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Validity of self-reported age at menarche in computer-assisted interview among Chinese schoolgirls: a cross-sectional study

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ABSTRACT

Objective The attitudes of girls regarding menarche vary according to their cultural backgrounds. Asian girls may hesitate to discuss menarche. Computer-assisted self-administered interviewing (CASI) is considered a valid and effective tool for investigating the timing of menarche; however, the validity of self-reported menarche data from CASI in Chinese culture is currently unknown. We aimed to validate the status and age of menarche attainment by comparing CASI with face-to-face interviewing (FFI).

Methods Based on a cross-sectional study, we collected information regarding the status and age of menarche attainment using CASI and FFI among Chinese schoolgirls. We explored the tools of standard epidemiological indices, including sensitivity, specificity, predictive values and accuracy to examine the capacity of CASI for correctly classifying the status of menarche. Both Pearson and Spearman correlations were calculated for the correlation of age at menarche using CASI with FFI. A Bland-Altman plot was drawn to measure the agreement between the two interview techniques.

Results In this study, CASI and FFI were conducted in 3478 schoolgirls with an average age (SD) of 14.3 years (2.46). Menarche attainment was reported in 2496 (71.2%) and 2538 (73.0%) girls using CASI and FFI, respectively. Compared with FFI, the sensitivity, specificity, positive predictive value (PPV), negative predictive value and the accuracy of CASI were 0.97, 0.80, 0.96 and 0.92, respectively. The correlation of age at menarche between CASI and FFI was 0.728. Approximately >95% and 76.3% of the difference in the age at menarche was within 12 months and 3 months, respectively, between the two interview methods. Among primary schoolgirls in grade 5, the sensitivity, specificity, PPV, accuracy and the correlation (0.335) of CASI was lower than those in other subgroups.

Conclusions Overall, the timing of menarche investigated using CASI was valid among all Chinese schoolgirls, except for those in grade 5 or lower.

Strengths and limitations of this study

► We validated the self-reported age at menarche using computer-assisted self-administered interviewing (CASI), in comparison with face-to-face interviewing (FFI), in a large population of 3478 schoolgirls in six provinces in China nationwide.
► The correlations in subgroups according to locations, grades, awareness in reproductive health and breast tanner stages were determined, and the correlation of the age at menarche reported using CASI with FFI was poorer among girls in lower grades or those with poor reproductive health knowledge.
► The data collected using CASI and FFI were self-reported and not prospectively recorded in this study.

an essential public health target for sexual education. The age at menarche is related to mental disorders.[1] Both early and late menarche were associated with an increased risk of vascular disease.[2 3] Therefore, a valid assessment of menarcheal age is fundamentally needed for epidemiology studies that are conducted to evaluate the impact of timing of menarche. Self-reporting of menarcheal age by face-to-face interviewing (FFI) has been commonly used and considered valid and effective for evaluating the timing of menarche by short-term recall.[4 5]

Girls' attitude to menarche has been found to vary according to their different cultural backgrounds.[6 7] In Asian countries, girls are more sensitive and conservative regarding reproductive health issues. Therefore, Asian girls tend to feel ashamed when talking about menarche. Computer-assisted self-administered interviewing (CASI), in which respondents read the questions of a survey on a computer screen and then directly enter their responses into a computer, has been applied for investigating reproductive

INTRODUCTION

Menarche, one of the milestones in pubertal development, is regarded as a unique maturation marker of transition from girls' childhood to adulthood and is considered

health to improve the quality and efficiency of self-reported data.[8] In addition to cost-saving, a higher reporting of adolescent sexual behaviour, drug use and violence in surveys of risk behaviours were observed with CASI for school-aged children in comparison with FFI or paper-and-pencil self-administered interviews.[9 10] This was because the CASI provides increased privacy of responses and the freedom for reporting behaviours that are widely believed to be risky or socially undesirable.[11 12] However, FFI for assessing adverse experiences is generally regarded as superior to self-administered interviewing because FFI allows for probing and clarification of relevant details and minimises biases related to subjective responses.[13] To our knowledge, there are currently no studies conducted to examine the validity and reliability of self-reported menarche data by CASI in Chinese culture.

The objective of the present cross-sectional study was to confirm the validity of the status and age of menarche attainment among schoolgirls in China obtained using CASI in comparison with FFI.

