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Self-reporting of height and weight: valid and reliable identification of malnutrition in preoperative patients

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Abstract

BACKGROUND: Preoperative screening for malnutrition has become mandatory in The Netherlands. A sensitive method to diagnose malnutrition would save time and improve effectiveness.

METHODS: A prospective cross-sectional study of 488 adult elective preoperative outpatients was performed. The accuracy of self-reported height and weight was compared with measured data and 3 commonly used malnutrition screening tools. Interobserver agreement was calculated by the intraclass correlation coefficient, studied in Bland and Altman plots, and analyzed by using Cohen's κ statistic. Accuracy was expressed in sensitivity, specificity, and false-negative rates.

RESULTS: Differences between self-reported and measured data were significant, but clinically irrelevant, because only 1 patient was falsely identified as well nourished. Intraclass correlation coefficient for height, weight, and body mass index was high (.97–.99). Bland–Altman plots showed that the mean $\pm$ standard deviation differences and 95% limits of agreement between both methods were as follows: height, .0096 m ($\pm$.0262, $-$.0417 to $+$.0609 m); weight, $-$1.28 kg ($\pm$2.29, $-$5.76 to $+$3.20 kg); body mass index, $-$.72 kg/m^2 ($\pm$1.11, $-$2.92 to $+$1.46 kg/m^2). The κ coefficient was .84 (95% confidence interval, .75–.94). Sensitivity was .97 and specificity was .98. Sensitivity and false-negative rates of self-reported data were better overall compared with the screening tools.

CONCLUSIONS: Self-reported data provide highly sensitive information to diagnose malnutrition in preoperative outpatients.

Every year approximately 1.3 million patients in The Netherlands undergo a surgical procedure, and approximately 75% of these procedures are elective. Although these surgeries vary in duration and intensity, and patients differ in age and health, all outpatients are required to undergo preoperative screening for malnutrition as specified by the National Dutch Guideline on Perioperative Nutrition.[1]

In clinical practice, malnutrition often is defined as involuntary weight loss within a certain time frame and/or a body mass index (BMI) below a defined cut-off point.[2–8] Although the prevalence rates of malnutrition for adults in outpatient clinics are low, ranging between 7% and 12%, early preoperative identification and treatment of malnutrition is considered essential because of the negative influence of malnutrition on postoperative outcome (eg, increased postoperative complications, higher mortality rates, and increased length of hospital stay).[1,9–16]

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Because of a change in policy, the (para)medical staff in The Netherlands have been made responsible for screening all preoperative patients for malnutrition in compliance with the National Dutch Guideline on Perioperative Nutrition.[1] Although they are convinced of the importance of such screening, this has created extra work for them, such as making systematic measurements of height and weight and calculating BMI and the percentage of recent involuntary weight loss. Our observed, unpublished data show that these measurements require 2 to 3 minutes of additional time per patient. If health care professionals screened all preoperative outpatients, this would result nationwide in more than 32 thousand additional hours yearly—time that could be spent more effectively by these caregivers.

To save time, malnutrition screening tools have been introduced to obtain a rough estimate of patients' nutritional status. In The Netherlands, the Short Nutritional Assessment Questionnaire (SNAQ),[10,17] the Mini Nutritional Assessment (MNA) for the elderly subpopulation,[18,19] and the Malnutrition Universal Screening Tool (MUST)[20] frequently are used for adults.[21] However, these tools have not all been validated for outpatients, and at least some of the tools need trained personnel to use them. In addition, patients at risk for malnutrition need a complementary and more comprehensive assessment.[1,22] It is thus very unlikely that these instruments will be applied for the purpose of preoperative screening.

If we can shorten the malnutrition screening time required, improve the sensitivity of a malnutrition screening tool, and thus increase the effectiveness, then the (para) medical staff can focus on their core work of preparing preoperative patients while still complying with the National Dutch Guideline on Perioperative Nutrition.[1] Self-reported data on height and weight are a possibility for reducing this screening time. According our knowledge, no studies have yet determined the adequacy of self-reported data to screen for malnutrition in preoperative surgical outpatients.

In general, the literature indicates that healthy persons and patients suffering from eating disorders tend to under-report their body weight and to over-report their height, which results in an underestimated BMI.[23–27] In underweight patients this relationship seems to be inverted; patients over-report their body weight, which leads to an underestimation of malnutrition based on weight loss.[24]

In this study we addressed the following research questions: (1) what is the sensitivity of self-reported height and weight by adult preoperative patients compared with objective anthropometric data assessed by health care professionals, and how many malnourished patients are missed by using self-reported data? (2) How does self-reported anthropometric data perform relative to 3 malnutrition screening instruments that frequently are used in The Netherlands: the SNAQ, MNA, and the MUST?

