Further evidence of male offspring preference for certain subgroups in the United States (2007–2015)

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ABSTRACT

Introduction: Males are born in excess of females. This ratio (M/T = male/total births) is influenced by various factors. A recent study showed that M/T in the United States (US) is Asian or Pacific Islander > White > American Indian or Alaska Native > Black or African American. This study was carried out in order to ascertain whether there are M/T differences in different races in the US by birth order.
Methods: Monthly male and female live births by race and birth order for the entire US were obtained for 2007–2015 with birth order as 1–≥6 for these races.
Results: There were 36,499,163 births. M/T decreased with increasing sibling order for all races (p < 0.0001) except for Asian or Pacific Islander births where M/T rose progressively to 3rd order births (p < 0.0001) then fell (p = 0.0002). Weighted mean maternal age for each birth order by race order was Asian or Pacific Islander > White Black or African American/American Indian or Alaska Native. The differences between adjacent means were all significant (almost all p < 0.0001). The mean maternal age spread followed the same order.
Discussion: Asians favour male offspring. This group may be systematically implementing foetal sex-specific feticide and/or implementing a Type1 stopping rule when a male birth is achieved in order to maximise male births. The potential putative effect of increasing maternal age to decrease M/T is not only excluded in this race, but goes contrary to the findings of this study insofar as Asian or Pacific Islander births have the oldest mean maternal ages. Son preference strongly persists in the US.

1. Introduction

Males are born in excess of females [1], and this ratio is conventionally referred to as M/T, denoting male divided by total births. This ratio approximates 0.515 but is influenced by many factors [1]. Factors that may influence M/T are legion [1], with additional influences continually being proposed, including putative infectious agents.

When M/T is ranked by race in the United States (US), the ordering is Asian or Pacific Islander > White > American Indian or Alaska Native > Black or African American [2]. These M/T differences between races are equivalent to half or more of the perinatal mortality rate [2].

It was speculated that the lower M/T of Indian or Alaska Native and Black and African American (when compared to White births) may be caused by chronic stress or innate hormonal differences that somehow influence the primary sex ratio directly at the time of conception [2]. It was also speculated that the higher M/T of Asian or Pacific Islander may be due to sex-selective abortion or the implementation of stopping rules that favour male over female progeny [2]. Type I stopping rules

occur when families desire one or more children of one sex, and cease reproducing when their wish is satisfied. Type II occurs when families desire both sexes among their offspring, and cease reproducing when their wish is satisfied [3,4]. Stopping rules may thus alter sex ratio by birth order by completed family size.

This is because due to the patriarchal nature of most societies, male offspring preference is far commoner than female preference. In Asia, this is reinforced by the Confucian patriarchal tradition that is characterised by strong son preference and female subordination [5].

Son preference has led to a significant number of missing women, particularly in Asia. This was brought to the fore in 1990 with an original estimate that over a hundred million women were "missing" [6]. The European Commissioner responsible for Employment and Social Affairs has quoted unofficial United Nations calculations that "estimate that 200 million females are missing in the world; women who should have been born or grown up, but were killed by infanticide or selective abortion" [7].

It is also known that M/T may be influenced by increasing parental age and increasing birth orders, with some studies implicating increas-

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ing maternal age and others increasing paternal age [8,9]. Birth order has been shown to be negatively correlated with M/T, declining from firstborn children with increasing numbers of offspring [1,10]. Furthermore, decreasing M/T has been noted with increasing duration of marriage [11]. It has also been shown that after marriage, coital rates approximately halve in the first year of marriage and halve again over another twenty years, and it has been speculated that this may be a possible contributor toward the lower M/T observed with duration of marriage [12].

Elevated M/T ratios have been demonstrated in earlier studies in the US for third and higher order births for Chinese, Asian Indians and Koreans [13]. This study was carried out in order to ascertain whether there are M/T differences in different races in the United States by birth order, and whether any such influences could be explained by differences in maternal age at delivery.

2. Methods

Monthly male and female live births by race and birth order for the entire US were obtained from the website of the Centers for Disease Control and Prevention (CDC Wonder) for the twelve year period 2007–2015. Birth order was available as 1 through to ≥ 6.

Births were available for four racial groups: American Indian or Alaska Native, Asian or Pacific Islander, Black or African American and White. All data were available online and was anonymous - no ethical approval was sought or required. Maternal age at delivery was also available but paternal age was not.