METHOD
Population and sample
This cross-sectional study was conducted in six provinces in China from November 2012 to April 2013. A total of 4290 girls from 26 sampled schools were recruited. These girls were sampled using the multistage cluster sampling strategy.[14] There were 24 girls with missing records regarding menarche and 788 girls refused to undergo the physical examination (online supplementary table S). Finally, 3478 girls were interviewed by both CASI and FFI.

Both parental permission and students' consent were obtained for all participants before the survey.

Data collection
Sawtooth Ci3, V. 2.6.16 (Sawtooth software, Inc., Utah, USA) was used to compile the questionnaire that was administered using personal computers. During CASI, girls were interviewed with two main questions regarding their menarche. The first question was 'do you have menstrual periods?'; if the answer was 'yes', they were asked 'how old were you when you started your first period?'. Additional questions were asked as necessary to probe for a more accurate date of menarche attainment (eg, 'what grade in school were you?' and 'what season was it?'). Girls were also tested for their awareness in reproductive health related to pubertal development, pregnancy and knowledge and perception of sexually transmitted diseases and acquired immune deficiency syndrome. The test contained 26 and 27 questions for girls in primary and middle schools, respectively. There were three research assistants in each room with 25~50 computers. One of these assistants issued unique codes and explained the background and objective of the survey, while the other two helped the participants log

into the computers using the codes and provided guidance for completing the interview. The research staff uploaded and saved the data to the computer station at the end of the survey. The research staff did not interpret survey questions or observe the participants respond to specific survey questions.

We also conducted a physical examination and FFI for the girls who had completed CASI (n=3478). During FFI, the girls were also asked the same two main questions regarding their menarche. The trained clinicians first explained about menstrual periods to the girls and clarified that menarche was the first menstrual bleeding. The clinicians also asked necessary questions to help the participants recall their age at menarche (eg, 'what grade in school were you?' and 'what season was it?'). Girls were additionally examined for their pubertal development (eg, inspection and palpation of breast), and their medical and surgical histories were obtained.

Statistics
FFI, conducted by the clinicians, was used as the reference for determining the age at menarche. The capacity of CASI to correctly classify the status of menarche (dichotomous data: yes/no) was verified by tools of standard epidemiological indices, including sensitivity, specificity, predictive values and accuracy.[15] There were three options for the CASI method: yes, no and unclear. Sensitivity was defined as the proportion of girls truly having menarche who were correctly grouped as such by the CASI. Specificity represented the proportion of girls who truly had no menarche and were correctly grouped as such by CASI. The predictive values were calculated as positive predictive value (PPV) and negative predictive value (NPV). The PPV was the proportion of girls truly having menarche among girls categorised as such by CASI. The NPV was the proportion of girls who truly had no menarche among girls categorised as such by CASI. The accuracy rate was the proportion of agreement between the classification of menarche status between CASI and FFI.

Subgroup analysis was conducted according to location (urban and rural), grades (grades 5–6: primary school, grades 7–9: junior middle school and grades 10–12: senior middle school), awareness in reproductive health and Tanner stages of breast development. The awareness of reproductive health was categorised into three groups according to the proportion of questions that the girls answered correctly (<25%, 25%–50% and >50%); all the questions were assumed to be equally important for evaluating their awareness. Breast development was categorised as Tanner stages B1–B5, where stage 1 (B1) represented immaturity and stage 5 (B5) represented full maturity.[16–18]

A retrospective method was used to estimate the average age at menarche, and the means and percentiles (P5, P25, P50, P75 and P95) were calculated. Both Pearson and Spearman correlations were computed for determining the consistency of the age at menarche by

CASI and FFI. The correlations between the difference in the age at menarche (CASI-FFI) and time interval between investigation and menarcheal onset were also calculated. Correlations were classified according to Cohen's criteria whereby a correlation of 0.10, 0.30 and 0.50 indicated a small, medium and large effect size, respectively. A Bland-Altman plot was constructed to measure the agreement of the age at menarche between FFI and CASI.[19 20] The age at investigation was computed according to the girls' birthdate, as obtained by FFI, and the date of investigation.

RESULTS

The mean age of the study participants was 14.3 years (SD: 2.46 years). Of the 3478 girls, 53.5% were from urban areas, 68.7% had a low awareness of reproductive health (<50% of correctly answered questions) and 24.1% answered <25% of the questions correctly. Almost 60% of the participants were categorised in the late Tanner breast stages (B1: 6.4%; B2: 10.5%; B3: 23.5%; B4: 28.1%; B5: 31.5%; table 1).

