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Differences between self-reports and measurements of weight in a Dutch sample

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ABSTRACT

The accuracy of self-reports is examined by measuring how closely they agree with actual measurements, where these are available. Previous research has suggested that there are differences between self-reports and measurements of weight. Nevertheless, empirical findings are inconclusive, and the determinants of misreporting have been examined in isolation. The study aimed to investigate the differences between self-reports and actual measurements of weight, whether gender, weight status, and age were related to these differences, and if weight reporting accuracy changed after frequent measurements of weight. Using a representative sample of Dutch individuals from the Longitudinal Internet Studies for the Social Sciences Panel, the study supported that on average participants underestimated their weight. No significant gender differences were found. Individuals with higher body mass index (BMI) underestimated their weight more than those with lower BMI, and the underestimation of weight was larger as individuals got older. Participants were more accurate reporters of their weight after frequent weighing. The findings of the study suggest that individuals underreport their weight in self-reports in systematic ways in this population. Researchers should consider collecting direct measurements to have reliable results or instruct respondents to weigh themselves before they are invited to report it.

Keywords: weight measurement, misreporting, secondary analysis, self-report, survey research

INTRODUCTION

A common way of assessing participants' characteristics and behaviors in research and clinical practice is by asking them to provide self-report measurements. Their responses, which are considered as indicators of their characteristics and behaviors, consist of two components: the true score, which reflects the respondent's situation, plus some error [1]. Errors can be random and systematic. A random error can vary across respondents and within a respondent depending on the occasion [2]. If the error is random, the answers will err sometimes in one and sometimes in the other direction due to unknown sources [1]. A systematic error reflects the tendency of the respondent to overreport or underreport [2]. The answers systematically differ from the true score in one direction and may reflect specified situational or individual effects [3-5].

Height, weight, and consequently body mass index (BMI), which is used to classify individuals into underweight, normal weight, overweight and obese categories, are important indicators of population health. They are convenient indices used to identify and monitor obesity, eating disorders and other health conditions [6, 7]. Unlike actual measurements, self-report measures are commonly used to collect height and weight data since they are convenient, time-saving, low cost, require no training or equipment to record, and allow for sampling large numbers of participants [8]. A question however arises about whether self-reported instead of actual measurements in assessing height and weight can be trusted.

The difference between self-reports and actual measurements of height and weight is defined as a reporting error. Empirical findings indicate that individuals in general tend to overestimate their height and underestimate their weight and BMI, with the degree of discrepancy varying across different demographic, psychological, behavioral or other characteristics [8]. It is important to identify the factors that affect the accuracy of self-reports and the extent of this inaccuracy as it appears to have a large effect on the estimates of the prevalence of obesity and other health conditions [9].

The gender of individuals appears to play a role in misreporting of weight, with previous studies suggesting that females exhibit a higher degree of underestimation compared to males [9, 10]. Possible reasons could be the greater emphasis that females give on thinness and the pressure they may perceive to conform to cultural norms for appearance [11].

Misreporting of weight relates to BMI classification, with previous studies supporting that individuals with higher BMI tend to underreport their weight [9, 12]. Possible reasons could be that they are more dissatisfied with their body [13], are less likely to weigh themselves [14], or desire to appear thinner influenced by societal norms [15]. Normal weight individuals were found to report their weight more accurately than obese individuals, by underestimating their weight by an average of 0.20 kg compared to an average of 2.50 kg respectively [16]. This finding may reflect "a social desirability bias towards low weight" [16]. It was also found that those with BMI below 18.5 kg/m² tend to overestimate their weight [17], probably influenced by societal norms for 'ideal' weight of being slim but not too skinny [15].

The age of individuals also seems to be associated with their weight reporting, with some previous studies documenting that older adults tend to underestimate their weight [18, 19]. Possible reasons of misreporting may be memory problems [20] or unawareness of changes in their bodies with ageing [18]. Some studies found that older females underestimate their weight more than older males [21], and others that older males underestimate more than older females [22, 23]. Although older adults appear to underestimate their weight, when younger and older ones were compared, there is additional evidence that the underestimation of weight was greater among the younger ones [24].

It has been found that individuals who weigh themselves often, estimate their weight more accurately than those who do not [9, 25]. It was found that females who weighed themselves at least once a month were more accurate reporters of their weight compared to those who weighed themselves less frequently [26]. Among males, that difference was not statistically significant. It was not found strong evidence that recent measurements of weight increased the accuracy of self-reporting in older people [18].

Obtaining objective measures for height and weight is one way to deal with the inaccuracy of self-reports. It was strongly suggested the use of objective measures instead of self-reports of height and weight, highlighting the fact that self-reports are not reliable [27]. Recent technological advances could help researchers collect objective measures easily and timely, with low cost, higher quality and no geographical limitations [28]. The development of online surveys and panels could certainly help researchers collect objective measures from representative samples of the general population, as well as to assess these anthropometric measurements at different points in time.

