Journal of Women's Health, Issues & Care

Reliability of Self-Reported Weight, Age at Menarche and Menopause, and Reason for Absence of Menses: A Cohort Study

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Abstract

Background: In epidemiological studies data on lifetime exposures are often self-reported. In this study we evaluate reliability of self-reported information on weight at eighteen years, age at menarche and menopause, and the reason for absence of menses. Furthermore we wanted to determine to what extent the reliability was affected by age, education and histo-pathological findings.

Methods: This study was conducted within the framework of the Diagnosis Optimization Study. The study population included all women who underwent image-guided core biopsy for evaluation of breast abnormality at University Hospital of Halle, Germany. A total of 1670 women reported their weight at 18, age at menarche and menopause in a questionnaire at baseline and at follow-up. Bland Altman plots were used for the reliability analyses, while linear regression analyses were performed to assess the factors that were independently associated with the reliability (measured by absolute differences).

Results: Weight at age of 18 and age at menarche and menopause were reported on average with small differences. The differences in self-reported weight and age at menarche and menopause were greater in women with lower education. Furthermore self-reported weights were related to age – the difference increased with increasing age. The observed agreement for the reason for absence of menses was 0.92 (95% CI: 0.91-0.94), the chance-corrected agreement was 0.85 (95% CI: 0.82-0.88), respectively.

Discussion: Our study provides evidence that women reported their weight at age 18 and age at menarche and age at menopause with good reliability. Furthermore, our results suggest that the reliability is positively associated with higher education and younger age. Therefore, our study results support the use of self-reported information with regard to weight at the age 18, age at menarche and menopause, and reason for absence of menses in epidemiological studies.

Keywords

Reliability; Epidemiological studies; Age; Weight; Menarche; Menopause

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Background

In epidemiological studies data on lifetime exposures are often self-reported, sometimes many years after the relevant age of interest. It is a simple and inexpensive method to collect data from a large number of individuals. A range of studies analysed the validity and reliability of self-reported data on anthropometry and reproductive variables [1-9]. Obesity is associated with multiple health problems and with excess mortality [9,10]. Previous studies have shown that participants tend to under-report their body weight and to over-report their body height, especially those with increased weight [1-9]. In addition, self-reported anthropometric data are more biased in older than in younger participants, and in participants with low socio-economic status (SES) [9,11].

Menarche heralds the beginning of a female's reproductive life and its timing indicates the start of regular exposure to endogenous oestrogen and other hormones. Age at menarche is predicted by several factors, including childhood growth and weight, and has been found to be associated with a range of diseases in adulthood, including breast cancer, endometrial cancer, depression and rheumatoid arthritis [7]. Menopause is an event that directly affects the reproductive capacities of women. In addition, the hormonal changes related to menopause may be associated with various chronic conditions, e.g., osteoporosis and cardiovascular diseases [12].

Some studies have investigated the reliability of self-reported age at menarche and age at menopause with moderate to good agreement [2-9]. Findings from several studies reported that recall of age at menopause within one year ranges from 44%–95%, and the accuracy declines with increasing years since menopause [13]. Women's reproductive history and related data are self-reported with reasonable accuracy which may vary according to educational attainment [7]. Little is known on reliability of self-reported information about the reason for absence of menses [13,14].

The objective of our study was to evaluate reliability of self-reported information on weight at eighteen years, age at menarche and menopause, and the reason for absence of menses among women who had undergone image-guided core biopsy for evaluation of breast abnormality. Furthermore, we determined to what extent the reliability was affected by age, education and histo pathological findings.