After physical examination, 2538 (73.0%) and 2496 (71.2%) girls who underwent FFI and CASI, respectively, were found to have attained menarche. Two hundred and three (5.84%) girls were unclear about their status of menarche during CASI (table 1). Compared with FFI, the sensitivity, specificity, PPV, NPV and accuracy of CASI method were 0.97, 0.80, 0.99, 0.96 and 0.92, respectively. The PPVs increased, while the NPVs decreased, with increasing grade and later Tanner breast stages. Among girls in grade 5, the sensitivity, specificity, PPV and accuracy were <0.8. The specificity was lower among girls from rural area (specificity: 0.71) or those with a lower awareness of reproductive health (specificity: 0.71; table 1).

Among the 2458 girls who reported their menarcheal age, the average age at menarche was 12.5 years in both FFI and CASI. The Pearson and Spearman correlation coefficients for the age at menarche between CASI and FFI was 0.802 and 0.869, respectively. The partial correlation coefficient was 0.728 after adjusting for locations, grades and awareness of reproductive health. The Pearson, Spearman and partial correlation coefficients were increased with increasing grade and awareness in reproductive health. Among girls in grade 5, the Pearson, Spearman and partial correlation coefficients were 0.369, 0.678 and 0.335, respectively (table 2). The mean difference in the age at menarche between CASI and FFI was 0.05 years (SD: 0.82 years). Approximately >95% and 76.3% of the difference in the age at menarche between CASI and FFI ranged within 12 months and 3 months, respectively (figure 1). The time interval between the age at investigation and age at menarche had a small effect on this difference (correlation: 0.189) in the investigated population (figure 2).

DISCUSSION

In the present study, we examined the capacity of CASI to correctly classify the status of menarche and validate the self-reported age at menarche compared with FFI, the reference method. We generally found that the validity of the status of menarche obtained by CASI was satisfactory due to higher scores obtained for the indices (ie, sensitivity, specificity, predictive values and accuracy). PPVs increased and NPVs decreased with increasing grades and Tanner breast stages. This negative correlation of PPV and NPV was probably attributed to the increased prevalence of menarche across the age groups.[15] The Tanner stages of breast development and school grades generally increased with age.[21 22]

We also found that the menarcheal age reported in CASI closely agreed with that in FFI. The discrepancy in the age at menarche between these two interviews varied by an average of 0.6 month. The average age at menarche in CASI was 12.5 years, which was similar to that of FFI. Dorn et al[23] conducted a cross-sequential study in 253 girls categorised into four age cohorts to explore the reliability of age at menarche across time points and methods. They reported large discrepancies in the age at menarche between the phone interview and FFI across 12 time points.

Moreover, we found lower scores of sensitivity, specificity, PPV and accuracy and a medium correlation of the age at menarche between CASI and FFI among girls in grade 5. We also found a relatively low specificity in those living in rural areas and those with a low awareness in reproductive health. Such lower scores would be due to the low awareness in reproductive health.[24] In our study, girls in grade 5 attended primary school and were aged 10.9 years on average. In China, most girls initially become informed regarding reproductive health, including menarche, in grade 5.[25] Girls who were not knowledgeable about menarche would probably not fully understand the questions that were asked from them during the interviews, which can result in inaccurate answers.[26] In our study, 603 (17.3%) girls did not know what menstruation was, and girls in grade 6 or lower had lower knowledge of menstruation than girls in grade 7 or higher. According to the subgroup analysis regarding the girls' knowledge of reproductive health, including menstruation, the correlation in the age at menarche between CASI and FFI was poorer among girls with low knowledge. Girls living in rural areas of China may have less access to computers and poorer computer skills compared with those in urban areas, which could impact the ability of the girls from rural areas to respond accurately during the CASI. Furthermore, the accuracy of the timing of menarche can be influenced by recall bias from the study participants.[5 27] In our study, the time from menarche to study participation had only a small effect on the difference between FFI and CASI. The correlations in the age at menarche between interview methods also showed similar results across time.[26]

Table 1 The capacity of computer-assisted self-administered interviewing (CASI) to correctly classify menarcheal status using face-to-face interviewing (FFI) as a reference

