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The male-taller norm: Lack of evidence from a developing country

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ABSTRACT

In general, women prefer men taller than themselves; this is referred to as the male-taller norm. However, since women are shorter than men on average, it is difficult to determine whether the fact that married women are on average shorter than their husbands results from the norm or is a simple artifact generated by the shorter stature of women. This study addresses the question by comparing the rate of adherence to the male-taller norm between actual mating and hypothetical random mating. A total of 7954 actually married couples are drawn from the last follow-up of the Indonesian Family Life Survey, a nationally representative survey. Their heights were measured by trained nurses. About 10,000 individuals are randomly sampled from the actual couples and randomly matched. An alternative random mating of about 100,000 couples is also performed, taking into account an age difference of 5 years within a couple. The rate of adherence to the male-taller norm is 93.4% for actual couples and 88.8% for random couples. The difference between the two figures is statistically significant, but it is emphasized that it is very small. The alternative random mating produces a rate of 91.4%. The male-taller norm exists in Indonesia, but only in a statistical sense. The small difference suggests that the norm is mostly explained by the fact that women are shorter than men on average.

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Introduction

Among the many physical attributes of potential partners, height plays an important role in finding a mate to form a reproductive unit. A well-known preference regarding height is that women prefer men taller than themselves; this is referred to as the male-taller norm. This norm is so prevalent that it is also called the "cardinal principle of date selection" (Ellis, 1992: 280); evidence of this is largely based on populations in developed countries (see references in Sorokowski and Butovskaya, 2012). However, since women are shorter than men on average (Gaulin and Boster, 1992), it is difficult to determine whether the fact that married women are shorter than their husbands results from the norm or is a simple artifact generated by the shorter stature of women. This question is of merit because recent studies based on indigenous populations have challenged the argument that the norm is universal (see the literature review); these studies have argued that the norm might be limited to Western populations.

To address this question, one needs to compare the rate of adherence to the male-taller norm between actual and hypothetical random pairings. For this exercise, it is important to distinguish between preferred mating and actual mating. Individuals can say anything when the stake is low, but they have to reveal their true preferences in actual behaviors (Courtiol et al., 2010a). Furthermore, it is desirable to use measured, rather than self-reported, height because self-reported height can be plagued by measurement error and bias (Danubio et al., 2008). One also needs to use nationally representative data to ensure the generalizability of results. In addition, a large sample size is preferred because it improves estimation precision. Furthermore, populations in developing countries can shed new light on the issue because the literature is entirely based on populations in developed countries and indigenous populations. These two sources of evidence are too extreme to determine the generalizability of the norm to the world's population since the vast majority lives in developing countries, and as such, an analysis of a developing country is of interest.

We follow these criteria to test the existence of the male-taller norm in a populous developing country, Indonesia. Among developing countries, Indonesia deserves attention because its population has characteristics of interest for the literature; namely, the Indonesian population exhibits mixed characteristics of populations in developed countries and indigenous populations. For example, Indonesia belongs to the region that has exhibited the shortest height in the world, at least for the past 200 years (Baten and Blum, 2012). Possibly due to this legacy, Indonesians remain short at present even compared to populations in other developing countries. In fact, they are so short that their mean height is similar to those of hunter-gathers and foragers living in subsistence-based economies (Walker et al., 2006). Thus, whereas Indonesia's socioeconomic conditions are more similar to those of developed countries than indigenous societies, inhabitants' heights are more similar to those from indigenous societies than developed countries. In addition, polygamy is legal in Indonesia. In this regard, the Indonesian marriage customs are more similar to those of indigenous societies. However, the practice of polygamy has almost disappeared, and monogamy is the norm. In this regard, the Indonesian marriage customs are more similar to those of developed countries. Moreover, the development stage of the Indonesian economy lies between developed countries and indigenous societies. These intermediate features of the Indonesian population and economy can provide an interesting case to the issue, alongside the two extreme cases (i.e., populations in developed countries and indigenous societies). Furthermore, Indonesian culture is based on Islam rather than Christianity or other religions of indigenous populations; thus, it is possible to investigate whether the male-taller norm is truly universal, regardless of culture.

