (column %)				
Only centimeters	62.3	–	0.7	100.0
Only feet and inches	23.8	99.4	98.0	–
Combination	13.9	0.6	1.3	–
Mean height[a] – men	177.8	178.9	176.8	174.9[b]
Mean height[a] – women	164.3	163.8	162.4	162.8[b]

Notes.
[a] Mean height was measured as the height at the first time point.
[b] There was variation in respondent height across the SHARE countries. Respondents reported smaller stature in Spain, Italy, France and Israel and were on average taller in Denmark, Sweden, Germany, Austria and Luxembourg. For both men and women, the lowest heights were in Spain (Male: 170.1 cm, Female: 159.4 cm). The tallest respondents were in Denmark (Male: 178.3 cm, Female: 159.4 cm).

with low levels of education reported an average height difference of 2.41 cm, compared to a mean height difference of 1.08 cm among those with high education.

For the surveys which allowed respondents to answer either in metric or imperial measurements, there was a clear pattern where respondents who reported their height in different systems across the two time points had much larger height differences. In Australia, those who used only the metric or only the imperial system had an average height difference of 1.30 cm and 1.29 cm respectively. Those who used different systems at each wave had an average height difference of 3.22 cm.

Table 2 also shows the distribution of responses according to whether there was no height difference, a difference of less than 5 cm, and a difference of 5 cm or more. As with the mean difference, Australia and the European SHARE data also had the highest share of respondents with a height difference of 5 cm or more, at 10.9% and 12.6% of the sample respectively. In contrast the United States PSID had the highest level of consistency with 71.9% of respondents reporting the same height in both waves, and only 5.9% reporting heights that differed by 5 cm or more.

Among those respondents who had heights that differed by 5 cm or more, there was a fairly even distribution between those who stated they were taller in the first time point compared to the second time point, and those who stated they were taller at the second time point. For example in Australia (HILDA), 51.1% indicated they were shorter in 2018 than in 2020 and 48.9% were taller in 2018 than in 2020.

The log odds of reporting heights that differed by 5 cm or more across waves, from the logistic regressions, are shown in Table 3. For the SHARE data, the model was run for all countries pooled together, controlling for country, as well as for individual countries. For ease of interpretation, the results were discussed in terms of predicted probabilities. In the European SHARE data, a large difference was found across the countries in the propensity for reporting different heights across waves. In Spain, controlling for sex, age, and education, the predicted probability of giving two different heights that differed by 5 cm or more was 28% [95CI 26.7–29.3], compared to less than 10% in Germany, Sweden, France, Denmark, Switzerland, Belgium, and Luxembourg.

The results largely reflect similar patterns to the bivariate analysis. Controlling for differences in age and education level, European SHARE

Table 2
Difference in height (centimetres) across two time points.

	Australia		United States		United Kingdom		European countries	
	HILDA		PSID		BHPS		SHARE	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Sex								
Male	**1.57**	0.05	**1.05**	2.66	**1.16**	2.32	**1.61**	2.91
Female	**1.54**	0.05	**1.10**	2.70	**1.15**	2.57	**1.78**	3.10
Age group								
20–29	**1.89**	0.12	**1.22**	2.70	**1.36**	2.51		
30–39	**1.31**	0.08	**1.02**	2.51	**1.04**	2.88		
40–49	**1.44**	0.07	**0.86**	2.13	**0.94**	2.70		
50–59	**1.49**	0.07	**1.02**	3.15	**1.03**	2.19	**1.38**	2.84
60–69	**1.56**	0.08	**0.86**	2.03	**1.16**	2.59	**1.47**	2.76
70–79	**1.70**	0.09	**1.27**	3.22	**1.44**	2.36	**1.74**	3.02
80+	**1.82**	0.13	**2.31**	3.80	**2.04**	3.28	**2.64**	3.62
Education level								
Low	**2.02**	0.09	**1.59**	3.69	**1.51**	2.70	**2.41**	3.52
Medium	**1.70**	0.06	**1.07**	2.48	**1.10**	2.12	**1.41**	2.72
High	**1.25**	0.05	**0.77**	2.07	**0.95**	3.03	**1.08**	2.36
Missing			**2.65**	5.84	**1.85**	3.03	**1.50**	2.78
Response								
Combination	**3.17**	0.11	**6.09**	9.47	**2.64**	3.44		
Only feet inches	**1.29**	0.07	**1.05**	2.58	**1.14**	2.45		
Only centimetres	**1.30**	0.04			**1.06**	1.80		
Total	**1.56**	0.03	**1.07**	2.67	**1.16**	2.45	**1.70**	3.02
Correlation: height at time 1 & time 2	**0.94**		**0.96**		**0.96**		**0.93**	
% respondents with:								
No height difference	**56.8%**		**71.9%**		**66.9%**		**50.2%**	
Height difference of 1-<5 cm	**32.3%**		**22.2%**		**26.3%**		**37.2%**	
Height difference 5 + cm	**10.9%**		**5.9%**		**6.7%**		**12.6%**	
Direction of difference between height at time 1 & time 2%. among those with 5 + cm diff.								
Negative	**51.1%**		**46.3%**		**47.5%**		**47.8%**	
Positive	**48.9%**		**53.7%**		**52.5%**		**52.2%**	