The hypothesis of our study was that self-reporting of height and weight is an effective method to diagnose malnutrition in preoperative elective patients with a better predictive value than the commonly used screenings tools.

Methods

Patients

The study was designed as a prospective cross-sectional study involving adult preoperative patients scheduled for elective surgery who were visiting the Pre-operative Screening Department of the VU University Medical Center (Amsterdam, The Netherlands) from March until June 2008.

This study was approved by the institutional Medical Ethics Committee. Patients were invited to participate and received verbal and written information about the study before visiting the anesthesiologist.

Study population

The study population initially consisted of all consecutive patients age 18 years and older (no age limitation) who visited the Pre-Operative Screening Department. From this group we collected patient-, clinical-, and surgery-related characteristics and height and weight. Exclusion criteria comprised patients suffering from cardiac failure, kidney disease, or liver failure. Because of a decrease in osmotic pressure these conditions can result in edema and fluid disturbances and affect a reliable measurement of body weight. Pregnant women and patients who were unable to undergo the physical examinations also were excluded.

Patient self-reported data

For this study a questionnaire was developed, consisting of 4 components: (1) sociodemographic characteristics (age, sex, living situation, and social situation); (2) clinical characteristics (comorbidity, indication for surgery, referring department); (3) anthropometric data, height, usual and present body weight, voluntary and involuntary changes in body weight in the past month and over the past 6 months; and (4) the questions from the 3 most frequently used malnutrition screening tools in The Netherlands: SNAQ, MNA (for patients $\geq$65 y), and MUST.[17–21] Patients filled out the questionnaire while in the waiting room at the outpatient clinic.

Objective clinical assessment

Height in meters and body weight in kilograms, without shoes and in light indoor clothing, were measured by a healthcare professional (E.B.H., research dietician) after the consultation of the patient with the anesthesiologist. The Seca stadiometer 222 was used for measuring height; weight was measured with the Seca 888 (Seca, GmbH, Hamburg, Germany). The BMI was calculated by dividing the body weight by the square of body height (kg/m^2). Patients were asked to recall their weight at 1 month and 6 months before the study. In case of weight loss, patients were asked whether they lost weight voluntarily or involuntarily. Only in cases of involuntary weight loss was the percentage of weight loss calculated.

Objective definition of malnutrition

For patients younger than age 65, malnutrition was defined in accordance with the National Dutch Guideline on Perioperative Nutrition: (1) involuntary weight loss of 5% or greater within 1 month; and/or (2) involuntary weight loss of 10% or greater within 6 months; and/or (3) a BMI less than 18.5. In accordance with hospital clinical guidelines, a BMI limit of 20.0 was used for patients age 65 and older.[1–3,8]

Aspects influencing malnutrition

Information about age, sex, living situation, ethnic origin (Dutch or non-Dutch), family or friends to support and help, ability to prepare food, household composition, comorbidity, indication for the surgical procedure, and referring department were collected. Such factors could influence the development or explain the presence of malnutrition.

Presence of malnutrition

If a patient was identified as malnourished after clinical assessment, a protein-rich and energy-rich diet was advised (at least until the surgical procedure). If necessary, sip feeding (a complete enteral formula to be taken as an oral beverage rich in energy, proteins and micronutrients) was prescribed according to the hospital standard guidelines.