Literature review

The influence of height on mating behavior has long been studied (e.g., Galton, 1889). Among many mating behaviors, the male-taller norm has been extensively investigated and confirmed for Western populations. Sorokowski and Butovskaya (2012) provided representative studies and briefly discussed them. Pawłowski's study (2003) constitutes an example for a Western (Polish) population. A notable feature of this study is that he considered the significance of relative rather than absolute height when studying height preferences. In addition, 363 women and 161 men in his study were presented six

pairs of silhouettes depicting couples of varying levels of sexual dimorphism in stature (SDS = male height/female height); the levels of SDS were 0.96, 1.00, 1.04, 1.09, 1.14, and 1.19. The participants were asked to choose the pair that they would prefer as their own. Pawłowski (2003) found that no man or woman chose the pair depicting a woman taller than a man (i.e., an SDS of 0.96). However, when Sorokowski et al. (2012) applied similar methods to a semi-nomad population (Himba) in Namibia, they found that 21.4% of their male sample and 13.8% of their female sample chose an SDS of 0.96. Realizing that the pictures of the pairs mixed height and body size, Sorokowski and Butovskaya (2012) changed only height in the pictures. Regardless, they found that few Polish participants chose an SDS of 0.96, while 26% of the male indigenous sample (the Datoga people of Tanzania) and 19% of the female indigenous sample chose an SDS of 0.96.

Although these studies produced contrasting results, they both commonly suffered from two limitations. First, their outcome of interest was the preferred level of SDS. As emphasized in the introduction, the preferred choice is not necessarily the same as the actual one, which is what we would like to examine. Second, they did not compare the male-taller norm in actual mating with that in random mating. Sorokowski and Butovskaya (2012) attempted this; however, their random mating did not concern the real distribution of the indigenous population, but rather an equal distribution of percentages across the six pairs. The former is a relevant counterfactual to actual mating, while the latter consisted of mechanically assigned percentages according to the number of depicted pairs.

Only a few studies have tested the existence of the norm while addressing these limitations, but each had limitations of its own. Gillis and Avis (1980) initiated this line of research by considering the differences in height of 720 UK couples reported by one bank branch. However, height in their sample was self-reported, and the sample was highly selective and small. On the other hand, Stulp et al. (2013) drew on a large number (12,502) of UK couples and confirmed that the rate of male-taller couples was greater than could be expected by chance; however, height in the sample was self-reported, and the data on the couples were not nationally representative (although the data on their children were).

Sear et al. (2004) examined an indigenous population in Gambia and found that they did not adhere to the norm. However, their sampling scheme (and, as a result, the representativeness of the sample) was unclear, and the sample size was not large (889 marriages). Sear and Marlowe (2009) examined another indigenous population (Hadza foragers) and found no evidence of the norm in this population; however, their sample size was very small (207 marriages). Similarly, Becker et al. (2012) considered African pygmies and found that the distribution of female-taller couples (five couples) was not statistically significantly different from that expected under random mating (7.8 couples). However, they paid more attention to the size of the difference than the statistical significance and acknowledged that the norm existed among these pygmies. Nevertheless, their sample size (72 couples) was small and selective. This study attempts to address all of these limitations and test the existence of the male-taller norm.

Data

The main dataset is the Indonesian Family Life Survey (IFLS), an on-going longitudinal survey. In 1993 (IFLS1), the survey began to follow more than 22,000 individuals from 7224 households in 13 provinces. Owing to cost constraints, the survey was representative of 83% of the Indonesian population. Four follow-up surveys have since been carried out in 1997 (IFLS2), 1998 (IFLS2 +), 2000 (IFLS3), and 2007 (IFLS4). The data are publically available at http://www.rand.org/labor/FLS/IFLS.html. IFLS2+ is an ad hoc survey, concerning only one quarter of the original sample and it is publically unavailable. This study analyzes IFLS4 because it has the largest sample size.

Height was measured by specially trained nurses, so we can ignore concerns of measurement error and bias stemming from self-reported height. If there are any errors in height, they are probably random recording errors. Because random recording errors increase estimation imprecision, we restrict the sample to heterosexual couples with valid and plausible heights (1.20–2.00 m) and height differences within couples (−0.2 to 0.3 m). These two ranges are wide enough to capture observations at lower than 1 percentile and greater than 99 percentile of each statistic in the raw data. More specifically, only 36 couples within the height range lie outside of the height difference range; however, the substance of our results remains the same even when we include them (not shown). Finally, our

sample size constitutes 7954 couples. The mean height is 1614 mm for men and 1507 mm for women (see Sohn, 2014c, 2015b, 2015c, for more about height in Indonesia). Note that the mean height is shorter than those in other developing countries. For example, the mean height of men (7 years older than in our sample) in China is 1667 mm (Fang et al., 2009). In addition, the Indonesian figures do not differ much from those of pygmies, as Becker et al. (2012) documented that the mean height was 1556 mm for men and 1462 mm for women.