data women were more likely to have a difference in height, of 5 cm or more, across the two waves of the survey. Females in Spain, Italy, France, Belgium and Slovenia were significantly more likely to report inconsistent heights compared to males in those countries. However no statistically significant sex difference was found in Australia, United States, or United Kingdom

For age, in all surveys the likelihood of a height difference 5 cm or greater was highest among the oldest age group aged 80 years or over. Fig. 1 shows the predicted probability of a height difference of 5 cm or more, controlling for other variables from the model for each survey. In Australia and the United Kingdom the youngest age group, in their 20s, also had relatively high likelihood of large differences in heights; however, in the United States, no such difference was found. In the Australian data the predicted probability of giving two different heights that differed by 5 cm or more was 13.3% for those in their 20s which was similar to the 12.9% for those in their 80s.

Turning to education level, we found that in every survey this was an important predictor of reporting heights that differed by 5 cm or more across the waves. The relationship between education level and height misreporting was linear, in that the higher the level of education the lower the likelihood of reporting large differences in height. For ease of interpretation, we plot the predicted probability of reporting a difference of 5 cm or more by education level and survey, in Fig. 2. In Australia, for those with low levels of education, the predicted probability of reporting a large height difference was 16.0% compared to 7.5% among those with high levels of education.

4. Discussion

When asked to report their height at two different time points either one or two years apart most people give a consistent answer. However, some individuals will give inconsistent answers which may suggest a lack of knowledge regarding what their height is. There were large differences across countries, as well as across sub-populations, in the incidence of inconsistent answers.

The reliability of height reports was particularly high in the United States and the United Kingdom where less than 6% of people reported two different heights that differed by 5 cm or more. However, in Australia, the percentage was significantly more at 10.9%, and among the elderly European population in the SHARE data it was 12.6%. The cross-country differences in reliability are in line with large national differences also found in validity studies. For example, a study in Italy, the Netherlands and North America found that Italians tended to overestimate their height the most (M = 2.6 cm), followed by persons in

Table 3
Log odds of reporting heights that differ by 5 cm or more across waves.