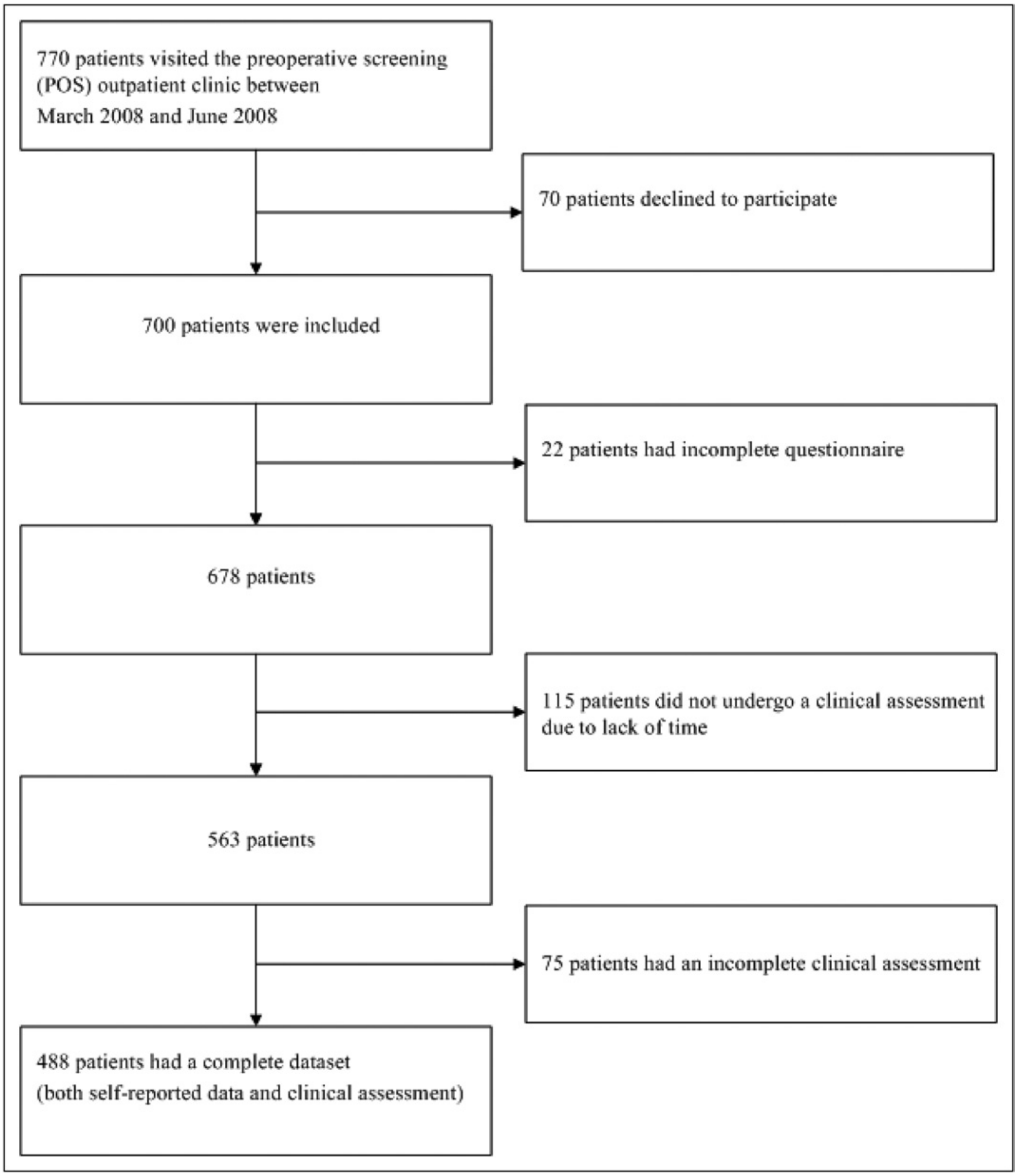

Figure 1 Study flow chart.

Table 1 Sociodemographic and clinical characteristics of the study population (n = 488)

Age, y*	51 (17)
Age range, y	18–91
Male sex	234 (48)
Top 4 living situations	
Independent	444 (91)
Living with parents	28 (6)
Partially independent	9 (2)
Institution	4 (1)
Not of Dutch ethnic origin	65 (13)
Presence of family/friends for support and help	459 (94)
Ability to prepare food	450 (92)
Top 3 household compositions	
Single	132 (27)
With a partner	181 (37)
Partner and child(ren) and/or others	165 (34)
Presence of comorbidity	298 (61)
Top 5 indications for surgical procedure	
ICD 140–239 neoplasm	105 (25)
ICD 710–739 diseases of the musculoskeletal system and connective tissue	47 (11)
ICD 800–999 injuries and poisoning	46 (11)
ICD 360–389 diseases of the sense organs	41 (10)
ICD 580–629 diseases of the genitourinary system	36 (8)
Top 5 referring departments	
Otorhinolaryngology	75 (15)
Surgery	67 (14)
Gynecology	51 (10)
Orthopedics	45 (9)
Plastic surgery	45 (9)

All values expressed in n (%) unless otherwise indicated.
ICD = International Statistical Classification of Diseases and Related Health Problems.
*Mean (±SD).

