Published in final edited form as:

Menopause. 2017 May ; 24(5): 484–489. doi:10.1097/GME.0000000000000778.

Inaccurate self-report of height and its impact on misclassification of body mass index in postmenopausal women

Xiaodan Mai, PhD, MBBS¹, Jill N Sperrazza, BS², Britt A Marshall, MD³, Kathleen M Hovey, MS¹, and Jean Wactawski-Wende, PhD¹

¹Department of Epidemiology and Environmental Health, School of Public Health and Health Professions, University at Buffalo, The State University of New York, Buffalo, NY

²Jacobs School of Medicine and Biomedical Sciences, University at Buffalo, The State University of New York, Buffalo, NY

³Department of Medicine. Penn State Milton S. Hershey Medical Center. Hershey, PA

Abstract

Objective—Self-reported height is commonly used in population obesity research. Evidence has also shown a positive association between depression and obesity. We examined the extent of height misreporting and its impact on body mass index (BMI) calculations and classification, and explored whether depression is associated with height misreporting.

Methods—The Buffalo Osteoporosis and Periodontal Disease Follow-up Study enrolled 1,015 postmenopausal women between 2002–2006. Participants self-reported their height on a questionnaire prior to stadiometer measurement at the clinical visit. Depressive symptoms were assessed using the Center for Epidemiologic Studies Depression Scale. Odds ratios (OR) and 95% confidence intervals (CI) for association between depression and height misreporting were estimated using logistic regression.

Results—Overall, 446 women (43.9%) misreported height by $>1/2$ inch, of which 296 (29.2%) underestimated and 150 (14.8%) overestimated their height. Height misreporting influenced BMI calculations by 1 unit in 12% of women, and influenced classification into WHO BMI categories in 8% of women. After adjusting for age, race, education, and measured BMI, women with significant depressive symptoms were more likely to misreport their height (OR=1.65, 95%CI: 1.04–2.61).

Conclusions—Height misreporting was common in older women and significantly influenced BMI calculations and classification. Obtaining objective data is thus important for studies investigating obesity-disease associations in this population, especially in those with significant depressive symptoms.

Keywords

height; misreporting; body mass index; postmenopausal women; depression

Corresponding author: Dr. Jean Wactawski-Wende, University at Buffalo, 410 Kimball Tower, Buffalo, NY 14214; phone 716-829-5374, fax 716-829-2979, jww@buffalo.edu.

Disclosure: No conflict of interest was declared

Introduction

Body mass index (BMI) is a measure of body habitus calculated as an individual's weight (kg) divided by the squared of height (m^2), which characterizes the extent of obesity and is frequently used to estimate the prevalence of overweight/obesity and to investigate the associations between overweight/obesity and disease outcomes in epidemiologic studies. BMI is often determined relying on self-reported values of height and weight. Self-reported measures are easy to collect in large scale studies. However, many studies have shown that people often misreport their weight and, in a fewer number of studies, their height.¹ Misreporting of height and weight could result in under- or overestimation of BMI. The degree of misreporting and ensuing under- or overestimation of BMI has been associated with gender, marital status, age, degree of obesity, and socioeconomic factors.¹⁻⁶ For instance, research has reported that individuals of age 60 years and over are more likely to provide unreliable estimates of these measures to healthcare providers,⁴ and that the elderly, females, and individuals with obesity are more likely to have lower BMI values calculated from self-reported height and weight than the actual BMI calculated from measured values.^{5, 7}

An increasing amount of evidence has shown a significant association between depression and obesity determined using self-reported height and weight.⁸⁻¹⁰ Limited information is available on the association between depression and misreporting of height and/or weight. The association between depression and obesity may be either underrated or exaggerated due to misclassification of BMI resulting from misreporting of height and/or weight. Few studies have explored associations between depression and misreporting of weight and/or height, and all of them yielded null results.¹¹⁻¹³ These studies, however, were conducted among people with binge eating disorder or obesity. Whether an association exists in older women from the general population needs further investigation.