	Australia	United States	United Kingdom	European countries	Austria	Germany	Sweden	Spain	Italy	France	Denmark	Switzer-land	Belgium	Israel	Czechia	Luxem-bourg	Slovenia	Estonia
	HILDA	PSID	BHPS	SHARE[a]														
Sex																		
Male (reference)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Female	0.02	0.12	−0.11	0.18***	0.02	0.04	−0.04	0.27***	0.24***	0.37**	0.08	0.17	0.38***	0.1	−0.06	0.34	0.41***	0.01
Age group																		
20–29	0.37***	0.25	0.75***															
30–39	0.11	0.15	0.19															
40–49	0.1	−0.04	0.12															
50–59	0.11	0.11	0.11	−0.03	0.40**	−0.07	−0.28	−0.1	−0.13	−0.16	−0.22	−0.44	−0.16	0.45***	0.04	−0.77**	0.03	0.18
60-69 (reference)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
70–79	0.01	0.49**	0.51***	0.18***	0.11	0.35*	0.36	0.25***	0.08	0.16	0.23	−0.32	0.37**	−0.05	0.11	−0.1	0.51***	0.30**
80+	0.34**	1.32**	1.10***	0.75***	0.64***	1.37***	1.25***	0.68***	0.34***	0.86***	1.22***	0.26	1.17***	0.13	0.67***	0.65**	1.08***	0.98***
Education level																		
Low (reference)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Medium	−0.31***	−0.61***	−0.61***		−0.52***	−0.54***	−0.32	−0.46***	−0.33***	−0.67***	−0.09	−0.68***	−0.50***	−0.26*	−0.34***	−0.49*	−0.61***	−0.49***
High	−0.89***	−1.19***	−1.24***		−0.57***	−1.07***	−0.46**	−0.60***	−0.43**	−1.25***	−0.44*	−0.72**	−0.71***	−1.04***	−1.04***	−0.81**	−1.50***	−1.20***
Missing		0.49	0.16		−0.45			−1.50**		0.68		0.39	0.21	−1.01	−0.1			
Response																		
Only centimetres	(reference)		0.68*															
Only feet inches	−0.40***	(reference)	(reference)															
Combination	1.15***	1.39***	1.13***															
Constant	−1.93***	−2.44***	−2.34***	−1.99***	−1.94***	−2.69***	−3.25***	−0.93***	−1.36***	−2.78***	−3.09***	−2.30***	−2.88***	−0.88***	−1.66***	−2.29***	−1.72***	−1.94***
Number of observations	11,865	5,938	11,997	45,683	3,010	4,262	3,432	4,537	3,568	3,076	3,291	2,539	4,190	1,550	4,312	1,090	2,318	4,453

Note: *p < 0.10; **p < 0.05; ***p < 0.01.
[a] This model controls for country (country coefficients not shown).

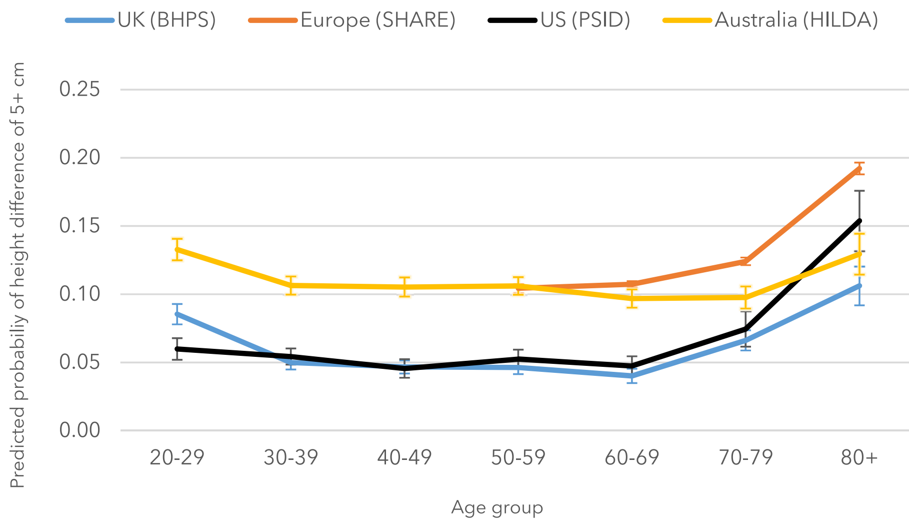

Fig. 1. Predicted probability of reporting two heights that differ by 5 cm or more, by age group and survey.

