

On the accuracy of perceived parental height in a native Amazonian society

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Abstract

Studies of secular trends in adult height in rural pre-literate societies are likely to show no change owing to random measurement error in age. In such societies, adults lack birth certificates and guess when estimating their age. We assess the accuracy of perceived height of the same-sex parent to estimate secular trends. We tested the method among the Tsimane', a native Amazonian society of farmers and foragers in Bolivia. Subjects included 268 women and 287 men >20 years of age. Over half the sample reported inaccurately the height of their same-sex living parent, with a tendency to report no difference when, in fact, differences existed. Results highlight the pitfalls of using perceived parental height to examine secular trends in adult height among the Tsimane', though the method might yield accurate information in other societies. We discuss possible reasons for the low accuracy of Tsimane' estimates.

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1. Introduction

Because socioeconomic and political conditions during the first two decades of a person's life affect final adult height, and because adult height bears a positive association with many indicators of well-being (e.g., mortality, income), researchers have used secular trends in adult height to infer changes in population well-being (Bogin and Keep, 1999; Fogel, 2005; Godoy et al., 2006, in press; Komlos, 1998; Steckel and Rose, 2002). The study of secular trends in adult height in rural pre-literate societies poses a challenge because adults lack birth certificates and guess when estimating their age (Godoy et al., 2005). Random measurement error in age produces a greater likelihood of finding no secular change in adult height. Researchers working with contemporary rural pre-literate societies might be able to redress the attenuation bias by asking adults of different generations about the height of their same-sex parent. The method might be one of the few ways to obtain reliable estimates of secular trends in height in rural, pre-literate societies, particularly if there is selective mortality of shorter adults. The validity of the method hinges on how accurately adults report the height of their same-sex parent.

We focus on the same-sex parent for two reasons. First, the norm in studies of secular trends in height is for the analysis to be done separately for women and men because secular trends for women and men might diverge. Second, rural pre-literate societies have a strong sexual division of labor (Panter-Brick, 2002), so the accuracy of reports of parental height is likely greater between a daughter and her mother or between a son and his father because an offspring and her/his same-sex parents will likely spend more time together.

In this article, we contribute to a growing body of research on the accuracy of perceived anthropometric measures (Brener et al., 2003; Ezzati et al., 2006; Goodman et al., 2000; LeJarraga et al., 1995; Ossiander et al., 2004; Strauss, 1999) and assess the accuracy with which adult offspring estimate the height of their same-parent. For the analysis, we use information from the Tsimane, a native Amazonian society of farmers and foragers in Bolivia.

In industrial nations perceived measures of anthropometric status matter because they lower the costs of doing surveys, but perceived measures may come at the cost of less accuracy. Ossiander et al. (2004) found a statistically significant, positive association between self-reported and measured height among 480 adult women in the state of Washington, USA. The regression coefficient of measured height against perceived height was 0.92. The association persisted after controlling for a woman's age and weight. Ezzati et al. (2006) used a larger, nationally representative random sample of 1.3 m people from the USA to compare measured and self-reported height and found evidence that people over-estimated their height. Drawing on data from the National Health and Nutrition Examination Survey and the Behavioral Risk Factor Surveillance System for 1988–1994 and 1999–2002, Ezzati et al. found that both women and men 20–44 years of age over-reported their height, with men over-reporting by a larger amount than women.¹ After 44 years of age, the difference in the bias between women and men disappeared. Except for older people, all other subjects reported higher height during telephone interviews than during face-to-face interviews.² LeJarraga et al. (1995) studied 82 mothers and 62 fathers attending a private high-status and a public pediatric clinic in the city of Buenos Aires, Argentina. Researchers measured the height of each parent, asked each to report their own height, and asked mothers to report the height of fathers. Researchers found that mothers and fathers

¹ The authors only provide graphical analysis so we could not assess the size of the bias.

² The study by Ezzati et al. (2006) meshes with earlier studies that also found a tendency to over-estimate height across the life cycle (cited in LeJarraga et al., 1995, p. 165).

over-estimated their own height and that mothers over-estimated the height of the father, but they only found the bias in the private clinic. In the private clinic mothers, on average, reported being 1.1 cm taller than their actual height and they said that fathers were 2.0 cm taller than they in fact were. LeJarraga et al. note that the bias in the private clinic “may reflect more concern of parents from upper social groups to enhance this physical trait [i.e., height]” (p. 164). LeJarraga et al. regressed the bias (difference between reported and measured height) against age, sex, and the type of clinic visited, and found that only attendance at the private clinic bore a statistically significant positive association with the bias.