	Age at investigation M (SD)(years)	Menarche attainment n (%)		Time since menarche M (SD) (years)	Sensitivity	Specificity	PPV	NPV	Accuracy
		FFI	CASI						
Total (n = 3478)*	14.3 (2.46)	2538 (73.0)	2496 (71.2)	2.81 (1.75)	0.97	0.80	0.99	0.96	0.92
Location									
Urban (n=1863)	14.3 (2.51)	1389 (74.6)	1364 (73.2)	2.96 (1.80)	0.97	0.88	0.99	0.96	0.95
Rural (n=1615)	14.3 (2.40)	1149 (71.2)	1132 (70.1)	2.63 (1.68)	0.97	0.71	0.99	0.97	0.90
Grades									
G5 (n=496)	10.9 (0.66)	52 (10.5)	53 (10.7)	0.65 (0.71)	0.77	0.73	0.75	0.98	0.73
G6 (n=484)	12.0 (0.60)	182 (37.6)	176 (36.4)	0.80 (0.57)	0.91	0.83	0.94	0.97	0.86
G7 (n=507)	13.0 (0.63)	364 (71.8)	354 (69.8)	1.22 (0.79)	0.95	0.90	0.98	0.96	0.94
G8 (n=440)	14.0 (0.68)	404 (91.8)	394 (89.6)	1.74 (0.86)	0.97	0.92	0.99	0.92	0.97
G9 (n=429)	15.1 (0.69)	419 (97.7)	411 (95.8)	2.58 (1.03)	0.98	0.90	1.00	0.90	0.98
G10 (n=388)	16.1 (0.73)	38 4 (99.0)	383 (98.7)	3.23 (1.09)	0.99	0.50	0.99	0.50	0.99
G11 (n=346)	17.1 (0.71)	346 (100.0)	342 (98.8)	4.02 (1.16)	0.99	–	–	–	–
G12 (n=388)	18.3 (0.71)	387 (99.7)	383 (98.7)	5.18 (1.34)	0.99	1.00	1.00	0.25	0.99
Awareness in reproductive health									
<25% (n=838)	13.0 (1.86)	481 (57.4)	445 (53.1)	1.84 (1.23)	0.91	0.71	0.98	0.96	0.82
25%–50% (n=1552)	14.2 (2.48)	1130 (72.8)	1127 (72.6)	2.73 (1.70)	0.98	0.82	0.98	0.96	0.93
>50% (n=1088)	15.3 (2.44)	927 (85.2)	924 (84.9)	3.36 (1.80)	0.99	0.93	1.00	0.96	0.98
Tanner breast stage									
B1 (n=223)	11.1 (0.79)	2 (0.90)	9 (4.04)	0.61 (0.48)	1.00	0.77	0.22	1.00	0.78
B2 (n=364)	11.6 (0.94)	59 (16.2)	63 (17.31)	0.84 (0.50)	0.92	0.77	0.86	0.99	0.80
B3 (n=818)	12.7 (1.33)	472 (57.7)	452 (55.3)	1.28 (0.92)	0.93	0.84	0.97	0.94	0.89
B4 (n=976)	14.5 (1.62)	910 (93.2)	889 (91.1)	2.29 (1.28)	0.97	0.80	0.99	0.92	0.96
B5 (n=1095)	16.9 (1.54)	1093 (99.8)	1081 (98.7)	3.95 (1.62)	0.99	0.50	1.00	0.14	0.98

*203 out of the 3478 girls (5.84%) were unclear about their status of menarche by CASI.

M, mean; NPV, negative predictive value; PPV, positive predictive value.

Table 2 The correlations in menarcheal age between computer-assisted self-administered interviewing (CASI) and face-to-face interviewing (FFI) among girls who have attained menarche