In this study, we evaluated data from a cohort of postmenopausal women who participated in the Buffalo Osteoporosis and Periodontal Disease (OsteoPerio) Year-5 Follow-up Study where both self-reported and measured heights were available. The accuracy of self-reported height and the impact of height misreporting on calculations and classification of BMI were explored. This information may be important in teasing out relationships between self-reported derived obesity measures and chronic disease. In addition, we assessed the association between depressive symptoms and misreporting of height.

Methods

Participants

The Buffalo OsteoPerio Study is an ancillary study to the Women's Health Initiative Observational Study (WHI-OS) conducted at the University at Buffalo Clinical Center between 1997 and 2000. A total of 2,249 potential participants from the Buffalo WHI-OS were approached at the time of their year-3 annual clinic visit to join this study. Exclusion criteria included having less than 6 teeth, report of systemic bone diseases other than osteoporosis, steroid use and report of cancer within the past ten years.¹⁴ A total of 1,362

eligible women participated in the baseline visit where they were asked about factors associated with both osteoporosis and oral health in addition to the questionnaires and measures conducted as part of the WHI-OS. Of those, 5 did not complete questionnaires and 16 had incomplete oral radiographs, leaving 1,341 women who were invited back for a follow-up study approximately 5 years later. During the follow-up visit, participants were administered the same questionnaires and examinations they had at the baseline visit. Some additional information was collected, including self-reported height. Among 1,341 women with complete baseline data, 101 were ineligible for the year-5 visit, 51 had passed away, 151 were not interested in participating, 3 had withdrawn from the parent WHI-OS, and 9 could not be found at the follow-up visit.¹⁵ Ineligibility criteria for the follow-up study included diagnosis of cancer or immunosuppressive disorders, long-term use of antibiotics, or dental X-rays within the past year.¹⁵ The data included in the present analysis were obtained from the remaining 1,015 individuals who completed the follow-up visit and questionnaires on self-reported height that was queried prior to clinic measure of height, and had height measured as part of the clinic visit. Of those individuals, 965 (95.1%) women had completed the Center for Epidemiologic Studies Depression Scale (CES-D), a self-administered questionnaire to assess depressive symptoms.¹⁶ Both studies were reviewed and approved by the University at Buffalo Institutional Review Board. Written informed consent was obtained from all participants.

Data Collection

Self-reported current height and clinically measured height were collected at the year-5 study visit. Actual current height was measured with a wall-fixed stadiometer (Perspective Enterprises, Kalamazoo, Michigan) in the clinical center according to standard protocols by trained and certified staff. The stadiometer measures within 1/16 of an inch. Self-reported height was asked on a self-administered questionnaire prior to measuring height in the clinic. Current weight was measured in the clinic by trained and certified staff using a calibrated scale (Health O Meter Inc., Bridgeview, Illinois) according to standardized protocols. No self-reported weight was obtained. Both measured and self-reported heights were used with measured weight to calculate BMI for the purpose of comparison.

Information on depressive symptoms was obtained from a shortened version of Center for Epidemiologic Studies Depression Scale (CES-D) developed by Burnam and colleagues.¹⁶ The shortened CES-D contains eight questions. Occurrence of each symptom is rated on a distress scale of 1–4, with 1 meaning “rarely or none of the time (less than 1 day)”, 2 meaning “some or a little of the time (1–2 days)”, 3 meaning “occasionally or a moderate amount of time (3–4 days)” and 4 meaning “most or all of the time (5–7 days)”. A total score of 0.06 or above (on a scale from 0–1) on the shortened CES-D has been shown to indicate that an individual has experienced significant depressive symptoms.¹⁶ This Burnam screen showed 74% sensitivity and 87% specificity for detecting major depression and dysthymia as compared to the standard psychiatric interview used in clinical settings by psychiatrists in a subset of WHI participants (n=436).¹⁷