In sum, studies from industrial nations and urban settings suggest the following conclusions about biases in reported height. First, studies using a small sample size may produce non-representative results. Second, men and women both over estimate their height, but men over-estimate more than women. Third, the tendency to over-estimate height has a life-cycle dimension, with the gap between women and men narrowing in older age. Fourth, high-status subjects may be more prone to over-estimate height. Last, most of the studies focused on self-reported height; in none of the studies did researchers ask about parental height.

It is unclear whether adult offspring will provide accurate information about the height of their same-sex parent, particularly in rural pre-literate societies. On the one hand, there are reasons to think that offspring may provide inaccurate estimates. First, some of the studies just reviewed suggest that people in industrial societies report inaccurately anthropometric status. If the same applies to people in rural pre-literate societies and to reports about parental height, one would expect offspring to report inaccurately parental height. Second, if height is an unimportant marker of socio-economic status (Case and Paxson, 2006) or if height has no cultural salience, then people will pay slight attention to their own or to other people’s height. If so, they will provide inaccurate reports of height. Third, rural pre-literate societies are often characterized by low rates of technological innovations so, in fact, they may experience modest secular change in height. In a recent review of the literature on secular trends in height in contemporary rural pre-literate societies we found evidence of negligible change (Godoy et al., 2006). If the measured difference in height between adults of adjacent generations is small because of low rates of socioeconomic change, then adults will likely err when estimating parental height. Fourth, in rural pre-literate societies one often finds preferential systems of marriage with close kin or various forms of preferential endogamy (e.g., preferential marriage within the clan, village). If followed by the majority, the cultural norm will contribute to stability in secular trends of adult height since it will curb the flow of new genes into the population.³

But we also have reasons to think that people in pre-literate rural societies might report accurately the height of their same-sex parent. First, owing to the strong sexual division of labor in such societies, people likely spend much time with their same-sex parent from childhood onwards, particularly if preferential post-marital residence makes it possible for offspring and parent to interacting frequently after the offspring marries. Second, if people use height as a status marker, then close, repeated interactions with parents over a lifetime will provide many opportunities to estimate accurately the height of the same-sex parent.

³ For instance, like other native Amazonian societies, the Tsimane’ have a preferential system of cross-cousin marriage (i.e., a man weds his mother’s brother’s daughter). In a pilot survey, we did during June–July, 2006, among 93 married adults in two villages we found that 75% had married their cross cousin. Ethnographic observations suggest that the incidence of cross-cousin marriage may reach 90% in remote villages.

2. Method and sample

2.1. Method

In earlier publications in this journal we described the background of the panel study in progress with the Tsimane' since 1999, how we measured height, and the two main empirical findings relevant to this article: the random measurement error in people's estimate of their own age and the absence of a marked secular change in height among adult women or men born between 1920 and 1980 (Godoy et al., 2005, 2006). The earlier analysis of the secular trend relied on regressions of people's measured height against dummy variables for birth cohorts. The finding of no secular change in height and the measurement error of age provided the impetus to develop another method for estimating secular trends. Because we covered background material in earlier publications, in this section we focus on the method to elicit information on perceived parental height.

During the annual panel survey of 2005 (May–September), we measured the standing height of all subjects. We limit the analysis here to people over 20 years of age since Tsimane' reach their final adult height by about age 20 (Godoy et al., 2006, *in press*). We asked adults whether they were currently taller, shorter, or the same height as their mother and their father, and whether their parents were alive.⁴ After they had answered the two questions, we gave them a sheet of white paper in daylight and asked them to mark on the paper their estimate of the present difference in height between their mother and themselves and between their father and themselves. Surveyors used a tape measure to convert into centimeters (cm) the difference marked on the paper by the subjects. The information allowed us to create two variables: the perceived difference in height in cm between subjects and their mothers and that of their fathers.

Since some of the adults whose height we measured and whom we asked about parental height had parents in the sample, we could do two analyses. First, we could assess whether adults reported accurately the height of their parents. Second, we could assess the congruence between the following two variables: (1) the parent–offspring difference in height in cm estimated during the survey from physical measures of the height of the parent and offspring and (2) the parent–offspring difference in height in cm estimated and reported by the offspring.