This study aims to examine the differences between self-reported and measured weight, and whether these differences relate to demographic factors such as gender, BMI, and age. In addition, it aims to investigate whether participants become more or less accurate reporters of their weight after a year of participating in a study that requires regular weight measurements. For the present secondary analysis, data from the Longitudinal Internet Studies for the Social Sciences (LISS) Panel administered by CentERdata (Tilburg University, The Netherlands) were used. The hypotheses of the study were, as follows:

1. **H1:** In their self-reports participants will on average underestimate their weight.
2. **H2:** Females will underestimate their weight more than males, those with higher BMI will underestimate it more than those with lower BMI, and younger adults will underestimate it more than older adults.
3. **H3:** Participants will report their weight more accurately after frequent measurements of weight.

METHOD

The Longitudinal Internet Studies for the Social Sciences Panel

The LISS panel is a representative sample of Dutch individuals who participate in monthly Internet surveys operated by CentERdata at Tilburg University [28, 29]. The panel is based on a true probability sample of households drawn from the population register by Statistics Netherlands. Households that could not otherwise participate are provided with a computer and Internet connection. A longitudinal survey is fielded in the panel every year, covering a large variety of domains including health, work, education, income, housing, time use, political views, values and personality [28].

The process began with an invitation to panel members to participate in the LISS Weighing Project, a three-year longitudinal study [29]. They were informed that a limited number of weighing scales were available and that a random sample of panel members would receive a scale. Instruction videos were given in the invitation to inform the members about their participation and to minimize the chances of refusals because of the respondents' fear of not being able to install the scale and connect it to the Internet [29].

About 1,000 households were randomly selected in which at least one member was willing to participate. For logistic reasons, the scales were distributed in several batches during the first quarter of 2011, and as a result the date of the first measurement varied across participants [28, 29].

Participants were provided with an advanced device that measured body weight, and wirelessly sent the information to the LISS database to minimize the role of the participants in transferring information. They were instructed to step on the scale without shoes and always at the same time of the day, wearing similar clothes. Researchers randomized the frequency with which participants were requested to step onto the scale, i.e., once a day, once a week, or unspecified [28]. Weight was measured to the nearest 0.1 kg.

Participants also provided self-reports of their weight about one to two months (in November or December 2010) before the Weighing Project was implemented, as part of a questionnaire on health. Panel members were asked the following questions: "how tall are you?" (in cm) and "how much do you weigh, without clothes and shoes?" (in kilos). At that point, respondents were not aware about the upcoming actual measurements of weight. For height, there were only self-reported values [28].

Secondary Data Analysis Procedure

To gain access and permission to use the data of the LISS Panel, a statement concerning the use of the data was completed and signed. Data from the Core Study Health (Wave 4) were downloaded from the LISS website (www.lissdata.nl). In Wave 4, self-reported height and weight data were collected in November 2010. The questionnaire was repeated in December 2010 for those that had not completed it in November 2010 [30]. Data from the Weighing Project were also downloaded from the website. The Weighing Project collected objective measurements of weight. For the purpose of the present secondary analysis, measured weight data collected at the beginning of the Weighing Project (i.e., January 2011) were selected [28].

A data file was created after merging the files with self-reported and measured weight of the same participants. It is important to note that the researchers did not distribute all the 1,000 scales at once. Specifically, we included the datafile of January 2011, with actual weight measurements close to the preceding self-reports, which includes the measurements of 371 participants. Six cases were missing from Wave 4, so the final file that was used for the present analysis included 365 participants. The frequency with which each participant stepped onto the scale varied. To avoid reactivity on behalf of the participants, it was decided to use only the first measurement of each participant for the analysis.

To examine the change in the reporting error in weight after a year of participating in the study, self-reported and measured weight values of the same participants, collected in 2010 (T1) and a year later (T2) were compared. As described above, for T1, self-reported data were collected in November 2010 (Core Study Health–Wave 4) and measured data in January 2011 (Weighing Project). It is important to note that participants were measured in January 2011 for the first time. For T2, self-reported (Core Study Health–Wave 5) and measured data (Weighing Project) were collected in November 2011.

Sample

A total of 365 participants (N_{males}=183, $N_{females}$=182) aged 16 to 88 years (*M*=50.49, *SD*=15.33) self-reported and measured their weight (in kilograms) and were analysed to examine the reporting error in weight for T1. A total of 255 participants (N_{males}=127, $N_{females}$=128) aged 16 to 86 years (*M*=52.39, *SD*=14.61) at T1 were also analysed to examine the reporting error in weight after a year of participating in the study. One hundred and ten cases were lost from T1 to T2 due to missing ID or weight data in T2 (50% male, age *M*=46.43 and *SD*=16.04).

We compared those who were selected and had their first measurement in January 2011 (*N*=365) to those that had their first measurement in the following months of the project, and were excluded from the analysis, to check whether they differed in terms of age and gender. The latter group comprised 532 respondents (N_{males}=258, $N_{females}$=274) with an average age of 49.52 years (*SD*=15.98). Respondents that were selected did not significantly differ from those that were not included in terms of age, $t(895)=-0.90$, $p=.37$, and gender, $\chi^2(1)=0.23$, $p=.63$.