Statistical Analyses

Accurate self-reported height was defined for this study as being within ½ inch or less of measured height and misreporting as being greater than ½ inch, either under- or overestimating. Initially we examined factors that may impact misreporting of height including age, race, education level and measured weight. Significant differences of height misreporting across key variables were tested using analysis of variance for continuous variables and Chi-square tests for categorical variables. Accuracy of self-reported height was categorized into accurately reported, underestimated or overestimated height categories as well as accurately reported and misreported height categories. Additional analyses were preformed to assess the impact of misreported height on BMI. Misclassification of BMI was defined as 1 unit (kg/m^2) difference between BMI calculated from measured height and BMI calculated from self-reported height. We also determined the impact of misreported height on BMI categories including under- or normal weight ($<25 \text{ kg/m}^2$), overweight ($25- <30 \text{ kg/m}^2$) and obese ($\geq 30 \text{ kg/m}^2$) according to WHO criteria.¹⁸ Later, logistic regression models were used to assess the odds of misreporting height according to depression status. Data analysis was conducted with SAS[®] version 9.2 (SAS Institute, Inc. Cary, NC).

Results

Information on participant characteristics overall and by accuracy of self-reported height is shown in Table 1. Of the 1,015 women in this analysis, 446 (44%) misreported their height by greater than ½ inch, with 296 (29.2%) underestimating their height and 150 (14.8%) overestimating their height. The mean age of the participants was 70.5 (SD=6.8) years old. Women who overestimated height were older than those who accurately reported and those who underestimated height ($P<0.01$). The mean measured height is 1.3 inches shorter among those who overestimated height as compared to those who underestimated height. Race, highest level of education, and measured weight were not significantly associated with misreporting of height.

We examined whether BMI calculated from self-reported height differs from that calculated from measured height. Among the 296 participants who underestimated their height by greater than ½ inch, the mean BMI calculated using measured height was 0.8 units lower than that calculated using self-reported height. As expected, women who accurately reported their height (i.e. within ½ inch or less of measured height) had little discrepancies between their measured and self-reported BMI. The participants who overestimated their height had a mean BMI calculated from measured height that was 1.1 units higher than a mean BMI calculated from self-reported height. Misreporting of height in our participants resulted in nearly 12% of women misclassified by 1 or more BMI units as compared to BMI according to measured height. Larger impact of height misreporting on BMI was seen among women who misreported their height to a greater extent (i.e. more than 1 inch). Of the 446 women who misreported their height by 1/2 inch or more, there were 121 women (27.1%) whose BMI was misestimated by greater than 1 unit. When assessing BMI according to WHO categories, misreporting height of 1/2 inch or more resulted in 63 women (14.1%) changing BMI categories (Table 2). For those who misreported height by 1 inch or more, there were 109 women (67.3%) whose BMI was misestimated by 1 unit or more and 37 women

(22.8%) whose BMI categories were misclassified (Table 2). In addition, misreporting of height significantly changed the distribution of BMI WHO categories. The prevalence of overweight and obesity was 36.8% and 20.7% when using measured height, while it was 35.0% and 22.2% when using self-reported height (Chi-square test: $P < 0.01$).

Of the 965 women with data on depressive symptoms, 82 (8.5%) were found to display significant depressive symptoms based on the CES-D scale using 0.06 as the cut point.¹⁶ There was a higher percent of women with significant depressive symptoms in the underestimated (10.0%) and overestimated (11.8%) height categories than those who accurately reported height (6.8%) ($p = 0.09$). When comparing those who misreported height to those who accurately reported, those who misreported were more likely to have significant depressive symptoms (6.8% vs. 10.6%, $p = 0.04$). The odds of misreporting of height is 1.65-fold higher (95% CI: 1.04–2.61) in women with significant depressive symptoms compared to those without, after adjusting for age, race, highest level of education and measured BMI (Table 3). When examining under- and overestimating height separately in multivariable-adjusted multinomial logistic regression model, the association of significant depressive symptoms with overestimation of height was slightly stronger (OR=1.93, 95% CI: 1.03–3.61) than the association with underestimation of height (OR=1.54, 95% CI: 0.91–2.60).