Statistical analysis

Patient and clinical characteristics, including anthropometric data, were summarized using descriptive statistics. Differences between mean scores were analyzed using the 2-group dependent *t* test, when appropriate. The Kolmogorov–Smirnov test was used to determine whether the anthropometric data were distributed normally.

Interobserver agreement between self-reported data and clinical assessment in relation to the anthropometric indicators (height, body weight, BMI) was assessed by calculating the intraclass correlation coefficient. In addition, the interobserver agreements were studied in scatter plots as described by Bland and Altman.[28] These plots show the differences of an anthropometric indicator between both methods for each patient on the vertical y-axis against their mean on the horizontal x-axis. To describe the possible range of differences, we also calculated the 95% limits of agreement (mean difference ± 1.96 times standard deviation of the difference scores).

Interobserver agreement regarding patients' nutritional status was analyzed using Cohen's κ statistic. Finally, we determined the criterion validity of the self-reported data on malnutrition and the screening instruments SNAQ, MNA (in patients ≥ 65 y), and MUST relative to the objective definition of malnutrition, in terms of sensitivity, specificity, positive predictive value, negative predictive value, false-positive rates, and false-negative rates.

Statistical uncertainty was expressed in 95% confidence intervals (95% CIs). A *P* value less than .05 was considered statistically significant. All analyses were performed in SPSS 16.0 (SPSS Corp, Chicago, IL).

Results

We identified 770 eligible patients. Seventy of them declined to participate, and the data from 212 patients (212 of 700; 30%) could not be analyzed for a number of reasons (Fig. 1). In total, 488 patients were included.

Except for household composition, the characteristics of participants and patients excluded owing to lack of time due to other medical appointments; excluded patients lived alone less often ($P = .01$). Patients incapable of undergoing clinical assessment differed from participants with regard to living situation, household composition, sex, referring department, and ability to prepare food ($P \leq .007$); excluded patients lived independently more often, lived with a partner (and children) more frequently, were pregnant women referred from the Obstetrics Department, and were patients

Table 2 Anthropometric characteristics of self-reports and clinical assessments of the study population (n = 488)

	Self-reported	Clinical assessment	ICC (95% confidence interval)
Height, m*	1.74 (.10)	1.73 (.10)‡	.97 (.96–.97)
Body weight (kg), usually self-reported*	77.0 (16.8)	Not applicable	
Body weight (kg), present*	77.6 (16.1)	78.9 (16.1)‡	.99 (.98–.99)
Self-reported weight loss ≥5% in 1 mo,†	9 (2)	Not applicable	
Self-reported weight loss ≥10% in 6 mo,†	16 (3)	Not applicable	
BMI calculated, kg/m^2*	25.6 (4.7)	26.3 (4.8)‡	.97 (.97–.98)

ICC = intraclass correlation coefficient.
*Mean (±SD).
†n (%).
‡Two-group dependent *t* test, $P < .001$.

referred from the Traumatology Department. The excluded trauma patients less often were capable of preparing their own food.

Table 1 describes in detail the sociodemographic and clinical characteristics of the included patients. The mean age (±standard deviation) of the patients was 51 years (±17), the age range was 18 to 91 years, and 48% of the patients were men. A neoplasm was the main indication for the surgical procedure. The Otorhinolaryngology and Surgery Departments referred the most patients (30% of all patients).

As shown in Table 2, differences between self-reported data and clinically assessed height (.01 m), weight (1.3 kg), and BMI (.7 kg/m^2) were small, albeit statistically significant ($P < .001$).

The intraclass correlation coefficient for height, weight, and BMI ranged from .97 to .99. Figure 2 shows the Bland–Altman plots of the differences between height, weight, and BMI scores based on self-reported data and clinical assessment. Mean (± SD) differences and the 95% limits of agreement between the self-reported method and the clinical assessment were as follows: height, .0096 m (±.0262), 95% limits of agreement, .0417 to +.0609 m; weight, −1.28 kg (± 2.29), 95% limits of agreement −5.76 to +3.20 kg; and BMI, .72 kg/m^2 (±1.11), 95% limits of agreement: −2.92 to +1.46 kg/m^2.