Statistical Analysis

The reporting error for weight was calculated using the following formula:

Weight reporting $error_i$=Self-reported $weight_i$-measured $weight_i$ for every individual *i*.

Cohen's *d* was used to evaluate the differences, with the values of 0.2, 0.5, and 0.8 indicating small, medium and large effect sizes, respectively [31]. Independent samples *t*-tests were performed for gender differences. Hierarchical multiple regressions were performed to examine quadratic relations. Pearson's *r* correlations were also conducted for the weight reporting error with age and BMI. BMI was calculated from self-reported height (measured height was not collected) and measured weight for each participant, with the following formula:

$$BMI_i = \frac{weight\ (in\ kg)_i}{height^2(in\ cm)_i} \times 10{,}000,$$

for each individual *i* [32]. Individuals were categorized as underweight (BMI<18.5 kg/m^2), normal weight (BMI 18.5-24.9 kg/m^2), overweight (BMI 25-29.9 kg/m^2), and obese (BMI≥30.0 kg/m^2). Paired samples *t*-test was performed to compare the reporting error in weight in T1 and T2, as well as Pearson's *r* correlations to examine the relationship between the weight reporting error and age at T2.

RESULTS

Overall Sample Statistics

Table 1 shows descriptive statistics for the main variables.

The mean measured weight was 79.88 kg, which is 1.61 kg higher than the mean self-reported weight of 78.27 kg. Preliminary analysis indicated that there were outliers for the weight reporting error. Four cases, all females, with reporting error |*z*-scores|>3 were flagged as outliers. Three of these cases underreported weight (by -14.2, -26.8, and -33.8 kg) and the other case overreported weight (by 9 kg). The mean reporting error for the overall sample without the four outliers was -1.45 kg[1].

One sample *t*-tests (two-tailed) indicated that participants on average underreported their weight. The reporting error in weight was significantly different from zero for the overall sample, $t(360)=-10.85$, $p<.001$, $d=-0.57$; for males, $t(182)=-.48$, $p<.001$, $d=-0.55$; and for females, $t(177)=-7.86$, $p<.001$, $d=-.59$[2]. Participants on average underestimated their weight and the reporting error in weight was significantly different from zero with medium effect sizes for the overall sample and gender subgroups.

[1] Henceforth, all analyses in the manuscript do not include outliers. Results with the four outliers included can be seen in [33].

[2] One-tailed one-sample *t*-tests were also performed to test if the reporting error in weight is significantly different from zero, and the results were similar.

Table 1. Descriptive statistics for the main variables

Variable	*N*	Range	Mean *(SD)*	Skewness *(SE)*	Kurtosis *(SE)*
Age	365	16-88	50.49 (15.33)	-0.07 (0.13)	-0.64 (0.26)
Measured weight	365	47.40-129.70	79.88 (16.02)	0.60 (0.13)	0.14 (0.26)
Self-reported weight	365	50.00-127.00	78.27 (15.30)	0.54 (0.13)	-0.03 0.26)
Reporting error (kg)					
Overall (with four outliers)	365	-33.80-90	-1.61 (3.42)	-3.54 (0.13)	29.04 (0.26)
Overall	361	-10.60-7.10	-1.45 (2.54)	-0.41 (0.13)	1.38 (0.26)
Males	183	-10.10-5.80	-1.43 (2.59)	-.051 (0.18)	1.13 (0.36)
Females	178	-10.60-7.10	-1.47 (2.49)	-0.29 (0.18)	1.77 (0.36)

Table 2. Descriptive statistics for the BMI categories

BMI categories	*N*	Measured weight: *Mean (SD)*	Self-reported weight: *Mean (SD)*	Reporting error: *Mean (SD)*
Underweight	8	53.94 (3.92)	54.75 (3.01)	0.81 (1.36)
Normal weight	161	68.82 (8.80)	67.97 (8.88)	-0.85 (2.18)*
Overweight	132	84.42 (9.48)	82.66 (9.79)	-1.76 (2.38)*
Obese	60	101.58 (12.75)	98.90 (12.10)	-2.68 (3.19)*