Discussion

Our study found that height misreporting was common in older women, with 44% of participants misreporting their height by greater than ½ inch. Although modest, height misreporting had an impact on BMI calculations and BMI categorization. In our study, using self-reported height led to mis-estimation of BMI of 1 unit among 12% of overall participants, as well as misclassification of BMI of 1 category among 8% of overall participants. BMI is a tool commonly used to monitor the prevalence and trends of obesity. BMI is also an important variable in studies investigating the impact of obesity on chronic diseases or mortality. Although self-reported BMI is often obtained as a cost-effective alternative to measured BMI, inaccurate BMI estimation could impact findings of these studies. Our study was conducted among a relatively healthy group of ambulatory postmenopausal women. It is possible that in women with other comorbidities, misclassification of BMI could be greater due to greater extent of height misreporting. Although weight has been recognized as often misreported and the impact of weight misreporting on BMI assessment has been reported, our study showed the additional importance of using measured rather than self-reported height, a measurement less studied for accurately assessing BMI, especially in older women. Postmenopausal women are more prone to bone loss and therefore loss of height due to vertebral fracture and other aging changes might be more common than in the general population of younger women and men.¹⁹ Thus, surveilling height loss by objectively measuring height at each clinical visit helps identify potential vertebral fracture in postmenopausal women.^{20, 21}

It is worth noting that in epidemiologic studies, misclassification of variables is inevitable. Non-differential misclassification would be expected to bias the estimates towards the null. However, in studies investigating associations between obesity and health outcomes,

misclassification of height/weight is of particular concern because the degree of biases in self-reported height/weight is likely to be differential across different status of obesity related diseases. Differential misclassification may bias the estimates either towards or away from the null, making it hard to predict how misclassification influences study results. Therefore, measured height and weight should be obtained in these studies. In certain large-scale epidemiologic studies where objectively measuring height and weight is not feasible, several correction algorithms have been developed to correct for self-reported BMI to some extent.^{22, 23} We hypothesized that older women with significant depressive symptoms reported their height less accurately than women who had not experienced these symptoms. Women with significant depressive symptoms may be more likely to be dissatisfied with their body image and thus more prone to underestimate height. They also may be less aware of changes in height, which may lead to overestimation of height. Our results support these hypotheses. Although a small number of women reported having significant depressive symptoms, this group had a 65% higher odds of misreporting height as compared to those without significant depressive symptoms. Therefore, using objective measure of height rather than self-report is more critical among individuals with depression. Few studies have focused on the impact of depression on misreport of height. A study by Jeffrey et al. reported that depression had no effect on either self-reported height or weight of 250 women with obesity.¹³ Another study by White and colleagues found that misreports of height, weight, and BMI were not related to psychological disorders, particularly binge eating disorder, among 392 overweight adult.¹² The discrepancy between these results and our study may be due to the make-up of the study populations as well as sample size. Our study had a larger sample size and included older women with a wide range of BMI, thus the results would be more generalizable.

In this study, 1,015 out of 1,341 women who completed baseline participated in the Follow-up Study and were included in the analytic sample of the present study. By comparing the relevant baseline characteristics of women included in this analysis to those of women who were not included, we found women who were not included were older ($P < 0.01$). As the extent of misreporting of height was found to be greater in older age groups,^{4, 5} we expect that the misestimation and misclassification of BMI would be greater if the 326 baseline participants were included in the analysis. Although we found a positive association between misreporting of height and significant depressive symptoms, the observed association may be partially explained by underlying medical conditions that related to both depressive symptoms and misreporting due to cognitive impairment, such as hypothyroidism^{24, 25} and obstructive sleep apnea.^{26, 27} We do not have data available to assess these conditions. Other limitations need to be taken into consideration. Generalizability of our findings can only be made to similar community-dwelling postmenopausal women since the study population is relatively well-educated and has healthier lifestyle. In addition, as self-reported weight was not obtained, we were not able to consider this additional factor in misclassification of BMI calculated by self-reported measures.