The sample exhibits an SDS of 1.07, which is the same as the SDS mean of the 155 societies that Gaulin and Boster (1992) examined – their mean remained the same with progressively more stringent case-inclusion rules. Thus, although Indonesians have long been very short, their mating behavior related to SDS is quite typical. Thus, our argument against the male-taller norm among Indonesians does not depend on the possibility of an untypical SDS among Indonesians.

In addition, when height is related to old individuals, shrinkage is of potential concern. If the rate of shrinkage dramatically differs between men and women, male-taller couples (when they are young) could become female-taller couples when they are older and vice versa. Fortunately for this study, shrinkage is typically small, and its rate does not differ much between men and women (Cline et al., 1989). That said, we adjust for shrinkage as proposed by Cline et al. (1989) and perform the same analyses; the adjustment is inconsequential (not shown) because the correlation coefficient between adjusted and unadjusted heights is 0.99.

Methods

For hypothetical random mating, the following procedure is performed. We randomly sample 100 observations by sex, without replacement from the actual sample, and repeat this exercise 100 times. We add up all of the randomly selected samples until we reach 10,000 observations for each sex. We then randomly match men and women until we have 10,000 couples. Finally, we exclude couples whose height difference is outside the range of −0.2 to 0.3 m. This random sample consists of 9923 couples.

Random mating using an actual sample guarantees that the randomly selected individuals are actually married ones. However, this sampling scheme violates a basic regularity in marriage: in general, wives are younger than their husbands, and the age difference is small. In the actual sample, the mean age of wives is 38.8 years, while the mean age of husbands is 43.7 years; therefore, wives are 4.9 years younger than their husbands on average. Drawing on IFLS4, an alternative sampling scheme is adopted to reflect this regularity. Specifically, the age of individuals with valid height (1.2–2.0 m) is restricted to 15–69 for men and 15–64 for women. Random mating is then performed by age group. Individuals are grouped by age on a 5-year interval basis such that men are one age group higher than the corresponding female group. For example, men aged 25–29 are mated with women aged 20–24, and so on. The exception is men below age 25 and women below age 20; they compose one age group for each sex. In total, 10 age groups are created for each sex. For each age group by sex cell, 100 observations are randomly sampled 100 times without replacement, and they are added. In total, 200,000 (=100 observations × 100 times × 10 age groups × 2 sexes) observations are randomly sampled, and 100,000 couples are randomly mated. The height difference in random marriages is restricted to −0.2 to 0.3 m. The final sample size is 98,939 couples. In addition, 99% confidence intervals are estimated to test whether the results of the actual mating are statistically significantly different from those of the random mating.

Marriage and divorce in Indonesia

Although this study mainly employs statistics, a brief explanation of marriage and divorce in Indonesia would help the reader understand the statistics.

In the early periods, marriages were often arranged at a young age. Because it is not unusual that young couples lacked the ability to support themselves at the time of their marriage, even after official marriage, some couples continued to reside in the homes of their respective parents. In addition, when arranging marriages, parents mainly considered the reputation of potential in-laws, rather than the emotional attraction of couples. At the same time, the kinship system and family structure provided

women with a high status. Furthermore, first marriages were often regarded as trial relationships that could end at any time (Geertz, 1961). All of these features made it easy to divorce in the past (Jones, 1994, chapter 5). However, as the practice of early arranged marriage disappeared, and women received greater education (which is associated with later marriage, self-sufficiency, urbanization, and greater freedom in choosing marriage partners), the divorce rate in Indonesia consistently declined over the second-half of the 20th century (Heaton et al., 2001). Only recently has there been a sign of reversal, but it is weak (Cammack and Heaton, 2011).