Material and Methods

Study population

This study was conducted within the framework of the Diagnosis Optimization Study (DIOS study). The design of DIOS is described elsewhere [15]. In brief, the DIOS study is an ongoing cohort study with prospective follow-up. The study population included all women who underwent image-guided core biopsy for evaluation of breast abnormality at University Hospital of Halle (Germany) over a 4-year period (April 2006 to July 2010) and gave informed consent for participation in the study including follow-up evaluations related to the study. Women with principal residence outside Germany or insufficient knowledge of the German language were excluded from the study. All eligible women received at baseline and two years later

a postal questionnaire that contained several questions related to risk factors of breast cancer and their gynecological history. Missing or implausible questionnaire data were clarified by telephone calls to the participants. All data from the case report forms and questionnaires were entered in an access data bank using the double-data entry method to ensure a high quality of data entry. Study data were checked regularly for quality by plausibility controls.

In the current analysis, we included all women who had completed a questionnaire at baseline and follow up. Median time between recruitment and follow-up was 29.9 months (range, 22-37; SD, 1.0).

Between 2006 and 2010, 1790 women completed the baseline questionnaire and were eligible for the follow-up questionnaire. Twenty-five women (1.4%) could not be invited for the follow-up questionnaire, mainly because they had died during follow-up period. Of the 1765 women invited for the follow-up study, 1670 responded (94.6%) (Figure 1).

Data collection

The question on self-reported weight was: "What was your weight at age eighteen (around in kilogram)?"

The question referring to age at menarche was: "How old where you when your menses started (in years)?" To define menopausal status, women were specifically asked: "Do you have menses?" If the answer was negative, the next question was: "What was the reason for absence of menses? Answer categories: menopause, operation, hormone intake, other reason." The question referring to age at last menses was: "When was your last menses?" The exact same set of questions was applied in the baseline and follow-up questionnaire.

To determine the education level, women were asked to indicate their highest school degree on an ordering 6-point scale: no degree, lower secondary school (no school leaving certificate or lower secondary school leaving certificate (*Hauptschulabschluss/ Volksschulabschluss*)), intermediate secondary school (intermediate secondary school leaving certificate (*Mittlere Reife/Polytechnische Oberschule*)), and upper secondary school (upper secondary school leaving certificate (*Fachhochschulreife/ Abitur*)). Next, school degree was divided into three categories: low education level (no degree, lower secondary school), intermediate education level (intermediate secondary school) and high education level (upper secondary school).

The histopathological findings of the core biopsy were documented using a standardized case report form that included both, the traditional diagnosis of the histological findings and the B-categories (B1: normal or uninterpretable, B2: benign, B3: benign but of uncertain biological potential, B4: suspicious of malignancy, and B5: malignant including in-situ and invasive cancer). The B-categories were pooled into three groups: group 1 included patients with B1or B2 outcome, group 2 patients with B3 outcome, and group 3 patients with B4 or B5 outcome. Education and histopathological findings were assessed at baseline.

Statistical analysis

We examined reliability by calculating mean values and standard deviations (SD), and Intraclass-Correlation Coefficients (ICC) of the differences between information on weight and age at menarche and menopause reported in the baseline and follow-up questionnaires. ICC according to Shrout & Fleiss and corresponding 95% CIs were computed using a one-way analysis of variance [16]. Bland Altman

plots were used to examine the individual agreement between self-reported weights, age at menarche, and menopause reported in the baseline and follow-up questionnaires. In these plots, the differences between the self-reported values (baseline values minus follow-up values) were plotted against the mean values of baseline and follow-up [17], while linear regression analyses were performed to assess the factors that were independently associated with the reliability (measured by absolute differences). We identified minimally sufficient adjustment sets depending on the outcome using causal diagrams that represented the presumed associations between exposure, outcome, and other variables [18]. The reliability for the reported reason for absence of menses was calculated as overall agreement - calculated as proportion of identically reasons reported for absence of menses at baseline and follow-up divided by all ratings - and as Cohen's kappa coefficient (k) with corresponding 95% confidence intervals [19]. The strength of the agreement was classified according to Landis and Koch [19]. All analyses were performed using the statistical software SAS Version 9.3 [20].