Strengths of this study include a relatively large cohort of postmenopausal women with both measured and self-reported heights available at one visit, teasing out the impact of actual height change due to time lag between self-reported and clinical measures. This is especially important for postmenopausal women whose height changes can occur over short period of

time. The use of a fixed stadiometer according to standardized protocols by trained and certified research staff minimized the measurement error.

Conclusion

In conclusion, we found that height to be commonly misreported in postmenopausal women and that inaccuracy could distort BMI estimation and categorization. Misreporting of height was more likely to occur in those with significant depressive symptoms. Our study shows the importance of using objective height measurement rather than relying on self-report in studies monitoring the prevalence and trends of obesity or investigating the obesity-disease associations, as well as in clinical settings to identify height loss and potential vertebral fracture in older women. The association between presence of significant depressive symptoms and misreport of height warrants further investigation.

Acknowledgments

Funding: This study was supported by grant R01DE013505 from the National Institute of Dental and Craniofacial Research, National Institutes of Health (NIH), Bethesda, MD., to Dr. Wactawski-Wende, U.S. Army, Medical Research and Materiel Command, Fort Detrick, Md., grant OS950077 and National Heart, Lung, and Blood Institute (NIH) contracts N01WH32122, HHSN268201100001C, and HHSN268201600001C (Women's Health Initiative) to Dr. Wactawski-Wende.

The WHI program is funded by the National Heart, Lung, and Blood Institute, National Institutes of Health, U.S. Department of Health and Human Services through contracts, HHSN268201600018C, HHSN268201600001C, HHSN268201600002C, HHSN268201600003C, and HHSN268201600004C.

We thank the staff in Women's Health Initiative Buffalo Clinical Center for collecting data and make them available, as well as the study participants.

Short List of WHI Investigators:

Program Office: (National Heart, Lung, and Blood Institute, Bethesda, Maryland) Jacques Rossouw, Shari Ludlam, Dale Burwen, Joan McGowan, Leslie Ford, and Nancy Geller

Clinical Coordinating Center: (Fred Hutchinson Cancer Research Center, Seattle, WA) Garnet Anderson, Ross Prentice, Andrea LaCroix, and Charles Kooperberg

Investigators and Academic Centers: (Brigham and Women's Hospital, Harvard Medical School, Boston, MA) JoAnn E. Manson; (MedStar Health Research Institute/Howard University, Washington, DC) Barbara V. Howard; (Stanford Prevention Research Center, Stanford, CA) Marcia L. Stefanick; (The Ohio State University, Columbus, OH) Rebecca Jackson; (University of Arizona, Tucson/Phoenix, AZ) Cynthia A. Thomson; (University at Buffalo, Buffalo, NY) Jean Wactawski-Wende; (University of Florida, Gainesville/Jacksonville, FL) Marian Limacher; (University of Iowa, Iowa City/Davenport, IA) Robert Wallace; (University of Pittsburgh, Pittsburgh, PA) Lewis Kuller; (Wake Forest University School of Medicine, Winston-Salem, NC) Sally Shumaker

Women's Health Initiative Memory Study: (Wake Forest University School of Medicine, Winston-Salem, NC) Sally Shumaker

References

1. Connor Gorber S, Tremblay M, Moher D, Gorber B. A comparison of direct vs. self-report measures for assessing height, weight and body mass index: a systematic review. *Obes Rev.* 2007; 8(4):307–26. [PubMed: 17578381]
2. Nawaz H, Chan W, Abdulrahman M, Larson D, Katz DL. Self-reported weight and height: implications for obesity research. *Am J Prev Med.* 2001; 20(4):294–8. [PubMed: 11331120]
3. Burton NW, Brown W, Dobson A. Accuracy of body mass index estimated from self-reported height and weight in mid-aged Australian women. *Aust N Z J Public Health.* 2010; 34(6):620–3. [PubMed: 21134066]