IFLS4 provides statistics consistent with the divorce trend. In the raw data of IFLS4, of 9953 non-single men aged 15+, 163 (1.57%) were divorced at the time of their interview. Of 12,803 non-single women aged 15+, the corresponding figure was 407 (3.18%). However, divorced men and women can remarry, and this may make the divorce rate appear lower than the actual rate. Thus, we need to examine the marriage history of an individual. When we observe 10,662 ever-married women aged 15–49 and women completed the same module in IFLS3, irrespective of age (the same data for ever-married men were not collected in the IFLS), 1165 (10.93%) married more than once. The median age of one-time married women is 33 years, whereas that of remarried women is 42 years. This age difference is consistent with the divorce trend in Indonesia. Unfortunately, IFLS4 cannot answer why they divorced. However, it is probably related to the forces mentioned above. Overall, divorce is not extremely rare, but nor is it common. This feature is helpful for this study because if divorce were common, we would have to determine which (first or last?) husband of a wife or which wife of a husband needs to be considered for the issue, and this would make the matter complicated. Nevertheless, one could still be concerned about the non-negligible proportion of women married multiple times. Thus, below we compare two sets of results: one with all observations, and the other with observations with no experience of divorce.

As in other Islamic countries, polygamy has long been practiced in Indonesia, but although legal, it has all but disappeared in Indonesia as modernization continues to exert its influence. Specifically, we examine all household members from IFLS4, a total of 73,016 individuals. Among 9877 married male household heads, only 12 reported having two wives (0.12%). No household head reported more than two wives. IFLS1, IFLS2, and IFLS3 produce almost the same results (not shown). This feature makes our analysis simpler because if polygamy were prevalent, we would have to determine which wife is matched with the husband.

Although marriage and divorce in Indonesia have become more similar to those in developed countries, an amalgam of cultural, religious, and social norms still restricts women to the domestic sphere. In the past, women's high status was associated with their privilege to stay home. In addition, the Islamic religion continues to promote men as the dominant, protective, and responsible party in the marriage, while women are assigned with reproductive and supportive roles. Such attitudes extend beyond the home, so women are discriminated against in the labor market (Sohn, 2015a).

Results

Assortative mating by height

Before proceeding to the main results, it is instructive to understand that Indonesian couples conform to assortative mating by height; that is, tall men tend to marry tall women, and vice versa. If this very typical feature of mating were absent among Indonesians, it would be difficult to generalize our results related to the male-taller norm. Fig. 1 presents assortative mating by height in the actual sample. The oval shape of the scatter plot exhibits a positive relationship between a husband's height and his wife's height. The fitted straight line clearly shows that the relationship is positive: the slope is 0.215, and the thin gray band around the line, representing the 95% confidence interval, indicates that it is precisely estimated. Therefore, a 10 mm increase in the husband's height is related to a 2.2 mm increase in his wife's height. The correlation coefficient between the two is 0.24.

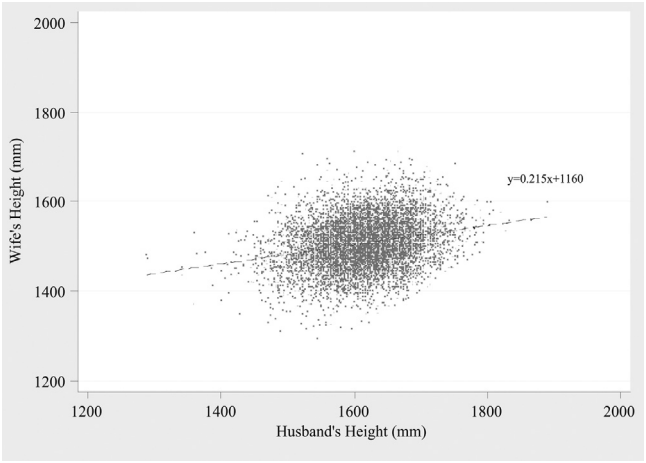

Fig. 1. Assortative mating by height. *Note*: The band around the linear fitted line represents the 95% confidence interval.

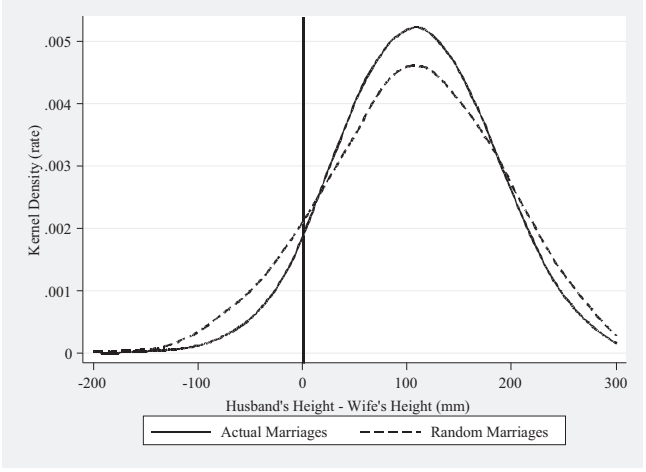

Fig. 2. The male-taller norm in actual and random marriages. *Note*: The kernel function is the Epanechnikov's function, and the bandwidth is 20.