2.2. Sample

The sample for the analysis included 268 women and 287 men with information on own height (Table 1). We used generations to create age cohorts. We draw on the demographic research of Hill and Hurtado (1996) among the Aché foragers of Paraguay to define a generation as a group of people born over a span of 21 years. The first generation included people over 58 years of age, the second generation included people between 57 and 36 years of age, and the third or youngest generation included people between 35 and 20 years of age. The procedure created variation in the number of observations in each cell (e.g., much fewer observations in older age cohorts), making it necessary to sometimes use non-parametric statistics. To ensure robustness in results we also re-analyze (but do not report) the information using family lines rather than age cohorts.⁵

⁴ In Tsimane' the words for mother and father refer to the biological progenitor rather than to a group of people, so we doubt respondents erred when identifying their mother or father.

⁵ Family line refers to people linked by a consanguineal line of descent (e.g., father–grandfather, daughter–mother–grandmother). Such an analysis allows one to control for genetic characteristics (Bock and Sykes, 1989).

Table 1
Summary statistics of individuals' measured height in cm: by sex, generation, and family line

(I) By generation				(II) By family line			
Generation (years)	<i>N</i>	Mean	S.D.	Kin group	<i>N</i>	Mean	S.D.
Men							
				GGF	1	168.0	^
First (58+)	58	161.0	5.1	GF	15	161.8	5.9
Second (57–36)	80	162.7	4.9	Father	64	162.6	4.9
Third (35–20)	149	163.0	4.8	Son	207	162.5	4.9
Total	287	162.5	4.9	Total	287	162.5	4.9
Women							
				GGM	1	151.0	^
First (58+)	54	148.6	5.5	GM	24	147.5	6.1
Second (57–36)	72	151.0	4.4	Mother	65	151.1	5.2
Third (35–20)	142	151.4	5.2	Daughter	178	151.0	4.8
Total	268	150.7	5.1	Total	268	150.7	5.1

GGF = great grandfather; GF = grandfather; GGM = great grandmother; GM = grandmother.

Of the 268 women, 178 (66.4%) had no ancestors in the sample, 65 (24.2%) had a mother in the sample, 24 (8.9%) had a mother and a grandmother in the sample, and one (0.3%) had a mother, grandmother, and a great grandmother in the sample. Of the 287 men, 207 (72.1%) had no ancestors in the sample, 64 (22.3%) had a father in the sample, 15 (5.2%) had a father and a grandfather in the sample, and one (0.3%) had a father, grandfather, and a great grandfather in the sample. Daughters who had mothers alive at the time of the survey were taller (mean = 151.4 cm, S.D. = 5.0) than daughters with mothers who had died (mean = 149.9 cm, S.D. = 5.2) and results were statistically significant ($p = 0.03$) in a *t*-test comparing mean differences in the height between the two groups of daughters. We found no statistically significant difference in mean height between sons whose fathers were alive (mean = 162.9, S.D. = 4.8) and sons whose fathers had died (mean = 162.2, S.D. = 5.3; $p = 0.32$) at the time of the survey.

3. Results

3.1. Measured height

Table 1 (section I) suggests that mean height increased over time by generations for both women and men. A regression of female height as an outcome variable against dummy variables for the second and third generation (with the first generation used as a reference category) suggests that mean height increased by 2.3 cm ($p = 0.01$) and 2.8 cm ($p = 0.001$) for the second and third generation relative to the first generation. A similar regression for males suggests that mean height increased by 1.7 cm ($p = 0.04$) and 2.0 cm ($p = 0.009$) among males in the second and third generation.⁶

Table 1 (section II) contains the analysis by family lines and shows an increase in height from grandparents to parents, and an insignificant decline to the offspring. Mothers (151.1 cm) were

⁶ Once we correct for age-related shrinkage for people over 31 years of age, results become statistically insignificant.