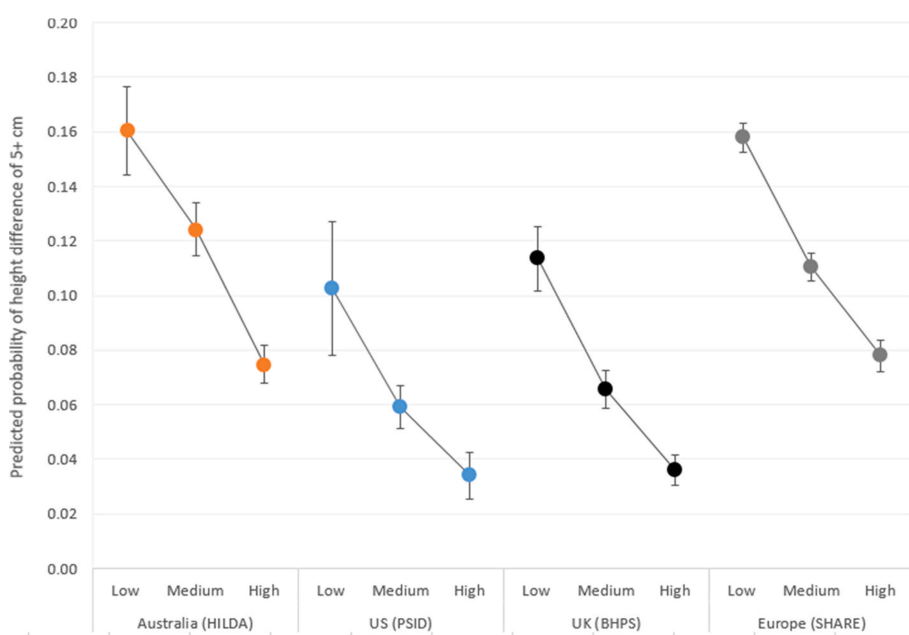

Fig. 2. Predicted probability of reporting two heights that differ by 5 cm or more, by highest education level and survey.

North America (M = 1.2 cm), while the smallest overestimation was in the Netherlands (M = 1.0 cm) (Krul et al., 2011). Less research has been conducted in lower income countries, but a study by Ng (2019) comparing differences in self-reported height in China, India, Russia, and South Africa found that in China and Russia, height was overestimated by 0.93 cm and 0.42 cm, respectively, whereas in India and South Africa self-reported height was underestimated by 5.88 cm and 3.24 cm respectively.

One possibility for the large differences across countries in the reliability of self-reported height could be due to differing degrees to which height is commonly referenced in everyday life; for example through the inclusion of height in identity documents or other commonly referenced documents. In the United States, the fact that height is included in most states driver's licences is likely one factor in the high reliability of reports across time in the PSID. In contrast, most European Union countries do not include height in drivers licences. In Australia, height is not included on drivers licenses, except in the state of Queensland where a persons' height was listed in centimetres up until October 2016. In some European countries such as Sweden, height is included on personal identification cards as well as in passports, but in the United Kingdom it is not.

Within all the countries studied in this paper, there were clear significant sub-groups of the population who appear to be unsure of how tall they are and as a result give different answers each time. The strongest finding was the link between education levels and the consistency of height reports. In this paper we are using education as an overall proxy for socio-economic status. Individuals with lower levels of education were significantly more likely to give two different height reports that differed by 5 cm or more. The reasons for the relationship between education levels and incidence of height misreporting are unclear, but one of the reasons put forward by Gil and Mora is that 'better informed individuals or individuals who have to be measured more frequently because of their health status will tend to declare their weight and height more accurately' (2011, p. 82).

It is possible that if lack of knowledge regarding height is due to the lack of frequency in which most adults get measured, that those with a higher level of education are exposed to more occasions when their height is measured, for example at a gym, for clothes fitting or at medical appointments. Alternatively, it is possible that people with a higher level of education may have higher levels of numeracy, and be able to remember their height, or perhaps they are more likely to understand the importance of providing accurate information for a survey and take the time to measure themselves if they do not know their height. However, this is unlikely to be the case in the CATI surveys conducted in the USA, UK and Europe.

Older age was also a strong predictor of inconsistency in height reports, and in the United Kingdom and Australia people in their twenties also had a higher likelihood of inconsistent or unreliable answers. The higher inconsistency of younger people is also in line with validity studies which have found that younger people more likely to overestimate their height compared to middle-aged people (Krul et al., 2011; Chernenko et al., 2019). Among the elderly it is possible that inconsistent answers could also be an early indicator of dementia (Schneider et al., 2021).

Sex was an important predictor in several European countries, but not in others. This result is also in line with validity studies which shows mixed results, with some studies reporting that men and women are no different in their propensity for overestimation (Strauss et al., 1999; Taylor et al., 2006; Dekkers et al., 2008; Lassale et al., 2013). Other studies find that men are more likely to overestimate their height (Stewart et al., 1987; Flood et al., 2000), but others find women are (Avila-Funes et al., 2004; Bowring et al., 2012).