The male-taller norm

Fig. 2 displays the kernel density of height differences within couples. The kernel function is the Epanechnikov's function (Epanechnikov, 1969) and the bandwidth is 20. Changing the kernel function and slightly adjusting bandwidth makes little difference (not shown). The vertical line at zero is added to help appreciate the male-taller norm. Clearly, the vast majority of actual couples (represented by the solid line) are distributed to the right of the vertical line, meaning that wives are generally shorter than their husbands. However, because women are shorter than men on average, we can expect this pattern even in the case of random mating. In fact, hypothetical random mating (represented by the dashed line) shows a pattern very similar to the actual one.

When specific numbers are considered (Table 1), 93.4% of actual couples and 88.8% of random pairings adhere to the norm; the two figures differ statistically significantly at the 99% level. Hence, as far as statistical significance is concerned, the Indonesian population exhibits the male-taller norm more than could be expected by chance. However, it is worth emphasizing that the difference is

Table 1
Summary statistics regarding the male-taller norm.

	Male-taller couples (99% CI)	Mean height difference (mm)	SD height difference (mm)	*N*
Actual marriages	93.4% (92.7, 94.1)	107	72	7954
Random marriages[a]	88.8% (88.0, 89.6)	104	84	9923
Random marriages[b]	91.4% (91.1–91.6)	108	79	98,940
Actual marriages with no divorce	93.5% (92.7, 94.3)	109	72	6424

[a] The actual sample is used for random mating.
[b] An age difference of 5 between the couple is taken into account for random mating.
See the section of methods for details. CI, confidence interval; SD, standard deviation; *N*, sample size.

very small at 4.6% points, which is only 4.9% of male-taller couples in actual mating. In addition, the difference in mean height differences is merely 3 mm.

The alternative method of random mating produces a slightly higher rate of norm conformation. This time, 91.4% of randomly matched couples conform to the male-taller norm, and this figure is statistically significantly different from that of actual mating. However, the difference (2% points) is too small to have significant implications. Furthermore, the difference is smaller than that between actual mating and the first method of random mating. As random mating patterns approach those of actual mating by taking age difference into account, the difference between both types of mating decreases. In addition, the difference in mean height differences is only 2 mm, which is also smaller than that between actual mating and the first method of random mating.

Recall that a small proportion of women experienced multiple marriages, and they may cause some bias in our results. Thus, we exclude them from the actual marriages and repeat the same procedure. All figures for this subsample are almost the same as those for the sample. This result is not surprising because if actual mating yields the same pattern as does random mating, as we argue here, it does not matter how many times the individual has married. Furthermore, the substance of the results (not shown) remains robust to slight changes in the ranges of height (1.2–2.0 m) and height difference (−0.2 to 0.3 m) for inclusion in the sample.

Discussion

Our results suggest that the male-taller norm exists among Indonesians, but only in a statistical sense. Sear et al. (2004) and Sear and Marlowe (2009) argued that there was little evidence of assortative mating by height among Gambian agriculturalists and Tanzanian Hadza hunter-gatherers, respectively. Because they also found little evidence of the male-taller norm for these populations, it is possible that an absence of assortative mating influences the absence of the male-taller norm. Thus, if we argue that there is no convincing evidence of the male-taller norm among Indonesians, one could object that this lack of evidence is somehow related to assortative mating by height. The correlation coefficient of a husband's height and his wife's height in our data (0.24) is much greater than Sear et al.'s (2004) corresponding figure of 0.051 (not statistically significant); Sear and Marlowe (2009) did not provide an exact number. At the same time, our figure is smaller than that of about 0.35 for Finnish twins and their spouses (Silventoinen et al., 2003). This is expected because Finnish sample concerned twins. However, our figure is close to that of 0.18 for non-twins in the UK (Stulp et al., 2013). In addition, Gillis and Avis (1980) argued that it was known that the correlation between spouses' heights was about 0.2 (they did not provide citations). Thus, Indonesians exhibit assortative mating by height, and its strength is not unusual. Because we present evidence of assortative mating by height among Indonesians, we can safely claim that our results regarding the male-taller norm are not a byproduct of an absence of assortative mating by height.