This study was conducted in accordance with the German guidelines of Good Epidemiological Practice [21]. The study was approved by the ethics committee of the Medical Faculty in Halle, Germany. Informed consent was obtained from all patients.

Results

A total of 1670 women (18-89 years, mean age 56.8 SD 10.2) completed both, the baseline and the follow-up questionnaire. Patients' baseline characteristics are given in Table 1.

Weight at age of 18, age at menarche and age at menopause were reported with small bias (mean weight difference: 0.24 kg; mean age difference at menarche: 0.0 years, and at menopause: 0.1 years). The corresponding ICCs were 0.47 for weight at age of 18, 0.68 and 0.90 for age at menarche and menopause, respectively (Table 2).

Figure 2 shows the extent of the differences (baseline values minus follow-up values) of self-reported weight at the age of 18 (a), age at first menarche (b) and age at menopause (c) plotted against the mean of baseline and follow-up values. Sometimes, there were large individual differences in the accuracy of the self-reported variables.

The differences in self-reported weight at eighteen years were greater in women with lower education and in women with in-situ or invasive breast cancer (B4 and B5 category) compared to women with benign or suspect biopsies (B1- B3 category). Furthermore, differences in self-reported weight at 18 years and age at menopause were related to age at baseline. Based on multiple linear regression models, the differences for weight at eighteen years and age at menopause increased for each of 10 age years by 0.38 kg and by 0.44 years, respectively (Table 3).
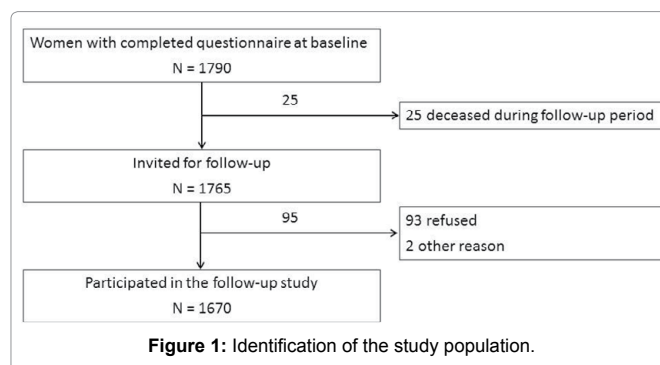

Figure 1: Identification of the study population.

Table 1: Characteristics of the study population at baseline.

Characteristics	All Woman		Menopause			
			Yes		No	
	N	(%)	N	(%)	N	(%)
All	1670	100	1343	100	327	100
Age (years)						
18-39	84	5.0	12	0.9	72	22
40-49	251	15.0	86	6.4	165	50
50-59	686	41.1	596	44.4	90	28
60-69	539	32.3	539	40.1	0	0
> 70	110	6.6	110	8.2	0	0
B-classification[1]						
B1	87	5.2	55	4.1	32	10
B2	849	50.8	676	50.3	173	53
B3	243	14.6	195	14.5	48	15
B4	4	0.2	4	0.3	0	0
B5	487	29.1	413	30.8	74	23
Education level[2,3]						
low	231	14.0	227	19.9	4	1
middle	1017	60.9	799	59.6	218	67
high	420	25.1	315	23.5	105	32

Note: 1) B1: normal or uninterpretable tissue, B2: benign, B3: benign but of uncertain biological potential, B4: suspicious of malignancy, and B5: malignant including in-situ and invasive cancer

2) Low education level (no degree, lower secondary school), middle education level (intermediate secondary school) and high education level (upper secondary school)

3) 2 Missing

Table 2: Intraclass-Correlation coefficients for weight, age at menarche and menopause.