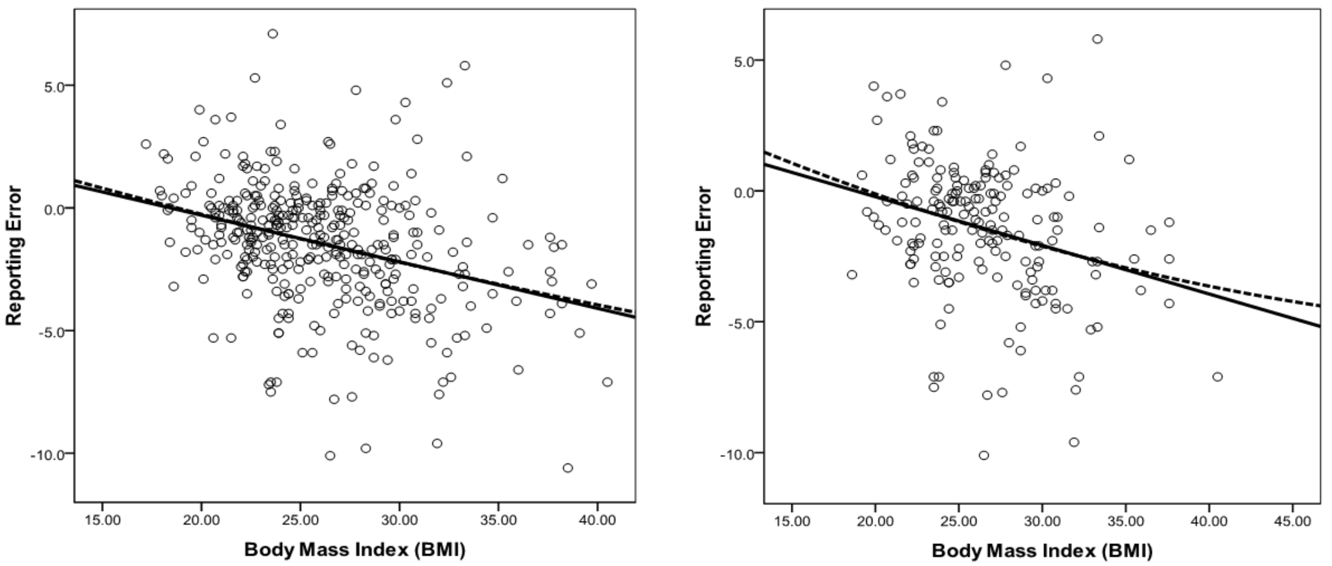
Note. $^*p$<.001

Weight Reporting Error and Gender and BMI Differences

An independent samples *t*-test indicated that the difference between males and females was not significant, *t*(359)=0.13, *p*=.90[3].

Table 2 presents descriptive statistics for the underweight, normal weight, overweight and obese individuals. The mean measured weight was higher compared to self-reported weight for all BMI categories, apart from the underweight participants. One sample *t*-tests (two-tailed) indicated that the reporting error in weight was significantly different from zero for the normal weight individuals, *t*(160)=-4.95, *p*<.001, *d*=-.39; for the overweight, *t*(131)=-8.50, *p*<.001, *d*=-0.74; and for the obese, *t*(59)=-6.49, *p*<.001, *d*=-0.84; but not for the underweight participants, *t*(7)=1.68, *p*=.14. The *d* values indicated a small effect size for the normal weight individuals, medium effect sizes for the overweight participants, and a large effect size for the obese individuals. To sum up, participants in all BMI categories, apart from the underweight individuals, significantly underestimated their weight.

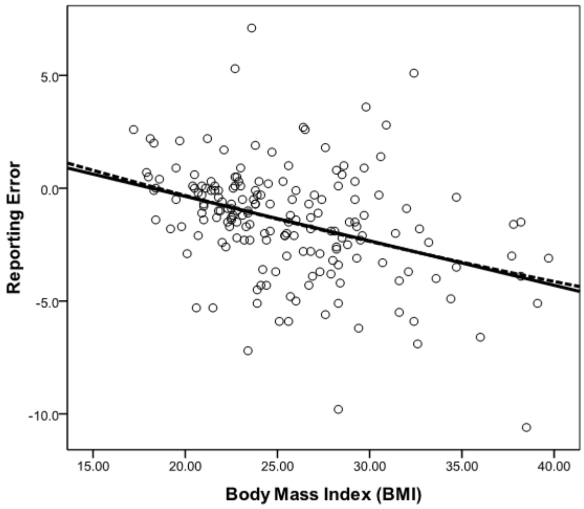
Based on previous findings suggesting that the heavier individuals tend to underestimate their weight, thinner individuals to overestimate it, and the normal weight individuals to slightly underestimate it [12, 16, 17], we examined the relationship between BMI and the reporting error in weight using both linear and quadratic functions (**Figure 1**). We also examined a cubic term, which did not improve the *R*-squared greatly as compared to quadratic function and is not presented in the analysis. As the visual representation of the data suggests there is more underreporting at higher BMI. Hierarchical multiple regressions were conducted with the reporting error in weight as the dependent variable. BMI was entered at stage one of the regression and represented the linear function. A variable that



(a) (b)

Figure 1. Scatterplots of the reporting error in weight & BMI for the overall (a), male (b), & female (c) samples (solid line: linear & dashed line: quadratic) (Adapted from [33])

[3] All group mean comparisons were also checked with a non-parametric Mann-Whitney test to verify the conclusions of the independent samples *t*-tests.



(c)

Figure 1 (continued). Scatterplots of the reporting error in weight & BMI for the overall (a), male (b), & female (c) samples (solid line: linear & dashed line: quadratic) (Adapted from [33])

represented the quadratic function was calculated (BMI squared) and entered at stage two. Adding a quadratic component to the model did not produce a significant *F* change in the overall sample or when the model was estimated on males and females separately, suggesting that the relationships between BMI and the reporting error for weight can be represented by a linear function. Pearson's correlation coefficients were calculated to examine the strength of the relationship. The reporting error in weight and BMI were negatively correlated, Pearson's r=-.33, p<.001 for the overall sample, r=- .29, p<.001 for males, and r=-.37, p<.001 for females. Participants with higher BMI tend to underestimate their weight more, i.e., larger negative bias, than participants with lower BMI.