3.6 cm taller than grandmothers (147.5 cm) and fathers (162.6) were 0.8 cm taller than grandfathers (161.8 cm).⁷

We regressed male height against dummy variables for ‘father’ and ‘sons’ (with great grandfathers and grandfathers as the reference category) and we repeated the analysis for women. We found no statistically significant association among men but we found that daughters were 3.5 cm ($p = 0.001$) taller than grandmothers or great grandmothers and mothers were 3.6 cm ($p = 0.003$) taller than grandmothers or great grandmothers. The analysis by family lines might produce inaccurate results if daughter–mother pairs belonged to different birth cohorts. For this reason, we re-estimated the regressions for females conditioning for birth cohorts. The coefficient for daughter became statistically insignificant, but the coefficient for mothers suggests that mothers were 2.4 cm taller than grandmothers and great grandmothers ($p = 0.07$).⁸

3.2. Perceptions of secular trend in height: men

Table 2 (section I C) suggests that most sons said that their fathers were taller than they. For example, among men in the first or oldest generation (>58 years of age), 56.4% said their fathers were taller, 12.8% said that their father was shorter, and the rest (30.7%) said they had the same height as their fathers. The older was the son, the larger was the percentage who stated that their father was taller. In row D of Table 2 (section I) we calculate the net share of men in the sample who reported being smaller than their fathers. To compute net shares for each age cohort we subtracted the share of men reporting being taller than their fathers from the share of men reporting being shorter than their fathers. A minus (–) sign indicates that the age cohort experienced net shrinking and a plus (+) sign indicates that the age cohort experienced net growth compared with the previous generation. Table 2 suggests that 43.5% of the oldest or first generation, 30.0% of the second generation, and 8.4% of the youngest generation perceived themselves as having become smaller than their fathers. In sum, the evidence suggest that living Tsimane’ men of all generations perceived themselves as being shorter than their fathers.

3.3. Perceptions of secular trend in height: women

Answers from women about perceived maternal height suggests non-linearity in the secular trend in height, with evidence of perceived secular decline in height among older women and perceived secular increase in height among younger women. Table 2, section II C, suggests that 45.4% of women over 58 years of age (first generation) said their mothers were taller, and only 22.7% said they were taller than their mothers. Nevertheless, among women of the second generation (57–36 years of age) the pattern switched, with 35.1% of women reporting being taller than their mothers and 33.3% reporting being shorter than their mothers. Most of the youngest women (35–20 years of age, or third generation) also perceived themselves as having grown;

⁷ The difference in height between daughter–mother and son–father might reflect a delay in reaching final adult stature owing to under-nourishment (Godoy et al., 2005, 2006). To test the idea we used quarterly anthropometric data covering 18 consecutive months (2002–2003) from an earlier study to assess whether Tsimane’ in their early 20s were still growing and did not find support for the idea.

⁸ The coefficients for mother and daughter became statistically insignificant after making corrections for age-related shrinking for women past 31 years of age.

Table 2
Perceived parental height relative to respondent's height by generations and respondent's sex

Relative to offspring	First: >58 years of age		Second: 57–36 years of age		Third: 35–20 years of age	
	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
(I) Generation of male respondents						
(A) Father alive is						
Taller	0	0	7	26.9	31	36.4
Same height	0	0	12	46.1	26	30.5
Shorter	1	100.0	7	26.9	28	32.9
Total	1	100.0	26	100.0	85	100.0
(B) Father dead was						
Taller	22	57.8	21	61.7	6	60.0
Same height	12	31.5	10	29.4	3	30.0
Shorter	4	10.5	3	8.8	1	10.0
Total	38	100.0	34	100.0	10	100.0
(C) Father alive or dead is/was						
Taller	22	56.4	28	46.6	37	38.9
Same height	12	30.7	22	36.6	29	30.5
Shorter	5	12.8	10	16.6	29	30.5
Total	39	100.0	60	100.0	95	100.0
(D) Net % of sons shrinking (taller less shorter)						
		+43.5		+30.0		+8.4
(II) Generation of female respondents						
(A) Mother alive is						
Taller	2	28.5	10	29.4	21	22.8
Same height	2	28.5	12	35.2	29	31.5
Shorter	3	42.8	12	35.2	42	45.6
Total	7	100.0	34	100.0	92	100.0
(B) Mother dead was						
Taller	18	48.6	8	40.0	4	26.6
Same height	12	32.4	5	25.0	5	33.3
Shorter		18.9	7	35.0	6	40.0
Total	37	100.0	20	100.0	15	100.0
(C) Mother alive or dead is/was						
Taller	20	45.4	18	33.3	25	23.3
Same height	14	31.8	17	31.4	34	31.7
Shorter	10	22.7	19	35.1	48	44.8
Total	44	100.0	54	100.0	107	100.0
(D) Net % of daughters shrinking (taller less shorter)						
		+22.7		-1.8		-21.5

44.8% of these women reported being taller than their mothers, with only 23.3% reporting being shorter than their mothers.