By using our objective definition of malnutrition, 38 patients (8%) were identified as malnourished based on self-reported data compared with 30 patients (6%) based on clinical assessment (Table 3). The difference was

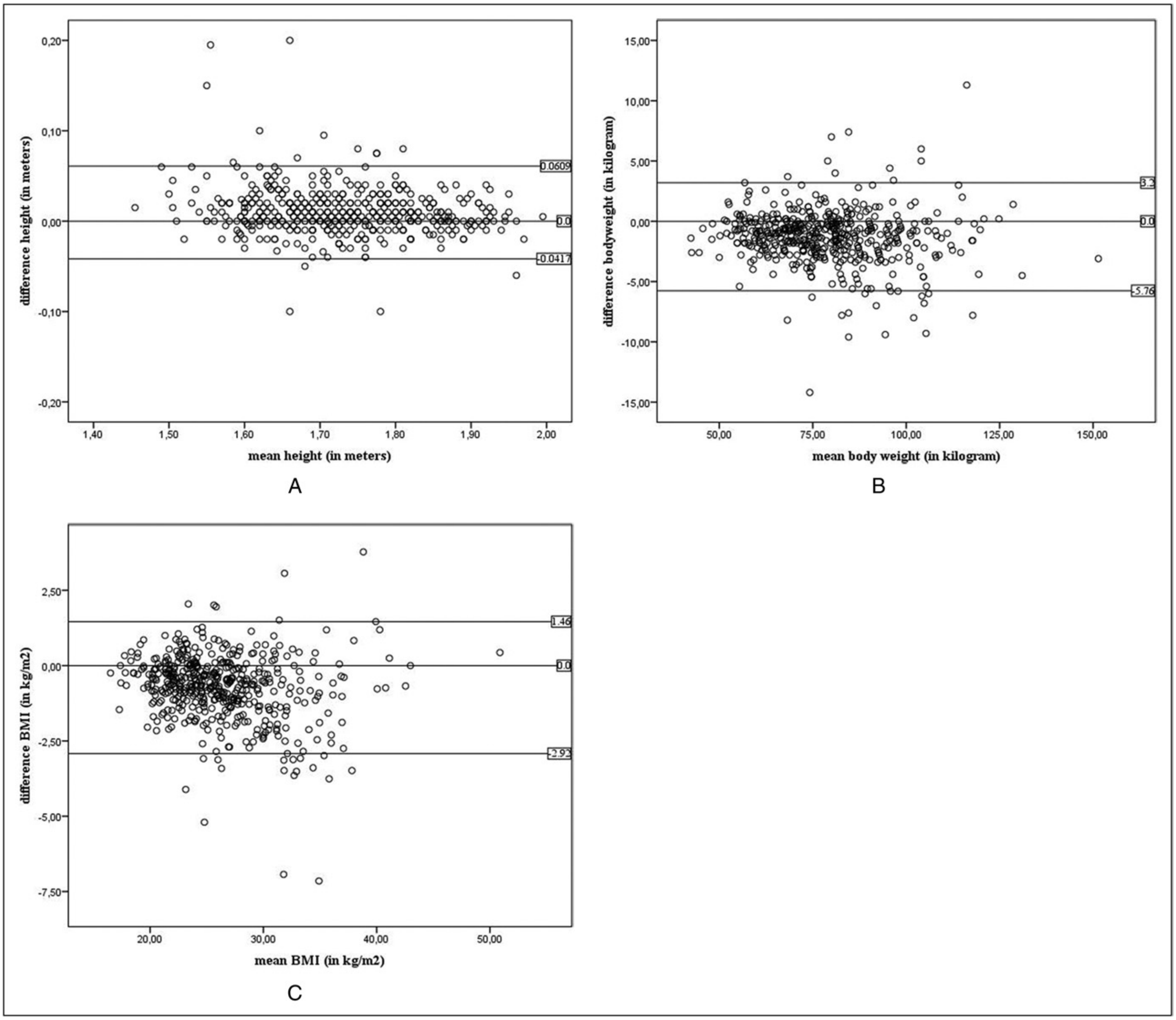

Figure 2 Bland–Altman plots (n = 488). The difference between height, weight, and BMI by self-report and clinical assessment for each person (y-axis) is plotted against the mean height, weight, and BMI averaged from the 2 methods (x-axis). The horizontal solid line (y = 0) represents ideal agreement; the upper and lower dotted lines show the 95% CIs.