Reporting Error and Age Differences

We examined the relationship between age and the reporting error in weight using both linear and quadratic functions (**Figure 2**). Adding a cubic term did not improve the *R*-squared greatly as compared to quadratic function and was not used in further analysis. A non-linear relation between age and the reporting error in weight cannot be detected graphically. As with BMI, hierarchical multiple regressions were conducted and no quadratic relations between age and the reporting error in weight were found.

Age and the reporting error in weight had a weak negative correlation, r=-.17, p=.02 for males; and r=-.11, p=.04 for the overall sample, but were not significantly correlated for females, r=-.05, p=.53. Underreporting of weight tends to be slightly larger as individuals, and specifically males, get older.

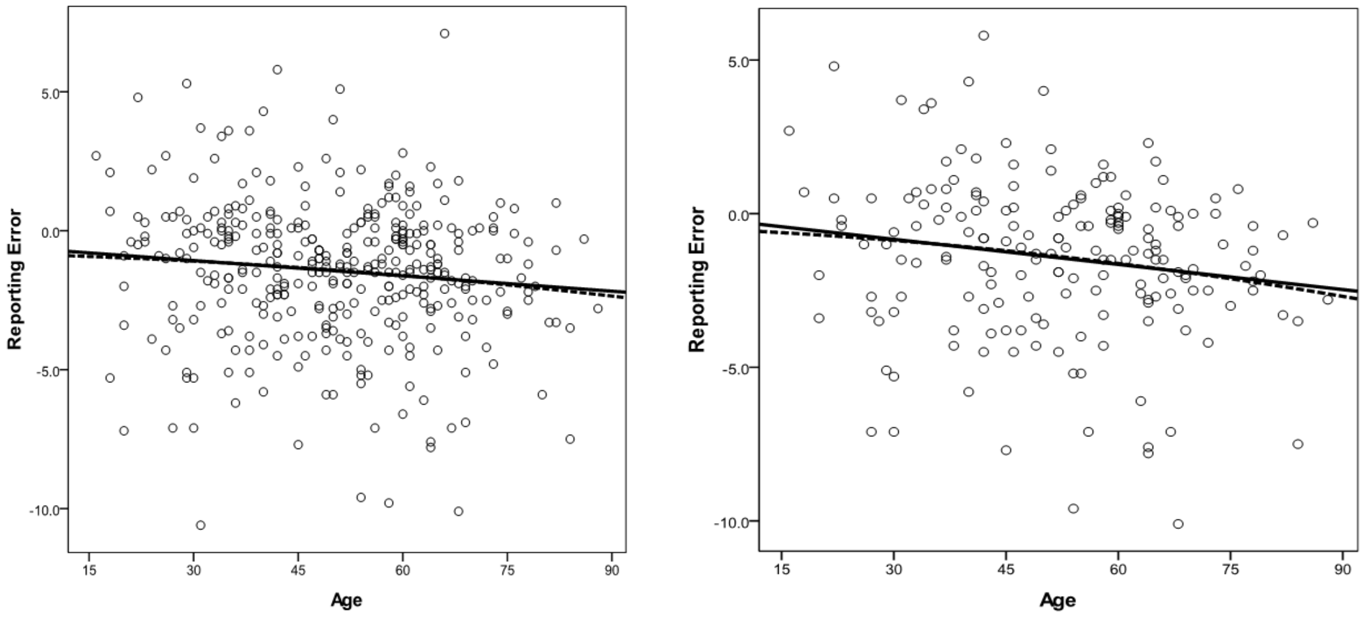


Figure 2. Scatterplots of the reporting error in weight & age for the overall (a), male (b), & female (c) samples (solid line: linear & dashed line: quadratic) (Adapted from [33])

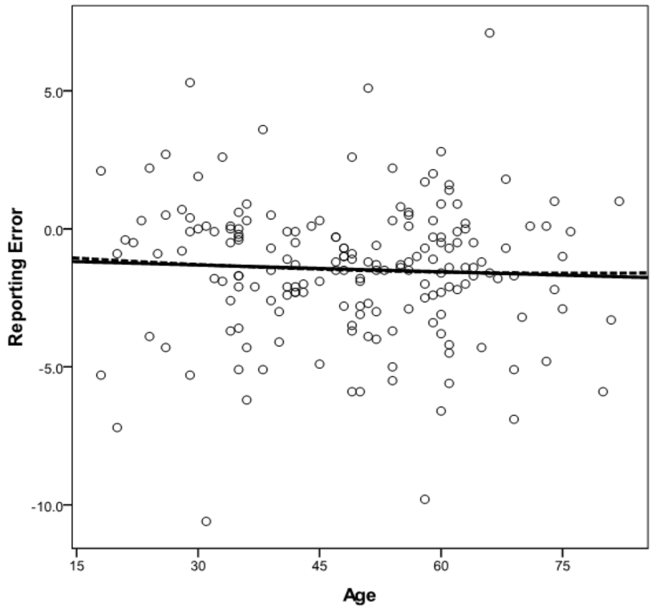


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Figure 2 (continued). Scatterplots of the reporting error in weight & age for the overall (a), male (b), & female (c) samples (solid line: linear & dashed line: quadratic) (Adapted from [33])