	N	at baseline (SD)	at follow-up (SD)	differences (SD)	ICC	(95% CI)
Mean weight at 18 years	1633	57.24 (8.42)	57.48 (10.0)	0.24 (6.98)	0.47	(0.43 – 0.51)
Mean age at menarche	1659	13.16 (1.49)	13.16 (1.50)	0.00 (0.67)	0.68	(0.65 – 0.70)
Mean age at menopause	1282	48.55 (6.38)	48.65 (6.49)	0.10 (2.89)	0.90	(0.89 – 0.91)

Note: SD: standard deviation; ICC: Intra-class correlations coefficient; CI: Confidence interval

Self-reported weight at 18, age at menarche and menopause at baseline and follow-up, the mean of the individual differences, and the intra-class correlations coefficients

The observed agreement for the reason for absence of menses at baseline and follow-up was 0.92 (95% CI: 0.91-0.94), the chance-corrected agreement was 0.85 (95% CI: 0.82-0.88) (Table 4). Of women with concordant data at baseline and follow-up (n= 1201) 66% reported natural type of menopause, 28% as consequence of operation, 2% as consequence of hormone intake and 3% for other reasons.

The mean absolute difference for self-reported age at menopause between baseline and follow-up according to the reason for absence of menses was 1.20 years (95% CI: 1.05-1.34). The highest absolute mean difference was observed for women who reported natural menopause (mean difference (MD) 1.4 years, 95% CI: 1.21-1.58), the lowest for women who reported "other reason" (MD 0.55 years, 95% CI: 0.18-0.91) (Table 5).

Discussion

To our knowledge, this is the first study on reliability of self-reported weight, age at menarche and menopause in women who underwent image-guided core biopsy for evaluation of breast abnormalities. Overall, our study showed that, women were quite capable to report their weight at 18 years, their age at menarche and their age at menopause with good reliability on average. However, in subgroups of elderly women and/or women with lower education, we found greater differences in self-reported weight. Younger age and high education were positively associated with the reliability

information of weight. This is in line with findings from previous studies [7,14,22]. Furthermore, the differences were also affected by the histo pathological findings of the core biopsy. The reliability of information on weight at 18 years was lower among women with malignant breast biopsies compared to women with benign or suspect biopsies. About the reason for this we can only speculate. We think that women, who have just learned that they have a cancer, think more intensively for about the present as about the past, resulting in a lower accuracy of self-reported in data.

The ICCs range from moderate to almost perfect. The lowest ICC was 0.47 for weight at the age of 18 , followed by an ICC of 0.68 for age at menarche, and an ICC of 0.90 for age at menopause. Our ICCs on age at menarche and menopause were in line with the ICCs from the German reliability study of self-reported reproductive and lifestyle data in the context of a German case-control study on breast cancer [8]. The ICCs in this study for age at menarche and menopause were 0.66 and 0.82, respectively. In summary, it is obvious that information are more imprecise the further the status was examined in the past, the lower the reliability, whereas we are only able to refer to our memory of "then" [23].