Among the oldest women we find net perceived shrinking figures of 22.7% for women of the first generation (section II D). Starting with women of the second generation we see a net increase in the share of women reporting being taller than their mothers. Among women of the second and

third generations, the net share of women reporting being taller than their mothers reached 1.8 and 21.5%.

In sum, analysis of information on perceived parental height suggests a decline in height among men, and a decline followed by an increase among women. The analysis along family lines yielded the same conclusions.

3.4. Comparison of reported and measured relative height of parents

We next assess how well estimates provided by the offspring about the perceived relative height of their same-sex parent compare with estimates from surveyor's measures (Table 3). In rows we summarize information about relative difference in height between parent and same-sex offspring from physical measures taken during the survey. We split measured height into three rows or categories: shorter, same, and taller. The category "same" includes measures within 1 cm of the actual measure of the standing height of the same-sex parent. For the main analysis we allow a margin of error of ± 1 cm because it would be unrealistic for an offspring to estimate with complete accuracy the height of a parent, but later we report the results of analyses allowing for a higher margin of error. If an offspring was 100% accurate about the relative height of their

Table 3
Comparison of self-perceived and measured relative height

I. Males:									
		Relative to father, son reports being:							
		Shorter		Same height		Taller		Total	
		N	%	N	%	N	%	N	%
Relative to father, son is measured as being:	Shorter	106		49		26		181	
	% across		58.5		27.0		14.3		100.0
	% down		94.6		64.4		45.6		73.8
	Same height	1		10		0		11	
	% across		9.09		90.9		0.0		100.0
	% down		0.8		13.1		0.0		4.4
	Taller	5		17		31		53	
	% across		9.4		32.0		58.4		100.0
	% down		4.4		22.3		54.3		21.6
	Total	112		76		57		245	
% across		45.7		31.0		23.2		100.0	
% down		100.0		100.0		100.0		100.0	
II. Females:									
		Relative to mother, daughter reports being:							
		Shorter		Same height		Taller		Total	
		N	%	N	%	N	%	N	%
Relative to mother, daughter is measured as being:	Shorter	69		49		36		154	
	% across		44.8		31.8		23.3		100.0
	% down		92.0		60.4		41.8		63.6
	Same height	0		9		1		10	
	% across		0.0		90.0		10.0		100.0
	% down		0.0		11.1		1.1		4.1
	Taller	6		23		49		78	
	% across		7.6		29.4		62.8		100.0
	% down		8.0		28.4		56.9		32.2
	Total	75		81		86		242	
% across		30.9		33.4		35.5		100.0	
% down		100.0		100.0		100.0		100.0	

"Correct" sample size and percentages are italicized and in bold, and follow a north-west-south-east diagonal line.

same-sex parent, then all the observations would fall along a diagonal line from the north-west to the south-east.⁹

Table 3 suggests that offspring often provide inaccurate answers about their parents being taller or shorter than themselves. Among males, we see in the row “Shorter” that of the 181 sons who were actually shorter than their fathers, only 106 (58.5%) reported being so. If we focus on the row “Taller” we see that of the 53 sons who were actually taller than their fathers, only 31 (58.4%) reported that they were, in fact, taller. Last, of the 11 sons who had the same height as their fathers, 10 (90.9%) were in fact of the same height. Of these 10, only 2 were truly accurate. The remaining eight were accurate within 1 cm of their father’s height. If we add the sample size of the diagonal cells or the total number of correct answers, we find that only 60.0% of sons provided accurate information about their father’s height (60.0% = 147 correct answers from adding samples in diagonal cells [106 + 10 + 31]/245 total sample of males).

Women displayed the same pattern of inaccuracy. If we examine the row “Shorter” in section II we find that of the 154 daughters who were shorter than their mothers, only 69 (44.8%) said they were shorter than their mothers. Examining the row “Taller” we find that of the 78 daughters who were taller than their mothers, only 49 (62.8%) reported being taller than their mothers. Last, of the 10 daughters who had the same height as their mothers, 9 (90.0%) reported having the same height. Again, of these nine, two were truly accurate, with the remaining seven accurate within 1 cm of their mother’s height. If we compute the grand total of accurate measures for daughters, we find that only 52.4% of answers were correct. In sum, for females and males we find that only in about half the cases (females = 52.4%; males = 60.0%) did offspring report accurately the relative height of their same-sex parent.