Table 3. Descriptive statistics for reporting error in T1 and T2

Reporting error (kg)	*N*	Mean (*SD*)		Range		Skewness *(SE)*		Kurtosis *(SE)*	
		T1	T2	T1	T2	T1	T2	T1	T2
Overall	249	-1.39 (2.25)	-0.60 (1.03)	-7.8-5.3	-4.5-2.5	-0.19 (0.15)	-0.69 (0.15)	0.56 (0.31)	1.03 (0.31)
Males	126	-1.34 (2.25)	-0.62 (0.98)	-7.8-4.3	-4.5-2.5	-0.49 (0.22)	-0.69 (0.22)	0.74 (0.43)	2.44 (0.43)
Females	123	-1.44 (2.24)	-0.57 (1.08)	-6.9-5.3	-3.5-1.6	0.12 (0.22)	-0.70 (0.22)	0.51 (0.43)	0.10 (0.43)

Comparison of the Reporting Error in Time 1 and Time 2

For comparing the reporting error in weight in T1 and T2, data from participants who had self-reported and actual weight data at both time points were used (*N*=255). Six cases (five females) with reporting error |*z*-scores|>3 were flagged as outliers and removed from the analysis[4]. Descriptive statistics can be seen on **Table 3**. One sample *t*-tests showed that the reporting error in weight was significantly different from zero, for T1, *t*(248)=-9.78, *p*<.001, *d*=-0.62, and for T2, *t*(248)=-9.17, *p*<.001, *d*=-0.58, indicating medium effect sizes. There was a significant difference in the reporting error in weight in T1 (*M*=-1.39, *SD*=2.25) and T2 (*M*=-0.60, *SD*=1.03), *t*(248)=-5.26, *p*<.001, *d*=-0.33. On average reporting was more accurate in T2 than T1 with a small effect size. Weight reporting errors at T1 and T2 were not significantly correlated, *r*=.10, *p*=.14.

Paired-sample *t*-tests were performed to compare the reporting error in weight in T1 and T2 separately for males and females. There was a significant difference in the reporting error in weight in T1 (*M*=-1.34, *SD*=2.25) and T2 (*M*=-0.62, *SD*=0.98), *t*(125)=-3.18, *p*=.002, *d*=-0.28 for males. There was also a significant difference in the reporting error in weight in T1 (*M*=-1.44, *SD*=2.24) and T2 (*M*=-0.57, *SD*=1.08), *t*(122)=-.36, *p*<.001, *d*=-0.39 for females. The reporting error in weight also decreased from T1 to T2 for both males and females with small effect sizes. The reporting error in weight was smaller (in absolute value) in T2 for the overall group, for males and for females. After about a year of frequent measurements of weight, participants appear to become more accurate reporters of their weight, i.e., underestimate their weight less in T2 compared to T1.

It was previously found that the underestimation of weight tends to be slightly larger as individuals, and particularly males, get older in T1. We now examine the relation between the reporting error in weight and age in T2, after frequent measurements of their weight. As shown in **Figure 3**, the relation between age and the reporting error in weight in T2 was represented by both linear and quadratic functions. A cubic term did not improve the *R*-squared greatly as compared to quadratic function.

Overall, the hierarchical multiple regressions revealed no quadratic relations between the reporting error in weight and age at T2. Age and the reporting error in weight were not significantly correlated for males, *r*=.11, *p*=.22, but weakly correlated for the overall sample, *r*=.14, *p*=.02; and for females, *r*=.18, *p*=.04. The weak positive association results indicate that after frequent measurements of weight, the underreporting of weight tends to be less pronounced as individuals, particularly females, get older.

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[4] Two of these cases had reporting error |*z*-scores|>3 in both T1 (by -10.1, 7.1 kg) and T2 (by -7.7, 6.5 kg). The other two cases had reporting error |*z*-scores|>3 in T1 (by -14.2, 9.0 kg) and the other two in T2 (by -9.4, -9.1 kg).