One approach to minimize incorrect information about weight at 18 years could be an additional question for dress size at the age of 18. The question offers two advantages: first, because dress size and BMI, and thus also the weight is associated [22], the participants will be in
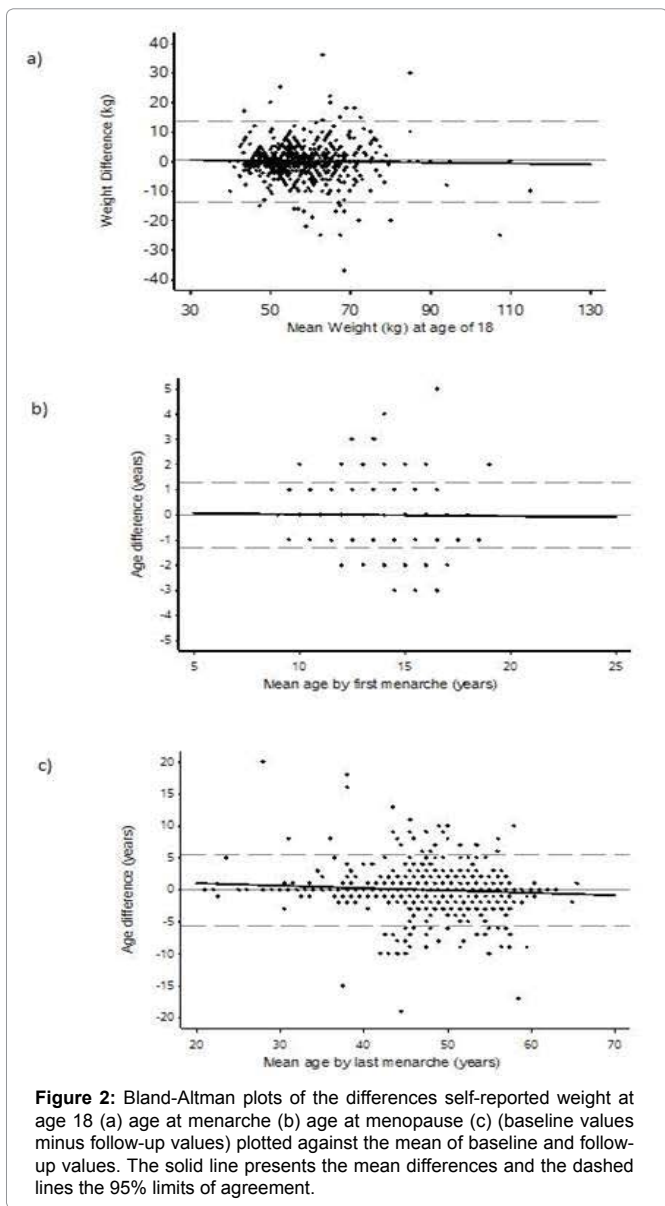
Figure 2: Bland-Altman plots of the differences self-reported weight at age 18 (a) age at menarche (b) age at menopause (c) (baseline values minus follow-up values) plotted against the mean of baseline and follow-up values. The solid line presents the mean differences and the dashed lines the 95% limits of agreement.

two different ways motivated to think about their weight, resulting in a more accurate answer. Second, if the information between weight and dress size are implausible, it stands out by editing of the questionnaire or directly by the interview and the interviewer can ask again for the correct answer. Furthermore, when designing questionnaires that ask study participants to recall the time of an event, which had been the past, researchers should consider using methods (e.g., comparison with best friends) that may elicit more accurate responses than are gained by asking only one simple question about timing. Clues about the location and social occasion of events have successfully increased accuracy of recall in experimental surveys [23].

The change corrected agreement for the reason for absence of menses at baseline and follow-up was high (Kappa: 0.85). As expected, the highest absolute mean difference in age at menopause was found for women who reported natural menopause. These findings were in line with other studies [5,13,14]. In the Nurses' Health study, 2–4 years after the first evaluation, 82% and 95% of women reporting natural and surgical menopause, respectively, agreed within 1 year [4]. A Swedish

cohort study reported in 55.6% of women with natural menopause recalled age at menopause correctly within 1 year [24]. A further Dutch study showed reproducibility proportions of 71% among women with natural menopause and 79% for women with surgical menopause [5]. Menopause is a prolonged biological event completed within 1 year or more, which by its nature favors inconsistent recall of a precise age. This may also explain the lower mean difference between interviews in women reporting surgical menopause, a comparatively instantaneous event, in contrast to those reporting natural menopause [14].

The strengths of our study are high response in the follow-up of our patients (95%), and low proportions of missing data relating to