At first glance, the norm seems prevalent even among people historically short and living in a developing and mostly Islamic country. Statistical significance notwithstanding, however, the difference in adherence to the norm is very small. Stulp et al. (2013) also reported a statistically significant but small difference for the UK – 92.5% vs. 89.8%.

Since an increase in sample size improves estimation precision, one is likely to obtain statistically significant results when the sample size is large. This may explain why Stulp et al. (2013) and we found statistically significant differences between actual and random marriages, but Sear et al. (2004) and Sear and Marlowe (2009) did not. With further scrutiny, we find that the differences in Sear et al. (2004) and Sear and Marlowe (2009) are consistent with the "expected" patterns. Specifically, according to Sear et al. (2004), while 90.3% of actual marriages adhered to the norm, 88.6% of random marriages did so. The corresponding figures in Sear and Marlowe (2009) are 91.8% and 91.2%. Thus, if their sample sizes had been large, they might have found statistically significant differences and argued that traditional populations also adhere to the norm.

Becker et al. (2012) understood this concern, but their logic is the exact opposite of ours. Among 72 pygmy monogamous couples, they observed five female-taller couples (i.e., 6.9% did not conform to the male-taller norm). This percentage was 3.9% points less than expected by chance, but the difference was statistically significant only at a p-value of 0.11. Statistical insignificance notwithstanding, they argued that the difference was similar to those of other populations, which were known to conform to the norm. Therefore, they concluded that the pygmy population also conformed to the norm. However, they did not consider the possibility that the evidence of conformation to the norm for other populations is not compelling (e.g., Stulp et al., 2013). In this case, Becker et al.'s (2012) conclusion would be the opposite of their original one. Our argument is that the percentage difference in male-taller couples between actual and random mating is statistically significant even at the 99% significance level, but too small to have substantive implications for human mating.

We state above that this argument is not influenced by some untypical degrees of SDS or assortative mating by height in Indonesia. Here, we add that this argument is not influenced by the relationship between age at menarche and height. If age at menarche somehow affects height via marriage age (e.g., the younger at menarche are taller and marry earlier), we may see our results. However, Sohn (2014a) showed that age at menarche and height were little related in Indonesia. This does not mean that age at menarche in Indonesia is anomalous. Sohn (2015d) illustrated that consistent with the medical literature, the improvement of material conditions in Indonesia was related to a decrease in age at menarche for women born in 1944–1988. Overall, Indonesians' mating behaviors related to height are not idiosyncratic, and this opens up the possibility of generalizing our claim to other populations.

Whether statistically significant or not, the percentage difference in male-taller couples between actual and random mating is small for a variety of populations, covering populations from a developed country (the UK), developing country (Indonesia), and indigenous societies. One reason could be that this small difference allows men and women to increase the pool of potential partners and, as a result, their chances on the mating market. If men and women strictly adhere to the male-taller norm, then some extremely short men and extremely tall women may not find partners and fail to reproduce. Pawłowski (2003) proposed this explanation to argue that men and women adjust their SDS preferences to reflect their own height; that is, short men and tall women desire smaller degrees of SDS than tall men and short women. He postulated a psychological mechanism by which individuals take into account the population mean height of the opposite sex. Analogous to this, we speculate that there is no evolutionarily "hardwired" adherence to the male-taller norm, but that individuals adjust their preference for the norm by taking into account the height distribution of men and women in the population. In consequence, the percentage of male-taller couples in actual mating is similar to that in random mating.

Another reason could be that height itself is only one factor (albeit an important one) among many others for mating. For example, consider a woman who likes two men: one man is shorter than her but rich, while the other is taller than her but poor. If she considers only height and wealth for marriage and these two men make a marriage proposal to her, then the choice for the woman would be difficult. Depending on her preferences, the woman would marry the short or tall man.

Chiappori et al. (2012) made this idea more explicit; specifically, they relied on two ideas. The first is that the nature of the matching process occurring in the marriage market is multidimensional and involves physical and socioeconomic ingredients. Second, various attributes matter only through some one-dimensional index. These ideas allowed them to define "iso-attractiveness profiles" and marginal rates of substitution among individual attributes. For example, a 1.3 increase in a male's body mass index can be compensated for by a 1% increase in his wage. Sohn (2014b) relied on a similar idea

but specifically focused on height. One noteworthy point is that he considered a husband's height relative to his wife's height; this concept of relative height is directly related to the male-taller norm. He estimated that the price of a 10 mm decrease in a husband's height relative to his wife's height is about 3% of his earnings, although that price was reduced to 1% once earnings-generating attributes were controlled for.