	Age at menarche (years)												Pearson correlation	Spearman correlation	Partial correlation
	FFI						CASI								
	M (SD)	P5	P25	P50	P75	P95	M (SD)	P5	P25	P50	P75	P95			
Total (n=2458)	12.5 (1.18)	11	12	12	13	15	12.5 (1.44)	11	12	12	13	15	0.802	0.869	0.728
Location															
Urban (n=1343)	12.3 (1.12)	11	12	12	13	14	12.3 (1.37)	11	12	12	13	14	0.782	0.856	0.711*
Rural (n=1115)	12.7 (1.22)	11	12	13	13	15	12.8 (1.48)	11	12	13	14	15	0.810	0.874	0.748*
Grades															
G5 (n=40)	10.6 (0.82)	9.5	10	10	11	12	9.79 (2.40)	9	10	10	11	11.5	0.369	0.678	0.335†
G6 (n=165)	11.4 (0.69)	10	11	11	12	12	11.2 (1.23)	10	11	11	12	12	0.488	0.674	0.475†
G7 (n=346)	11.9 (0.87)	11	11	12	12	13	11.8 (1.16)	10	11	12	12	13	0.601	0.773	0.596†
G8 (n=392)	12.3 (0.99)	11	12	12	13	14	12.4 (0.99)	11	12	12	13	14	0.816	0.817	0.806†
G9 (n=410)	12.5 (1.06)	11	12	12	13	14	12.6 (1.21)	11	12	13	13	14	0.741	0.871	0.731†
G10 (n=380)	12.8 (1.06)	11	12	13	13	15	13.0 (1.22)	11	12	13	14	15	0.769	0.811	0.754†
G11 (n=342)	13.1 (1.10)	12	12	13	14	15	13.2 (1.35)	12	12	13	14	15	0.730	0.779	0.710†
G12 (n=383)	13.1 (1.22)	11	12	13	14	15	13.2 (1.26)	11	12	13	14	15	0.870	0.872	0.867†
Awareness in reproductive health															
<25% (n=436)	12.1 (1.13)	10	11	12	13	14	12.1 (1.58)	10	11	12	13	14	0.710	0.866	0.585‡
25%–50% (n=1102)	12.6 (1.19)	11	12	12.5	13	15	12.6 (1.34)	11	12	13	13	15	0.808	0.868	0.731‡
>50% (n=920)	12.6 (1.16)	11	12	12	13	15	12.7 (1.26)	11	12	13	13	15	0.845	0.867	0.804‡

*Partial correlation adjusted by grades and awareness in reproductive health.
†Partial correlation adjusted by location and awareness in reproductive health.
‡Partial correlation adjusted by grades and location.
M, mean.
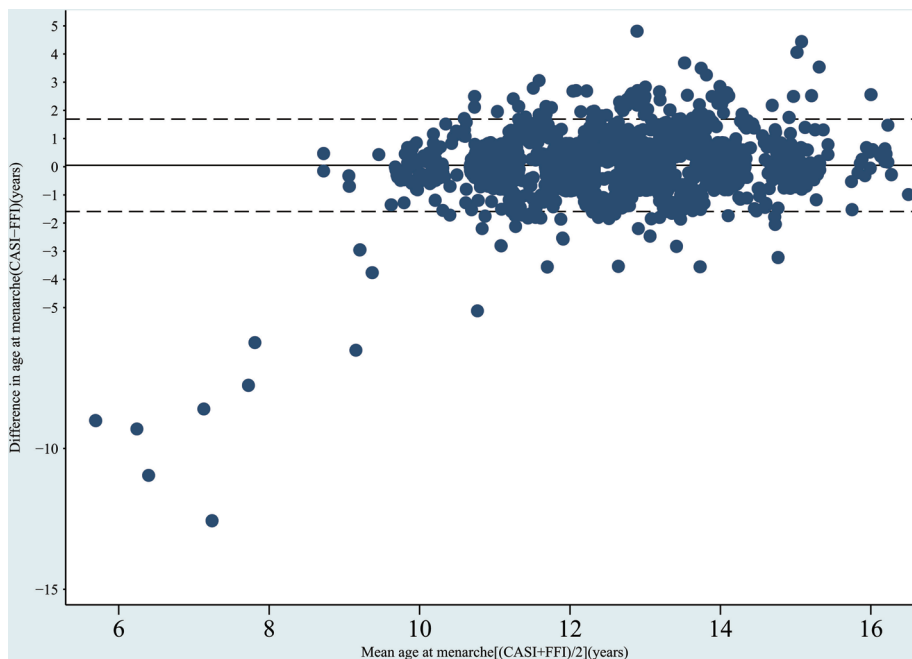
Figure 1 Bland-Altman plot showing agreement of age at menarche between CASI and FFI.The line in the middle represents the mean difference in age at menarche between the two instruments (M=0.05), and the two other dotted lines represent the upper and lower limits of agreement (M±2 SD=−1.59, 1.69). CASI, computer-assisted self-administered interview; FFI, face-to-face interview.