Table 3: Multivariable linear regression models for age at baseline, histo pathological findings and highest school degree in relation to absolute differences between self-reported weight (kg) at 18, age at menarche and age at menopause reported in the baseline and follow-up questionnaires

	number	weight at eighteen (kilograms)		age at menarche (years)		age at menopause (years)	
		b[1]	SE[2]	b[1]	SE[2]	b[1]	SE[2]
Age (increment one year)	1670	0.038	0.015	0.001	0.001	0.044	0.009
B-Categories[8]							
B1+B2	936	Ref.[3]		Ref.[3]		Ref.[3]	
B3	243	- 0.235[5]	0.461	0.087[6]	0.042	- 0.192[5]	0.215
B4+B5	491	0.653[5]	0.362	-0.061[6]	0.033	- 0.264[5]	0.166
Education level[4]							
low	231	1.658[6]	0.563	0.043[7]	0.052	0.232[6]	0.245
middle	1017	1.046[6]	0.371	0.008[7]	0.034	- 0.142[6]	0.179
high	420	Ref.[3]		Ref.[3]		Ref.[3]	

Note: 1) regression coefficient 2) standard error 3) reference group 4) low education level (no degree, lower secondary school) ,middle education level (intermediate secondary school) and high education level (upper secondary school) 5) adjusted for age and education level 6) adjusted for age 7) adjusted for age and B-categories

8) B1: normal or uninterpretable tissue, B2: benign, B3: benign but of uncertain biological potential, B4: suspicious of malignancy, and B5: malignant including in-situ and invasive cancer

Table 4: The reason for absence of menses at baseline and follow-up.

		Follow-up				
		Natural	Operation	Hormone intake	Other reason	Total
Baseline	Natural	**798**	13	10	9	**830**
	Operation	9	**341**	0	7	**357**
	Hormone intake	13	1	**28**	8	**50**
	Other reason	17	7	6	**34**	**64**
	Total	837	362	44	58	**1301**

Note: Observed agreement: 0.92 (95% CI: 0.91-0.94); Chance-corrected agreement: 0.85 (95% CI 0.82-0.88)

Table 5: Differences in age at menopause between baseline and follow-up, according to the reason for absence of menses.

Reason for absence of menses	Number	Mean absolute differences (years)	95% CI
Overall	1282	1.20	1.05 – 1.34
Natural	773	1.40	1.21 – 1.58
Operation	340	0.60	0.39 – 0.81
Hormone intake	27	1.00	0.24 – 1.76
Other reason	33	0.55	0.18 – 0.91

Note: CI: Confidence interval

the variables of interest. But, our study could not address validity, the reported versus true age at first menarche and menopause, as well as true weight at age 18. However, previous studies demonstrated that self-reported height and weight correlate well with measured values, although individuals tend to overestimate their height and underestimate their weight [25]. Relating to menarche and menopause, validation studies suggest that the accuracy of self-reported reproductive variables is high in the most populations [14]. Furthermore, some subgroups were small, therefore produced imprecise estimates.

Conclusion

Body weight as well as age at menarche and menopause, whether spontaneous or induced, are associated with long-term health risks which may include premature death, cardiovascular disease, osteoporosis, and cancer [10,12]. These diseases are characterized by long latency periods, and although clinical manifestations become evident in middle-aged and older adults, pathologic processes may start as early as young adulthood or childhood. Researchers analysing retrospective data must rely on recall to characterize the long term behaviour of study participants in answering to questionnaires. Therefore, reliability of recall is an important methodological issue in epidemiologic studies. Our study provides evidence that women reported their weight at 18 years and age at menarche and age at menopause with good reliability. Furthermore, our results suggest that the reliability is positively associated with higher education and younger age. Therefore, our study results support the use of self-reported information with regard to weight at 18 years, age at menarche and menopause, and reasons for absence of menses in epidemiologic studies.

Authors' Contributions

ASP provided substantial contributions to conception and design of the study, data extraction, analysis and interpretation of data, drafted the article and revised it critically for important intellectual content. AK provided substantial contributions to acquisition of data and interpretation of data, revised the article critically for important intellectual content. PT provided substantial contributions to interpretation of data and revised the article critically for important intellectual content. MZ gave statistical advice and critical revised the manuscript. AS provided substantial contributions to conception and design of the study, interpretation of data and revised the article critically for important intellectual content. All authors read and approved the final manuscript.

Acknowledgment

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