Another reason could be that the matching process is not frictionless. This happens not only in marriage, but in every matching process (see Sattinger, 2012 for a review). For example, a worker searches for the "right" job, but it is costly; a seller of a good searches for a buyer who will pay the highest price for the good, but it is costly. The costs do not need to be restricted to pecuniary ones. Non-pecuniary costs such as time and psychological costs are equally relevant. Eventually, not all individuals reach their goals, and some compromise at some point. Related to the male-taller norm, even if every individual tries to adhere to the norm, not everyone will succeed in the endeavor when it is costly to search and find the "right" mate.

Shimer and Smith (2000) provided an interesting model with search frictions, considering time costs that result from discounting. Their model can be extended to our case as follows. Consider two women who are identical in every way except for height and value of time. One is 1.7 m tall, and the other is 1.6 m tall, and time is more valuable to the tall woman than to the short woman. Similarly, consider two men who are also identical in every way except for height: one is 1.75 m tall, and the other is 1.65 m tall. Suppose further that both women want to conform to the male-tall norm. According to Shimer and Smith's model, the 1.70 m woman may actually end up marrying the 1.65 m man, and not the 1.75 m man as the male-taller norm dictates. This is because time is so valuable to the tall woman that she stops searching for the 1.75 m man after some effort. This theoretical result is also consistent with the empirical finding that preferred mate characteristics are not always the same as actual mate characteristics (Courtiol et al., 2010a).

It is worth emphasizing that by arguing that evidence of the male-taller norm is weak among Indonesians and possibly other populations, we do not discount the importance of height in human mating. As Fig. 1 shows, Indonesians exhibit assortative mating by height similar to other populations, which is also the case for some Western populations (e.g., Silventoinen et al., 2003; Stulp et al., 2013). Evolutionary biology has provided ample evidence of the importance of height in human mating (Buss, 1994: 38–40; Courtiol et al., 2010b; Ellis, 1992: 279–281; Gregor, 1979; Symons, 1979: 196–198), which has at least been expressed among Western populations (see references in Sorokowski and Butovskaya, 2012).

At this point, it is unclear whether the differences between the actual and random marriages were based on truth or estimation imprecision. Replication studies for other populations will surely clarify this issue. However, it is clear that regardless of people's socioeconomic development stage, the male-taller norm is mainly explained by the fact that women are shorter than men on average.

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References

Baten, J., Blum, M., 2012. Growing tall but unequal: new findings and new background evidence on anthropometric welfare in 156 countries, 1810–1989. Econ. Hist. Dev. Reg. 27, S66–S85.

Becker, N.S.A., Touraille, P., Froment, A., Heyer, E., Courtiol, A., 2012. Short stature in African pygmies is not explained by sexual selection. Evol. Hum. Behav. 33, 615-522.

Buss, D.M., 1994. The Evolution of Desire: Strategies of Human Mating. Basic Books, New York.

Cammack, M., Heaton, T., 2011. Explaining the recent upturn in divorce in Indonesia: developmental idealism and the effect of political change. Asian J. Soc. Sci. 39, 776–796.

Chiappori, P., Oreffice, S., Quintana-Domeque, C., 2012. Fatter attraction: anthropometric and socioeconomic matching on the marriage market. J. Polit. Econ. 120, 659–695.

Cline, M.G., Meredith, K.E., Boyer, J.T., Burrows, B., 1989. Decline in height with age in adults in a general population sample: estimating maximum height and distinguishing birth cohort effects from actual loss of stature with aging. Hum. Biol. 61, 415–425.