4. Kuczmarski MF, Kuczmarski RJ, Najjar M. Effects of age on validity of self-reported height, weight, and body mass index: findings from the Third National Health and Nutrition Examination Survey, 1988–1994. *J Am Diet Assoc.* 2001; 101(1):28–34. [PubMed: 11209581]
5. Bostrom G, Diderichsen F. Socioeconomic differentials in misclassification of height, weight and body mass index based on questionnaire data. *Int J Epidemiol.* 1997; 26(4):860–6. [PubMed: 9279620]
6. Gildner TE, Barrett TM, Liebert MA, Kowal P, Snodgrass JJ. Does BMI generated by self-reported height and weight measure up in older adults from middle-income countries? Results from the study on global AGEing and adult health (SAGE). *BMC Obes.* 2015; 2:44. [PubMed: 26509041]
7. Yannakoulia M, Panagiotakos DB, Pitsavos C, Stefanadis C. Correlates of BMI misreporting among apparently healthy individuals: the ATTICA study. *Obesity (Silver Spring).* 2006; 14(5):894–901. [PubMed: 16855199]
8. Simon GE, Ludman EJ, Linde JA, et al. Association between obesity and depression in middle-aged women. *Gen Hosp Psychiatry.* 2008; 30(1):32–9. [PubMed: 18164938]
9. Xiang X, An R. Obesity and onset of depression among U.S. middle-aged and older adults. *J Psychosom Res.* 2015; 78(3):242–8. [PubMed: 25553601]
10. Gavin AR, Simon GE, Ludman EJ. The association between obesity, depression, and educational attainment in women: the mediating role of body image dissatisfaction. *J Psychosom Res.* 2010; 69(6):573–81. [PubMed: 21109045]
11. White MA, Masheb RM, Burke-Martindale C, Rothschild B, Grilo CM. Accuracy of self-reported weight among bariatric surgery candidates: the influence of race and weight cycling. *Obesity (Silver Spring).* 2007; 15(11):2761–8. [PubMed: 18070767]
12. White MA, Masheb RM, Grilo CM. Accuracy of self-reported weight and height in binge eating disorder: misreport is not related to psychological factors. *Obesity (Silver Spring).* 2010; 18(6):1266–9. [PubMed: 19834465]
13. Jeffery RW, Finch EA, Linde JA, et al. Does clinical depression affect the accuracy of self-reported height and weight in obese women? *Obesity (Silver Spring).* 2008; 16(2):473–5. [PubMed: 18239662]
14. Wactawski-Wende J, Hausmann E, Hovey K, Trevisan M, Grossi S, Genco RJ. The association between osteoporosis and alveolar crestal height in postmenopausal women. *J Periodontol.* 2005; 76(11 Suppl):2116–24. [PubMed: 16277584]
15. Bole C, Wactawski-Wende J, Hovey KM, Genco RJ, Hausmann E. Clinical and community risk models of incident tooth loss in postmenopausal women from the Buffalo Osteo Perio Study. *Community Dent Oral Epidemiol.* 2010; 38(6):487–97. [PubMed: 20636416]
16. Burnam MA, Wells KB, Leake B, Landsverk J. Development of a brief screening instrument for detecting depressive disorders. *Med Care.* 1988; 26(8):775–89. [PubMed: 3398606]
17. Tuunainen A, Langer RD, Klauber MR, Kripke DF. Short version of the CES-D (Burnam screen) for depression in reference to the structured psychiatric interview. *Psychiat Res.* 2001; 103(2–3):261–70.
18. World Health Organization. Physical status: the use and interpretation of anthropometry. Report of a WHO Expert Committee. Geneva: World Health Organization; 1995.
19. Briot K, Legrand E, Pouchain D, Monnier S, Roux C. Accuracy of patient-reported height loss and risk factors for height loss among postmenopausal women. *Can Med Assoc J.* 2010; 182(6):558–62. [PubMed: 20308271]
20. Siminoski K, Jiang G, Adachi JD, et al. Accuracy of height loss during prospective monitoring for detection of incident vertebral fractures. *Osteoporos Int.* 2005; 16(4):403–10. [PubMed: 15309381]
21. Xu W, Perera S, Medich D, et al. Height loss, vertebral fractures, and the misclassification of osteoporosis. *Bone.* 2011; 48(2):307–11. [PubMed: 20870048]
22. Nyholm M, Gullberg B, Merlo J, Lundqvist-Persson C, Rastam L, Lindblad U. The validity of obesity based on self-reported weight and height: Implications for population studies. *Obesity (Silver Spring).* 2007; 15(1):197–208. [PubMed: 17228048]
23. Akhtar-Danesh N, Dehghan M, Merchant AT, Rainey JA. Validity of self-reported height and weight for measuring prevalence of obesity. *Open Med.* 2008; 2(3):e83–8. [PubMed: 21602953]