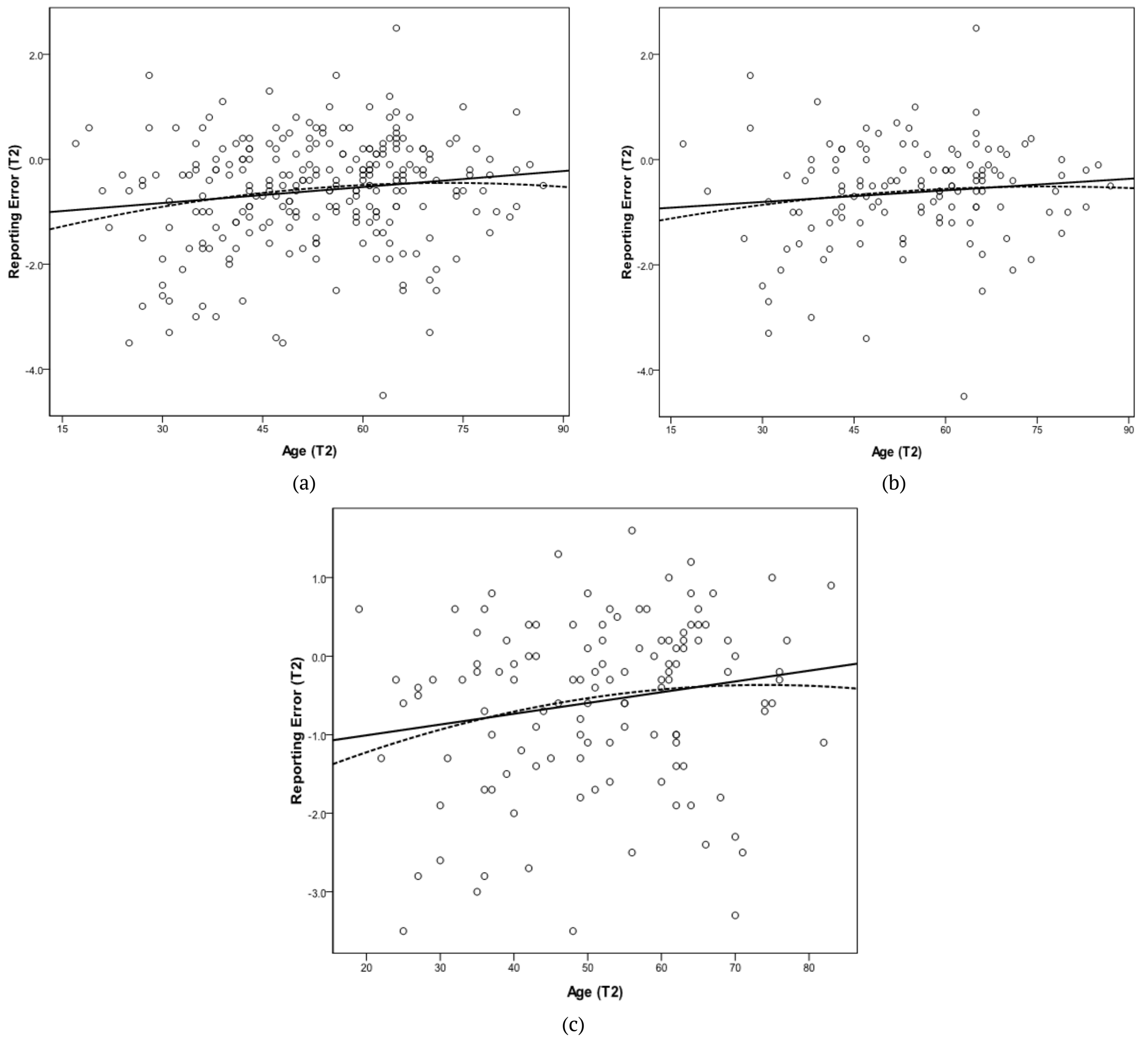

Figure 3. Scatterplots of the reporting error in weight & age at T2 for the overall (a), male (b), & female (c) samples (solid line: linear & dashed line: quadratic) (Adapted from [33])

DISCUSSION

The present study aimed to examine the differences between self-reported and measured weight and investigate the role of gender, weight status and age in relation to the accuracy of self-reports in a representative sample of Dutch individuals from the LISS Panel. The study also aimed to investigate whether respondents become more or less accurate reporters of their weight after a year of participating in the study requiring frequent measurements of weight, and whether these tendencies are different for males and females, for younger and older participants.

The findings of the study provide evidence that there were differences between self-reports and actual measurements of weight in this sample. In general, participants were not accurate reporters of their weight, as their mean self-reported weight was 1.45 kg lower than the mean measured weight. On average, participants underreported their weight with medium effect sizes, and the mean reporting error in weight was significantly different from zero. These findings support the well documented underreporting of weight [10]. It was found 1.1 kg mean weight underreporting in a Dutch sample [34], with more accurate reporting by young males. In an overweight working sample in the Netherlands weight underreporting was on average 1.4 kg. [35].

Previous studies found gender differences in the misreporting of weight, and specifically that females tend to underestimate their weight significantly more than males in the Netherlands [36] and elsewhere [9, 10]. In the current data the underestimation of weight was more pronounced in females than males, but the difference was not significant. This may be explained by the fact that there is an increase in underestimation of weight in males due to the increasing male body dissatisfaction and the prevalence of severe weight and shape control behaviors in recent years [37].