In the present study, conducted in a large population of 3478 schoolgirls in six provinces of China nationwide, we validated the use of CASI for determining girls' status and age of menarche attainment using FFI as a reference. FFI has been considered a valid and reliable method[26] for measuring menarcheal age based on long-term[28–31] and short-term recalls.[5 32 33] However, our study was based on a cross-sectional study, and the data

regarding menarche collected using both CASI and FFI were self-reported and not prospectively recorded.

CONCLUSIONS

The timing of menarche investigated in CASI was valid among all Chinese schoolgirls, except for those in grade 5 or lower, which suggested that the CASI method should
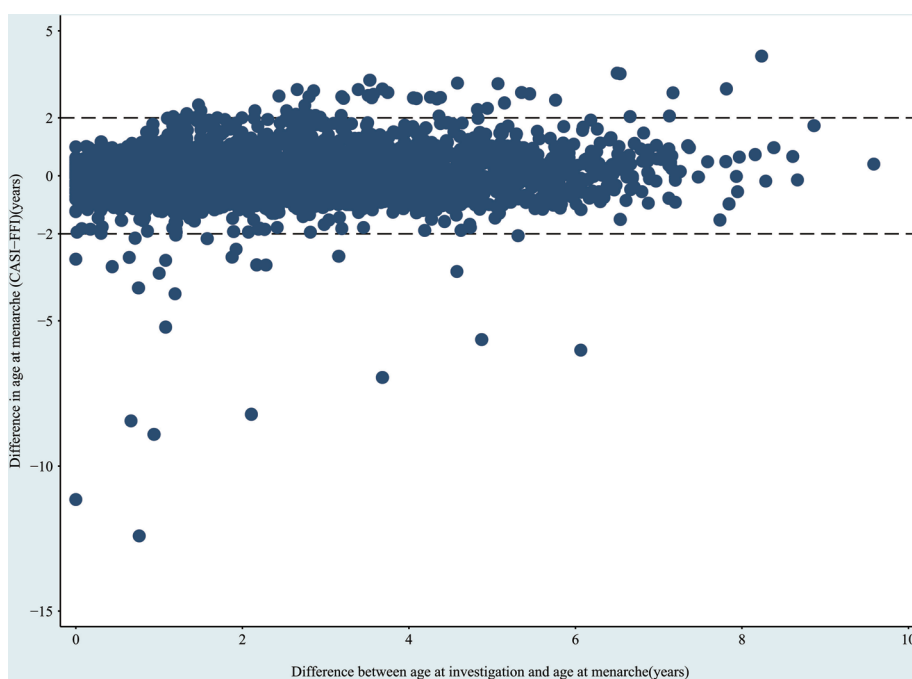
Figure 2 Correlation between differences CASI and FFI across the time interval since menarche to investigation (partial correlation=0.189). CASI, computer- assisted self-administered interview; FFI, face-to-face interview.

be used with caution among Chinese primary school students.