Most of the errors came from lumping parents into the category of “same height”. For example, among sons who were shorter than their fathers ($n = 181$) or among daughters who were shorter than their mothers ($n = 154$), 49 or 27.0% of sons and 49 or 31.8% of daughters reported being of the same height as their same-sex parent when, in fact, they were shorter.

Since a margin of error of ± 1 cm around the true value may be too strict, we lowered the standard of accuracy and re-did the analysis and equated accuracy with estimates that fell within ± 3 cm of the true value. Among men, we found that the share of subjects reporting accurately their parent’s height increased from 60.0 to 65.7% and among females the share increased from 52.4 to 58.2%. We re-did the analysis with a ± 5 cm margin of error and found that 68.1% of men and 62.3% of women accurately reported their parent’s height.

In sum, Tsimane’ reported the relative height of their same-sex parents inaccurately, with a bias toward reporting no difference in height when, in fact, differences existed.

3.5. Comparison of parent–offspring height difference in cm from self reports and actual measures

In Table 4, we compare parent–offspring height difference by generations in cm from self reports and actual measures.

Table 4 suggests that sons over estimated the stature of their fathers. For example, section I of Table 4 shows that sons of the third and second generation reported that, on average, their fathers

⁹ For example, offspring who were shorter than their same-sex parent would report being shorter than their same-sex parent (north-west corner) and offspring who were taller than their same-sex parent would report being taller than their same-sex parent (south-east corner).

Table 4

Comparison of parent–offspring difference in height (in cm) between self-reports of offspring and actual measures by sex and generation

Father was	(1) Reported difference			(2) Measured difference			(3) Column (1) – (2)
	<i>N</i>	Mean	S.D.	<i>N</i>	Mean	S.D.	Mean
(I) Males reporting							
(A) First generation, >58 years of age							
Taller	27	16.0	10.7	0	0	0	–
Shorter	8	10.0	11.0	1	0.6	0	9.4
Same	15	0	0	0	0	0	0
(B) Second generation, 57–36 years of age							
Taller	31	18.8	11.7	6	5.5	4.7	13.3**
Shorter	14	11.1	9.3	6	7.4	3.2	3.7
Same	22	0	0	11	2.4	2.1	–2.4***
(C) Third generation, 35–20 years of age							
Taller	54	13.0	10.1	30	3.5	3.0	9.5***
Shorter	35	7.0	5.2	26	5.1	3.2	1.9
Same	39	0	0	22	2.5	2.2	–2.5***
(II) Females reporting							
(A) First generation, 58+ years of age							
Taller	24	13.3	10.9	2	10.3	9.8	3.0
Shorter	10	17.3	16.8	3	7.9	5.4	9.4
Same	14	0	0	0	0	0	0
(B) Second generation, 57–36 years of age							
Taller	22	12.6	9.7	9	6.3	5.5	6.3
Shorter	22	8.8	8.2	11	4.5	2.7	4.3
Same	19	0	0	10	3.5	2.3	–3.5***
(C) Third generation, 35–20 years of age							
Taller	29	10.0	8.7	19	4.2	3.0	5.8***
Shorter	54	10.3	10.2	36	5.1	3.2	5.2*
Same	48	0	0	26	2.5	2.2	–2.5***

In columns (1 and 2), *N*, mean, and S.D. refer to the difference between subjects' reported (column 1) and measured (column 2) height of parents. Column 3 contains the difference between column 1 minus column 2 and the results of a Wilcoxon test for the statistical difference between columns (1) and (2). Asterisks (*, **, ***) significant at the 10, 5, and 1% level, respectively.

were 13.0 cm (third generation) and 18.8 cm (second generation) taller than they were, but fathers were, in fact, only 3.5 cm (third generation) and 5.5 cm (second generation) taller than their sons.

Women also over-estimated the difference in height in cm with their mothers. For illustration and because of sample size, we focus on women of the third generation and the row “Shorter” (section II). Third-generation women reported their mothers were, on average, 10.3 cm shorter than themselves (instead of 5.1 cm).