Individuals with higher BMI appear to underreport their weight more than those with lower BMI with medium and large effect sizes [9, 12]. It was also found that the mean measured weight was higher than the mean self-reported weight for all BMI categories, apart from the underweight individuals. These findings may be explained by the tendency of individuals with higher weight to experience more weight fluctuation [38] and by the 'flat slope syndrome' [39, 40]. According to this pattern, people tend to underestimate high values and overestimate low values. Overweight and obese people may underestimate their weight more since they might be dissatisfied with their bodies, weigh themselves less frequently, or desire to appear thinner according to societal norms [9, 13-15]. Normal weight individuals may also underestimate their weight, but in a lesser extent, due to their desire to appear thinner according to societal norms [16]. Underweight people may overestimate their weight due to the fact that they are influenced by societal norms to have an ideal and desirable weight of being slim but not too skinny [15]. However, the overestimation of underweight individuals was not significantly different from zero in the present study, possibly due to the small sample size.

The findings of the study also suggest that the underestimation of weight tends to be slightly larger as individuals, and specifically males, get older. Some previous studies indicated that older adults tend to underreport their weight [18,19], and also that older males tend to underestimate it more than older females [22, 23]. It is evident that as people get older, there is a decrease in fat-free mass and body water and an increase in body fat [41]. Many older adults and particularly males may not be aware about these changes in their bodies or may recall their weight from earlier years. Possible reasons could be that unlike older males, older females may be more aware about these bodily changes due to the fact that they weigh themselves more regularly, visit their doctors more frequently or due to the occurrence of osteoporosis, which is more common in females and is related, among others, to weight changes [23, 42].

With regard to the longitudinal component of the study, both males and females became more accurate reporters of their weight after a year of participating in the study that involved frequent weighing. These findings are in line with previous studies, which found that people who weighed themselves more often estimated their weight more accurately [9, 25, 43]. But, unlike the present study, these previous studies examined weighing frequency using questionnaire responses. It is not surprising to assume that participants become more aware about their weight values after frequent objective measurements of their weight. An alternative explanation could be that the respondents have realized that the information they have provided about their weight the first time did not carry any negative consequences for them. Consequently, at subsequent times when they were asked to report their weight, there was less motivation to misreport their answers and possibly this was the reason that they underreported less [44]. In contrast to findings in [18] that there is no strong evidence that recent measurements increase the accuracy of reporting in older adults, we found that after frequent measurements of weight the underreporting of weight tends to be less pronounced as females, specifically, get older. Frequent measurements of weight may help older people to be more aware about their weight values or to remember their body weight more accurately. A more general implication from this finding concerns the criticism for the inaccuracy of self-reports: if opportunities for actual, reliable measurements of a characteristic are routinely available to individuals, then over time their perceptions and reporting of those quantities could become more accurate.

The main strengths of the study were the representative sampling in the original study and the fact that the actual measurements were collected at participants' homes and can be considered more ecologically valid; data were wirelessly sent to the LISS database and therefore minimized recording errors and the role of participants in transferring information. The study protocol and methodology were detailed, as researchers instructed all participants to weigh themselves following the same specific guidelines. The analysis had some methodological strengths, such as the inclusion of the longitudinal component, i.e., comparison of the reporting error in weight at T1 and T2, and the examination of quadratic terms. Future studies should examine other factors that might be responsible for the discrepancy between self-reports and measurements of weight, such as when was the last time that participants measured their weight or whether participants exercise regularly. Other factors may also be considered as potential correlates of reporting error: personality traits [45], socio-economic and health characteristics (e.g., [10]). The identified factors of the reporting error in weight should be entered into models and applied to minimize the reporting error [46].

The present study has certain limitations. Even though the study sample was representative, due to design issues, only a subsample was used in the analyses. We compared those who were selected versus those excluded from the analyses and found that they did not differ in terms of age and gender. Self-reports of weight were collected one to two months prior to the actual measurements of weight at T1. It is possible that any potential error may be associated to environmental and time factors. Future studies should attempt to collect both self-reports and actual measurements at about the same time. Another limitation of the longitudinal section of the study was attrition, as 110 cases were lost from time 1 to time 2. Possible causes of the attrition might be the fact that panel members could not be traced or refused to carry on with the study [47]. Since actual measurements of height were not available, self-reports of height were included for the calculation of the BMI, and consequently their accuracy could not be ensured.

Overall, the present study suggests that the reporting error for weight is not negligible in this population. Researchers should consider these results, and that there are differences in misreporting across specific populations. Despite the cost of direct measurements, they should be preferred in favor of more reliable data. Availability of modern technological tools, such as those implemented in LISS, that measure body weight and wirelessly send the information to the research database, could facilitate cost-effective and accurate measurements of personal characteristics. Whenever actual measurements are difficult to record, researchers should instruct respondents to measure their weight by themselves before they are invited to report it. In general, individuals should self-monitor and take frequent measurements of their weight to increase self-awareness of eating and physical activity behaviors and outcomes.

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Data sharing statement: In this paper we make use of data of the LISS (Longitudinal Internet Studies for the Social sciences) panel administered by CentERdata (Tilburg University, The Netherlands). The authors are grateful for the permission to use the data.

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