24. Duntas LH, Maillis A. Hypothyroidism and depression: salient aspects of pathogenesis and management. *Minerva Endocrinol.* 2013; 38(4):365–77. [PubMed: 24285104]
25. Gaitonde DY, Rowley KD, Sweeney LB. Hypothyroidism: an update. *Am Fam Physician.* 2012; 86(3):244–51. [PubMed: 22962987]
26. Lal C, Strange C, Bachman D. Neurocognitive impairment in obstructive sleep apnea. *Chest.* 2012; 141(6):1601–10. [PubMed: 22670023]
27. Chen YH, Keller JK, Kang JH, Hsieh HJ, Lin HC. Obstructive sleep apnea and the subsequent risk of depressive disorder: a population-based follow-up study. *J Clin Sleep Med.* 2013; 9(5):417–23. [PubMed: 23674930]

Table 1

Participant characteristics overall and by accuracy of self-reported height in postmenopausal women: Buffalo OsteoPerio Study

	Overall	Underestimated Height >½ Inch	Accurately Reported Height Within ½ Inch	Overestimated Height >½ Inch	P-value ^a
N	1015	296 (29.2%)	569 (56.1%)	150 (14.8%)	
Age (years)					
Mean±SD	70.5±6.8	69.2±6.4	70.3±6.7	73.6±6.6	<0.01
Min-Max	58.0–87.0	58.0–84.0	58.0–87.0	59.0–87.0	
<60 (N (%))	33 (3.25)	11 (3.7)	21 (3.7)	1 (0.7)	<0.01
60–<70 (N (%))	453 (44.6)	154 (52.0)	255 (44.8)	44 (29.3)	
70–<80 (N (%))	422 (41.6)	109 (36.8)	237 (41.7)	76 (50.7)	
>80 (N (%))	107 (10.5)	22 (7.4)	56 (9.8)	29 (19.3)	
Race					
White (N (%))	994 (97.9)	293 (99.0)	556 (97.7)	145 (96.7)	0.23
Other (N (%))	21 (2.1)	3 (1.0)	13 (2.3)	5 (3.3)	
Highest level of education					
High school (N (%))	213 (21.4)	64 (22.2)	112 (20.0)	37 (25.0)	0.26
College (N (%))	432 (43.4)	113 (39.1)	258 (46.2)	61 (41.2)	
Post graduate (N (%))	351 (35.2)	112 (38.8)	189 (33.8)	50 (33.8)	
Self-reported current height (inch)					
Mean±SD	63.7±2.44	63.1±2.3	63.9±2.4	64.1±2.6	<0.01
Min-Max	54.0–71.0	56.0–70.0	58.0–71.0	58.0–72.0	
Measured height (inch)					
Mean±SD	63.8±2.42	64.2±2.3	63.9±2.4	62.9±2.6	<0.01
Min-Max	55.8–74.6	57.1–74.6	57.8–71.0	55.8–70.5	
Measured weight (kg)					
Mean±SD	70.15±14.33	69.2±13.7	70.3±14.1	71.7±16.3	0.21
Min-Max	36.0–139.3	45.5–133.3	36.0–139.3	42.5–129.8	
BMI using measured height (kg/m²)					
Mean±SD	26.7±5.3	26.1±5.0	26.7±5.2	28.1±6.3	<0.01
Min-Max	15.8–57.4	15.8–57.4	16.7–51.9	16.9–51.0	
<25 (N (%))	432 (42.6)	142 (48.0)	240 (42.2)	50 (33.3)	<0.01