REFERENCES

1. Tondo L, Pinna M, Serra G, et al. Age at menarche predicts age at onset of major affective and anxiety disorders. *Eur Psychiatry* 2017;39:80–5.
2. Canoy D, Beral V, Balkwill A, et al. Age at menarche and risks of coronary heart and other vascular diseases in a large UK cohort. *Circulation* 2015;131:237–44.
3. Yang L, Li L, Millwood IY, et al. Age at menarche and risk of major cardiovascular diseases: Evidence of birth cohort effects from a prospective study of 300,000 Chinese women. *Int J Cardiol* 2017;227:497–502.
4. Hediger ML, Stine RA. Age at menarche based on recall information. *Ann Hum Biol* 1987;14:133–42.
5. Koo MM, Rohan TE. Accuracy of short-term recall of age at menarche. *Ann Hum Biol* 1997;24:61–4.
6. Uskul AK. Women's menarche stories from a multicultural sample. *Soc Sci Med* 2004;59:667–79.
7. Chang YT, Hayter M, Wu SC. A systematic review and meta-ethnography of the qualitative literature: experiences of the menarche. *J Clin Nurs* 2010;19:447–60.
8. Turner CF, Ku L, Rogers SM, et al. Adolescent sexual behavior, drug use, and violence: increased reporting with computer survey technology. *Science* 1998;280:867–73.
9. Rew L, Horner SD, Riesch L, et al. Computer-assisted survey interviewing of school-age children. *ANS Adv Nurs Sci* 2004;27:129–37.
10. Le LC, Blum RW, Magnani R, et al. A pilot of audio computer-assisted self-interview for youth reproductive health research in Vietnam. *J Adolesc Health* 2006;38:740–7.
11. Watson PD, Denny SJ, Adair V, et al. Adolescents' perceptions of a health survey using multimedia computer-assisted self-administered interview. *Aust N Z J Public Health* 2001;25:520–4.
12. Newman JC, Des Jarlais DC, Turner CF, et al. The differential effects of face-to-face and computer interview modes. *Am J Public Health* 2002;92:294–7.
13. Cristóbal-Narváez P, Sheinbaum T, Ballespí S, et al. Impact of Adverse Childhood Experiences on Psychotic-Like Symptoms and Stress Reactivity in Daily Life in Nonclinical Young Adults. *PLoS One* 2016;11:e0153557.
14. Lian Q, Zuo X, Mao Y, et al. Anorexia nervosa, depression and suicidal thoughts among Chinese adolescents: a national school-based cross-sectional study. *Environ Health Prev Med* 2017;22:30.
15. Hajian-Tilaki K. Receiver Operating Characteristic (ROC) Curve Analysis for Medical Diagnostic Test Evaluation. *Caspian J Intern Med* 2013;4:627–35.
16. Marshall WA, Tanner JM. Variations in pattern of pubertal changes in girls. *Arch Dis Child* 1969;44:291–303.
17. Bordini B, Rosenfield RL. Normal pubertal development: part II: clinical aspects of puberty. *Pediatr Rev* 2011;32:281–92.
18. Chipkevitch E. [Clinical assessment of sexual maturation in adolescents]. *J Pediatr* 2001;77(Suppl 2):135–42.
19. Bland JM, Altman DG. Measuring agreement in method comparison studies. *Stat Methods Med Res* 1999;8:135–60.
20. Bland JM, Altman DG. Statistical methods for assessing agreement between two methods of clinical measurement. *Lancet* 1986;1:307–10.
21. Sun Y, Tao FB, Su PY, Py S, et al. National estimates of the pubertal milestones among urban and rural Chinese girls. *J Adolesc Health* 2012;51:279–84.
22. Anderson SE, Must A. Interpreting the continued decline in the average age at menarche: results from two nationally representative surveys of U.S. girls studied 10 years apart. *J Pediatr* 2005;147:753–60.
23. Dorn LD, Sontag-Padilla LM, Pabst S, et al. Longitudinal reliability of self-reported age at menarche in adolescent girls: Variability across time and setting. *Dev Psychol* 2013;49:1187–93.
24. Yu J. Teenage sexual attitudes and behaviour in China: a literature review. *Health Soc Care Community* 2012;20:561–82.
25. Hong J, Fongkaew W, Senaratana W, et al. Development of a theory-based sexual and reproductive health promotion and HIV prevention program for Chinese early adolescents. *Nurs Health Sci* 2010;12:360–8.
26. Dorn LD, Sontag-Padilla LM, Pabst S, et al. Longitudinal reliability of self-reported age at menarche in adolescent girls: variability across time and setting. *Dev Psychol* 2013;49:1187–93.
27. Castilho SD, Nucci LB, Assuino SR, et al. [The importance of memory bias in obtaining age of menarche by recall method in Brazilian adolescents]. *Arq Bras Endocrinol Metabol* 2014;58:394–7.
28. Livson N, McNEILL D, Nd M. The accuracy of recalled age of menarche. *Hum Biol* 1962;34:218–21.
29. Damon A, Bajema CJ. Age at menarche: Accuracy of recall after thirty-nine years. *Hum Biol* 1974;46:381–4.
30. Casey VA, Dwyer JT, Coleman KA, et al. Accuracy of recall by middle-aged participants in a longitudinal study of their body size and indices of maturation earlier in life. *Ann Hum Biol* 1991;18:155–66.
31. Must A, Phillips SM, Naumova EN, et al. Recall of early menstrual history and menarcheal body size: after 30 years. *how well do women remember? Am J Epidemiol* 2002;155:672–9.
32. Bergsten-Brucefors A. A note on the accuracy of recalled age at menarche. *Ann Hum Biol* 1976;3:71–3.
33. Koprowski C, Coates RJ, Bernstein L. Ability of young women to recall past body size and age at menarche. *Obes Res* 2001;9:478–85.