In Australia, we also found that misreporting was significantly higher when respondents alternated between imperial and metric systems across the two-time points. In Australia, the Metric Conversion Act passed in 1970 made the metric system the sole system of legal measurement. Yet, for some measurements such as height, some people still commonly use the imperial system. Younger generations would have grown up learning the metric system in school, however, may have been taught the imperial system by their parents. In other countries such as the United Kingdom, which have also undergone some degree of metrication the imperial system is very much still in use with much of the population not having a good understanding of metric measurements (Paice, 2014). We note that this does not seem to have effected consistency of height reports in the results from BHPS.

5. Conclusion

The monitoring and surveillance of overweight and obesity will continue in the future to depend heavily on self-reported height and weight, due to the ease and cost-effectiveness at which these measures can be collected in surveys (Taylor et al., 2006). When anthropometric measurement questions are included in surveys, particularly in high income countries, the assumption is that most respondents will have enough knowledge to respond reasonably accurately.

However, extensive validity studies have highlighted that people will often underestimate their weight, and overestimate their height leading to biased BMI scores and an overall underestimation of obesity prevalence. While validity studies find that self-reported measures of height tend to be overestimations there is still little understanding of the reasons for this. Social desirability is one possibility, but our study indicates that lack of knowledge about one's height is another major driver in some cases.

In this paper we found that across multiple surveys there are clear subgroups of people, including the elderly and those with lower levels of education were identified as those most likely to give inconsistent and unreliable answers. The problem is exacerbated in countries such as Australia where the imperial system is still widely used in society for reporting height, although the metric system is the official one. For researchers using self-reported height to calculate BMI extra care should be taken particularly in countries such as Australia which use both the metric and imperial system.

Knowledge about one's own height can be thought of as a continuum. On one end there are people who are certain about how tall they are, perhaps due to recently having been measured. In a survey environment these respondents would give a valid answer, and an answer that would reliable if they were asked multiple times to report their height. Then there are people who may have less certainty, but have some idea of how tall they are. In surveys they may engage in end-digit preference, reporting a height that is rounded up or down. When asked repeatedly to report their height they may give the same answer every time or at least answers within a narrow range. At the other end there may be people with very poor knowledge of their height. These respondents may also engage in end-digit preference but would display large inconsistencies and unreliable answers in a longitudinal survey.

Given that particular groups of the population provide inaccurate reports, understanding the traits of inaccurate reporters is particularly crucial as the bias introduced by their misreported height, could have ramifications for health planning for these populations (Gorber et al., 2007). If a large part of misreporting is due to lack of knowledge, for more accurate self-reports of height, survey questions could be adjusted to give respondents more guidance if they do not feel comfortable that they know their height. Simple instructions such as asking people to take a moment to measure their height against a wall, if they are unsure about their height may improve data quality. In countries where different measurement systems are used within the population, like Australia, adding an instruction for respondents only to answer their height in the system (imperial or metric) that they are most comfortable or knowledgeable with could also improve results.

Due to the cross-national nature of the data used in this study we were unable to include a wider range of possible explanatory variables that may correlate with inconsistent reporting including frequency of physician visits or ethnicity. The fact that both metric and imperial measurements were included also limited our ability to examine end-digit preference in further detail, and its link to inconsistent reporting. In examining the SHARE data we found a strong relationship between end-digit preference and inconsistent reporting both at the individual and country level which would suggest that in the absence of longitudinal data, end-digit preference could be an alternative indicator of end-digit preference in countries using the metric system. Further research would be useful to examine the consistency of height reporting in more detail in individual countries or surveys.

Understanding the characteristics of misreports, can also help develop more effective correction factors or adjustment formulas which are sometimes used to calculate BMI scores based on self-reported data (Stommel & Osier, 2013). However, when calculating adjustment researchers must take into consideration the particularities of the data or country setting as models for one population or country may not be applicable to other populations (Ng, 2019).

Declarations of interest

None.

Ethical statement

Declarations of interest: none.

Author statement

Ann Evans: Conceptualization; Methodology; Investigation; Writing- Original Draft; Writing- Review & Editing; Supervision.

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Data availability

The authors do not have permission to share data.

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