Table 3 Malnutrition characteristics of malnourished preoperative surgical outpatients based on self-reports (n = 38) and clinical assessments (n = 30)

	Self-reported (n = 38)	Clinical assessment (n = 30)
Malnutrition based on 1 characteristic		
Loss of ≥5% body weight in 1 mo	4	4
Loss of ≥10% body weight in 6 mo	9	9
BMI below normal range*	18	10
Malnutrition based on 2 characteristics		
Loss of ≥5% body weight in 1 mo and loss of ≥10% body weight in 6 mo	3	4
Loss of ≥10% body weight in 6 mo and BMI below the normal range	2	2
Malnutrition based on all 3 characteristics		
Loss of ≥5% body weight in 1 mo and loss of ≥10% body weight in 6 mo and BMI below the normal range	2	1

Normal BMI range: patients <65 years, BMI > 18.5; patients ≥65 years, BMI > 20.0.

caused mainly by the calculated BMI below the normal range; self-reporting identified 18 patients with a low BMI compared with 10 patients identified by clinical assessment.

One patient was identified falsely as well nourished by self-reported data, whereas in fact the patient was malnourished (false-negative), and 9 patients (<2%) were wrongly identified as malnourished (false-positive).

The interobserver agreement (κ) was .84 (95% CI, .75–.94). Compared with the objective definition, self-reports had a sensitivity of .97 (95% CI, .83–.99) and a specificity of .98 (95% CI, .96–.99). The positive predictive value was .76 (95% CI, .61–.87) and the negative predictive value was .99 (95% CI, .99–1.0).

There were significant differences between malnourished and well-nourished patients with regard to living situation, ability to prepare food, household composition, indication for surgical procedure, and adjuvant therapy ($P \leq .01$) (Table 4).

When we compared the self-reported data with the results of the screening instruments SNAQ, MNA (for patients ≥65 y), and MUST, the diagnostic accuracy of self-reported data overall proved to be better than the diagnostic accuracy of the screening instruments (Table 5).

Comments

This prospective cross-sectional study showed that self-reporting of height and weight is a highly sensitive alternative for malnutrition screening in adult preoperative patients. We observed a high level of agreement between self-reported anthropometric data and clinical assessment by a professional for height, weight, calculated BMI, and classification of nutritional status. In addition, self-reporting was found to be more sensitive than the generally applied malnutrition screening tools (SNAQ, MNA, and MUST).

Of our 488 patients, only 1 malnourished patient had a false-negative test result and was therefore at risk of not being treated in the preoperative stage. Nine patients (<2%) had a false-positive result. Based on the test results they would run the risk of being treated with a protein- and energy-enriched diet until the surgical procedure. However, this only results in a treatment that is excessive but considered harmless.

Our results confirm the tendency of patients to overestimate their height, to underestimate their body weight, and consequently to underestimate their BMI.[23–27]

We found significant differences between self-reported height and weight and measured data. Nevertheless, we consider these differences of no clinical importance because they only overestimated the number of malnourished patients (estimated body weight and estimated BMI were too low), and did not underestimate the prevalence of malnutrition.

This study also highlights groups at special risk that need further attention: patients unaware of their height and/or weight, patients physically unable to undergo an examination, and patients with an unreliably measured body weight. Our results therefore imply that a more thorough nutritional assessment still is necessary for patients with incomplete data: approximately 3% of the population. This subgroup was unable to provide adequate information about their present height and/or weight. Additional professional assessments therefore still will be required even if a systematic screening program is introduced based on self-reported data. Moreover, the nutritional status of about 11% of the patients could be estimated based only on self-reported data because their physical condition prevented a reliable examination (eg, patients who were unable to stand up, patients with a heavy plaster, patients with edema or fluid disturbances, and pregnant women). This is a clear advantage of self-reporting over objective assessment.

Because malnutrition prevalence rates are low in outpatients, the additional task of performing systematic malnutrition screening of all elective surgical outpatients will increase the workload considerably, but without yielding a corresponding benefit in terms of detection of malnourished patients. In our study we found a prevalence of about 6% based on clinical assessment, which is comparable with previous studies.[10,11] Use of self-reported height and weight for screening malnutrition therefore could result in greater efficiency.