In Table 5 and Figs. 1 and 2, we present the distribution of errors between reported and measured parental height (1st & 3rd stacks represent men and 2nd & 4th stacks represent women in Figs. 1 and 2). In Fig. 1 we equate error with the absolute value of the difference

Table 5

Distribution of errors in parent's height between self-reports of offspring and actual measures: by sex and generation

<i>N</i>	Mean	S.D.	Median	Minimum	Maximum
(1) Males					
(A) Second generation, 57–36 years of age					
23	4.7	5.8	2.4	0	22.4
(B) Third generation, 35–20 years of age					
78	5.1	8.6	2.0	0	45.5
(2) Females					
(A) Second generation, 57–36 years of age					
30	4.9	5.8	2.7	0	27.3
(B) Third generation, 35–20 years of age					
81	4.0	5.8	1.7	0	29.2

Error = absolute difference in cm between reported and actual height of parents.

between reported height and measured height, rounded to the nearest tenth. Fig. 2 presents the distribution of the raw error values. We exclude people in the first generation from the analysis owing to the small sample of observations.

On average, men of the second generation reported their father's height within 4.7 cm of their father's actual height, and men of the third generation were within 5.1 cm of their father's actual height. Women of the second generation were, on average, within 4.9 cm of their mother's actual height, and women of the third generation were within 4.0 cm of their mother's actual height. If we examine the column for median values, we find that 50.0% of men in the second and third generation were within 2.4 cm (second generation) or 2.0 cm (third generation) of their father's measured height and that 50.0% of women of the second and third generation were within 2.7 cm (second generation) or 1.7 cm (third generation) of their mother's height.

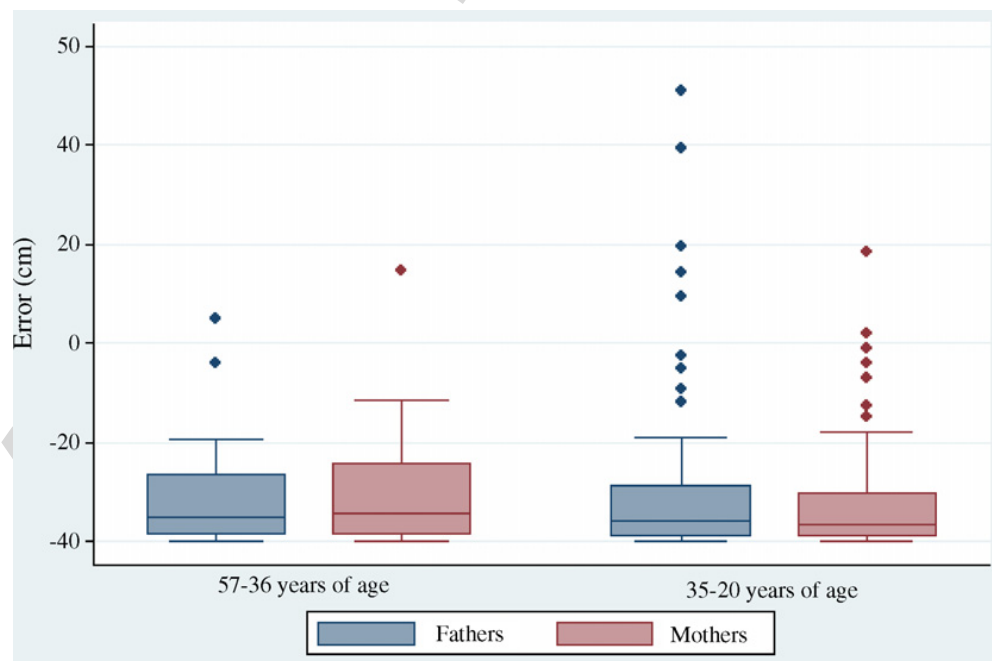


Fig. 1. Distribution of errors, expressed in absolute values, in parent's height between self-reports of adult offspring and actual measures: by sex and generation.