Courtiol, A., Picq, S., Godelle, B., Raymond, M., Ferdy, J.B., 2010a. From preferred to actual mate characteristics: the case of human body shape. PLoS ONE 5, e13010.
Courtiol, A., Raymond, M., Godelle, B., Ferdy, J., 2010b. Mate choice and human stature: homogamy as a unified framework for understanding mating preferences. Evolution 64, 2189–2203.
Danubio, M.E., Miranda, G., Vinciguerra, M.G., Vecchi, E., Rufo, F., 2008. Comparison of self-reported and measured height and weight: implications for obesity research among young adults. Econ. Hum. Biol. 6, 181–190.
Ellis, B.J., 1992. The evolution of sexual attraction: evaluative mechanisms in women. In: Barkow, J.H., Cosmides, L., Tooby, J. (Eds.), The Adapted Mind: Evolutionary Psychology and the Generation of Culture. Oxford University Press, Oxford, pp. 267–288.
Epanechnikov, V.A., 1969. Non-parametric estimation of a multivariate probability density. Theor. Probab. Appl. 14, 153–158.
Fang, H., Ali, M.M., Rizzo, J.A., 2009. Does smoking affect body weight and obesity in China? Econ. Hum. Biol. 7, 334–350.
Galton, F., 1889. Natural Inheritance. MacMillan, London.
Gaulin, S.J., Boster, J.S., 1992. Human marriage systems and sexual dimorphism in stature. Am. J. Phys. Anthropol. 89, 467–475.
Geertz, H., 1961. The Javanese Family: A Study of Kinship and Socialization. Free Press, New York.
Gillis, J.S., Avis, W.E., 1980. The male-taller norm in mate selection. Pers. Soc. Psychol. Bull. 6, 396–401.
Gregor, T., 1979. Short people. Nat. Hist. 88, 14–23.
Heaton, T.B., Cammack, M., Young, L., 2001. Why is the divorce rate declining in Indonesia? J. Marriage Fam. 63, 480–490.
Jones, G.W., 1994. Marriage and Divorce in Islamic Southeast Asia. Oxford University Press, Oxford.
Pawłowski, B., 2003. Variable preferences for sexual dimorphism in height as a strategy for increasing the pool of potential partners in humans. Proc. R. Soc. Lond. B. Biol. Sci. 270, 709–712.
Sattinger, M., 2012. Qualitative mismatches. Found. Trends Microecon. 8, 1–168.
Sear, R., Allal, N., McGregor, I.A., Mace, R., 2004. Height, marriage and reproductive success in Gambian women. Res. Econ. An. 23, 201–222.
Sear, R., Marlowe, F.W., 2009. How universal are human mate choices? Size does not matter when Hadza foragers are choosing a mate. Biol. Lett. 5, 606–609.
Shimer, R., Smith, L., 2000. Assortative matching and search. Econometrica 68, 343–369.
Silventoinen, K., Kaprio, J., Lahelma, E., Viken, R.J., Rose, R.K., 2003. Assortative mating by body height and BMI: Finnish twins and their spouses. Am. J. Hum. Biol. 15, 620–627.
Sohn, K., 2014a. Age and size at maturity in Indonesian women: a norm of reaction? Am. J. Hum. Biol. 26, 713–715.
Sohn, K., 2014b. The value of male height in the marriage market. Mimeo.
Sohn, K., 2014c. Height and happiness in a developing country. J. Happiness Stud., http://dx.doi.org/10.1007/s10902-014-9566-8.
Sohn, K., 2015a. Sex discrimination in earnings in Indonesia: a fuller picture. Bull. Indones. Econ. Stud. 51, 95–121.
Sohn, K., 2015b. The height premium in Indonesia. Econ. Hum. Biol. 16, 1–15.
Sohn, K., 2015c. Is leg length a biomarker of early life conditions? Evidence from a historically short population. Am. J. Hum. Biol., http://dx.doi.org/10.1002/ajhb.22682.
Sohn, K., 2015d. The trend in age at menarche in Indonesia: birth cohorts 1944–1988. J. Biosoc. Sci. 47, 407–412.
Sorokowski, P., Butovskaya, M.L., 2012. Height preferences in humans may not be universal: evidence from the Datoga people of Tanzania. Body Image 9, 510–516.
Sorokowski, P., Sorokowska, A., Fink, B., Mberira, M., 2012. Variable preferences for sexual dimorphism in stature (SDS) might not be universal: data from a semi-nomad population (Himba) in Namibia. J. Cross Cult. Psychol. 43, 32–37.
Stulp, G., Buunk, A.P., Pollet, T.V., Nettle, D., Verhulst, S., 2013. Are human mating preferences with respect to height reflected in actual pairings? PLOS ONE 8, e54186.
Symons, D., 1979. The Evolution of Human Sexuality. Oxford University Press, Oxford.
Walker, R., Gurven, M., Hill, K., Migliano, A., Chagnon, N., de Souza, R., Djurovic, G., Hames, R., Hurtado, A.M., Kaplan, H., Kramer, K., Oliver, W.J., Valeggia, C., Yamauchi, T., 2006. Growth rates and life histories in twenty-two small-scale societies. Am. J. Hum. Biol. 18, 295–311.