Table 4 Sociodemographic and clinical characteristic differences between well-nourished preoperative surgical outpatients (n = 458) and malnourished preoperative surgical outpatients (n = 30)*

	Well-nourished patients (n = 458)	Malnourished patients (n = 30)	*P* value
Age, y*	50 (17)	56 (16)	.08
Male sex	221 (48)	13 (43)	.71
Top 4 living situations			.01†
Independent	418 (91)	26 (87)	
Living with parents	26 (6)	2 (7)	
Partially independent	9 (2)	—	
Institution	2 (.4)	2 (7)	
Not of Dutch ethnic origin	60 (13)	5 (17)	.98
Presence of family/friends to support and help	430 (94)	29 (97)	.81
Ability to prepare food	425 (93)	25 (83)	.01†
Top 3 household compositions			.01†
Single	121 (26)	11 (37)	
With a partner	171 (37)	10 (33)	
Partner and child(ren) and/or others	160 (35)	5 (17)	
Presence of comorbidity	280 (61)	18 (60)	1.0
Top 5 indications for surgical procedure			.01†
ICD 140–239 neoplasm	92 (20)	13 (43)	
ICD 710–739 diseases of bone, muscle and connective tissue	47 (10)	—	
ICD 800–999 injuries and poisoning	44 (10)	2 (7)	
ICD 360–389 diseases of the sense organs	40 (9)	1 (3)	
ICD 580–629 diseases of the genitals	35 (8)	1 (3)	
Top 5 referring departments			.25
Otorhinolaryngology	66 (14)	9 (30)	
Surgery	64 (14)	3 (10)	
Gynecology	47 (10)	4 (13)	
Orthopedics	41 (9)	4 (13)	
Plastic surgery	44 (10)	1 (3)	
Adjuvant therapy	16 (4)	7 (23)	<.001†

All values are expressed as n (%).
ICD = International Statistical Classification of Diseases and Related Health Problems.
Continuous variables were tested with the independent *t* test. Nominal variables were tested by the chi-square test.
*Mean (±SD).
†A *P* value of less than .05 was considered statistically significant.

In our study, 30% of the eligible patients had to be excluded: 16% owing to lack of time, and 14% owing to incomplete data (3%) or an unreliable examination (11%). If self-reporting is implemented in the future, this remaining 14% will need special attention. Still, we believe that the efficiency gain for the majority of the population is worthwhile, given the large number of patients undergoing preparation for surgery every year.

There were significant differences between included and excluded patients regarding a number of sociodemographic and clinical characteristics. We initially assumed that only the inability to prepare food could have influenced the

Table 5 Diagnostic accuracy of self-reported anthropometric data (n = 488), SNAQ (n = 488), MNA in the elderly subpopulation (n = 113), and MUST (n = 488)

	Self-report*	SNAQ*	MNA*†	MUST*
Kappa	.84 (.75–.94)	.63 (.50–.77)	.26 (.07–.46)	.53 (.40–.67)
Sensitivity	.97 (.83–.99)	.63 (.49–.78)	.89 (.62–.98)	.67 (.53–.81)
Specificity	.98 (.96–.99)	.98 (.97–.99)	.73 (.65–.80)	.95 (.94–.97)
Positive predictive value	.76 (.61–.87)	.68 (.53–.82)	.22 (.13–.35)	.49 (.36–.62)
Negative predictive value	.99 (.99–1.0)	.98 (.96–.99)	.99 (.94–.99)	.98 (.97–.99)
False-positive rate	.02 (.007–.03)	.02 (.007–.03)	.27 (.18–.35)	.05 (.03–.06)
False-negative rate	.03 (−.03–.09)	.37 (.20–.54)	.11 (−.09–.32)	.33 (.16–.50)

*Value (95% CI).
†Patients ≥ 65 years of age (n = 113).

nutritional status. However, this aspect was reported by only 5 of the excluded patients, so we have no reason to assume that the prevalence of malnutrition would have been different in the excluded group compared with the participating patients.

Although nutritional support was provided to patients at risk of malnutrition, this study did not evaluate the effects of nutritional intervention on postoperative outcome parameters such as complications and mortality. It would be of interest to perform a follow-up study on whether self-reporting of height and weight has a better predictive value than other screening methods when it comes to outcome (reduced morbidity and decreased length of hospital stay).

More research also is needed to validate the results in clinical and nonsurgical patients and in nontertiary hospitals.

In conclusion, self-reporting of anthropometric data is a highly sensitive method to diagnose malnutrition among preoperative elective surgical outpatients and performs better than 3 of the most frequently used screening instruments SNAQ, MNA, and MUST. Self-reporting of height and weight perhaps can be implemented directly at the Preoperative Outpatient Department, thereby reducing workload and at the same time eliminating the problem of noncompliance with the National Dutch Guideline on Perioperative Nutrition.

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