	Overall	Underestimated Height >1/2 Inch	Accurately Reported Height Within 1/2 Inch	Overestimated Height >1/2 Inch	P-value ^a
N	1015	296 (29.2%)	569 (56.1%)	150 (14.8%)	
25-<30 (N (%))	373 (36.8)	107 (36.2)	210 (36.9)	56 (37.3)	
>30 (N (%))	210 (20.7)	47 (15.9)	119 (20.9)	44 (29.3)	
BMI using self-reported height (kg/m²)					
Mean±SD	26.8±5.3	26.9±5.3	26.7±5.2	27.0±6.0	0.71
Min-Max	16.2–59.4	16.2–59.4	16.6–51.1	16.6–46.8	
<25 (N (%))	435 (42.9)	126 (42.6)	242 (42.5)	67 (44.7)	0.91
25-<30 (N (%))	355 (35.0)	102 (34.5)	205 (36.0)	48 (32.0)	
>30 (N (%))	225 (22.2)	68 (23.0)	122 (21.4)	35 (23.3)	
CES-D^b score					
N	965	280	542	143	
Mean±SD	0.03±0.11	0.03±0.09	0.03±0.11	0.04±0.14	0.33
Min-Max	0.00–0.90	0.00–0.64	0.00–0.88	0.00–0.90	
Significant depressive symptoms					
No (N (%))	883 (91.5)	251 (90.0)	505 (93.2)	127 (88.2)	0.09
Yes (N (%))	82 (8.5)	28 (10.0)	37 (6.8)	17 (11.8)	

^a Analysis of variance for continuous data and chi-square test for categorical data

^b CES-D Center for Epidemiologic Studies Depression Scale, 0.06 indicates significant depressive symptoms

Table 2

Misclassification of BMI by extent of height misreporting in postmenopausal women: Buffalo OsteoPerio Study

	Overall	Underestimated Height >1 Inch	Underestimated Height 1/2-1 Inch	Accurately Reported Height Within 1/2 Inch	Overestimated Height 1/2-1 Inch	Overestimated Height >1 Inch
BMI ^a mis-estimation						
>= 1 unit off	121 (11.9)	61 (61.6)	10 (5.1)	0	2 (2.3)	48 (76.2)
Within 1 unit	894 (88.1)	38 (38.4)	187 (94.9)	569 (100)	85 (97.7)	15 (23.8)
BMI category ^b misclassification						
Yes	80 (7.9)	21 (21.2)	16 (8.1)	17 (3.0)	10 (11.5)	16 (25.4)
No	935 (92.1)	78 (78.8)	181 (91.9)	552 (97.0)	77 (88.5)	47 (74.6)

^aBMI: body mass index (kg/m²)

^bBMI category: Under- or normal weight (<25), overweight (25-<30), obese (≥ 30)

Table 3

Logistic regression analysis for the association between depressive symptoms and height misreporting in post-menopausal women: Buffalo Osteoporosis Study

	Accurately Reported Height Within 1/2 Inch		Inaccurately Report Height >1/2 Inch	Crude	Age-adjusted	Multivariable-adjusted ^c
	N (%)		N (%)	OR (95% CI) ^a	OR (95% CI) ^a	OR (95% CI) ^a
Significant depressive symptoms (CES-D) ^b						
No	505 (93.2)		378 (89.4)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Yes	37 (6.8)		45 (10.6)	1.63 (1.03–2.56)	1.63 (1.03–2.57)	1.65 (1.04–2.61)

^aOdds ratio (OR) and 95% confidence interval (CI) in logistic regression model

^bCES-D Center for epidemiologic studies depression scale, 0.06 indicates depressive

^cAdjusted for age, race (white, other), highest level of education (high school, college, post college) and measured body mass index (continuous)