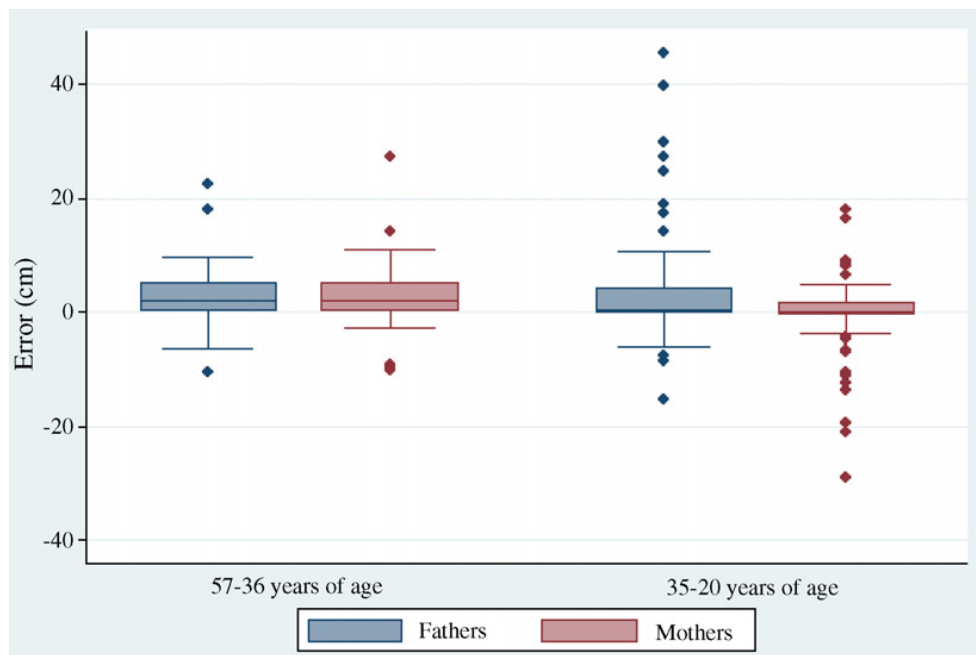


Fig. 2. Distribution of errors in parent's height between self-reports of adult offspring and actual measures: by sex and generation.

4. Discussion and conclusions

Two caveats deserve mention before discussing the implications of the study. First, like other rural pre-literate societies, Tsimane' adults do not know their chronological age with accuracy because most do not have birth certificates. Misreporting of age means that the age cohorts we created might contain people who belonged to other age cohorts. Second, asking people in pre-literate societies to mark on a blank paper their perceived height difference with their same-sex parent may have contributed to inaccurate estimates since many adults are unfamiliar with the use of pencils and paper.

Bearing the caveats in mind, one can nonetheless draw several tentative conclusions from the analysis. First, the results suggest that offspring are, on average, right only about half the time when asked about the height of their same-sex parent compared with their own height. Second, we found roughly the same pattern of misclassification among women and men. Third, we found a tendency by offspring to overstate the difference in height between themselves and their same-sex parent. Last, because respondents provided inaccurate answers about relative parental height, one must be cautious about using answers about perceived parental height to draw inferences about secular trends in adult height.

Why might Tsimane' provide inaccurate answers about the height of their same-sex parent? Several possible explanations come to mind beyond the ones discussed in the introduction. First, in a pre-literate rural society where people are not measured frequently people may be less aware of their measured height and therefore more likely to produce 'unintentional' misreporting (Ezzati et al., 2006). However, even in industrial societies adult men (Ezzati et al., 2006; LeJarraga et al., 1995; Osslander et al., 2004) and perhaps adolescents as well (Brener et al., 2003; Goodman et al., 2000; Strauss, 1999) over-estimate their own height, so it is quite possible that even people in industrial societies may provide inaccurate answers about parental height.

Second, objective differences in height between offspring and same-sex parent may have been too small for Tsimane' to detect through casual observations. For example, on average a son or a

daughter was only 1.4 cm shorter than his father or mother (section II, Table 1). Differences in height may have been too small for people to spot with accuracy.

Third, Tsimane' may have a cultural norm of portraying themselves as shorter than their parent to show deference. We explored the topic through open-ended interviews in 2006, and did not find support for the hypothesis, but it is possible that a more systematic probing of the topic would support the explanation.¹⁰

In sum, this paper highlights the pitfalls of using perceived parental height to examine secular trends of height in rural pre-literate societies. Researchers using perceived height should keep in mind that people tend to inaccurately assess their parents' height. The use of self reports is an attractive option to elicit anthropometric information because of its low cost, and may perhaps allow one to estimate secular trends in height in pre-literate rural societies, but the method is inaccurate and cannot be used with confidence among the Tsimane', though it is possible that it might work well in other settings.

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¹⁰ In Tsimane' myths we found evidence of tall men called *rajnaty* who live in the forest, only appear at night, are as large as tall trees, and who elicit fear and respect from human, but who do not harm humans.

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