Excel was used for data entry, overall analysis and charting. The quadratic equations of Fleiss were used for the calculation of 95% confidence intervals for ratios [14]. Chi tests and chi tests for trends for annual male and female births were used throughout by means of the Bio-Med-Stat Excel add-in for contingency tables [15]. Data were further analysed in a bespoke spreadsheet which was designed to calculate weighted mean maternal age and variance at delivery for race and for each birth order. The spreadsheet also performed *t*-tests on means using n, mean and variance for adjacent races ranked according to M/T, by birth order. A p value ≤ 0.05 was taken to represent a statistically significant result.

3. Results

There were a total of 36,499,163 live births (Table 1). Birth order was not given for a total of 210,379 births. These were excluded from further analysis. Overall, M/T ratios were Asian or Pacific Islander > White > Black or African American > American Indian or Alaska Native (Chi2 for linear trend = 473, p < 0.0001).

M/T decreased with increasing sibling order for all races (p < 0.0001) except for Asian or Pacific Islander births. In this race, M/T rose progressively to 3rd order births (p < 0.0001) then fell (p = 0.0002 - Fig. 1, Table 2).

Birth order was analysed by maternal age for different races. Peaks varied by race and were unimodal, except for 1st order births for Whites which displayed a bimodal peak at 20 and 28 years of age (Fig. 2).

Table 1
M/T for different United States races, 2007–2015.

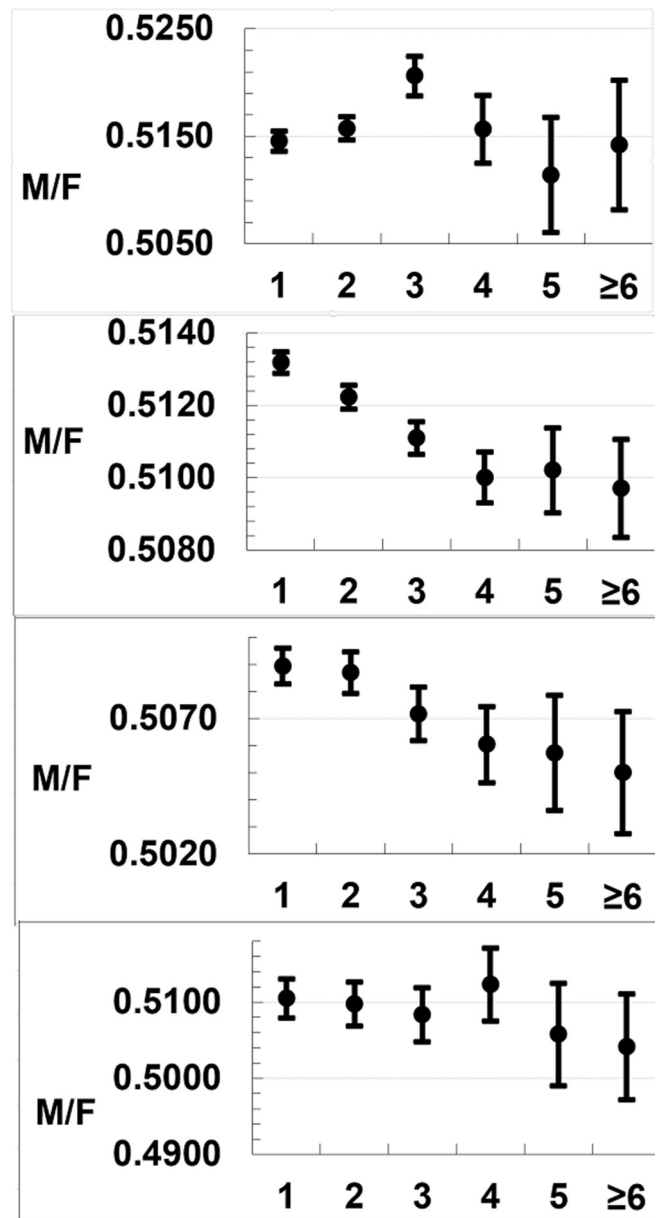|	Asian or Pacific Islander	White	American Indian or Alaska Native	Black or African American	Totals
Male	1,218,094	14,285,766	215,153	2,958,540	18,677,553
Female	1,143,931	13,606,281	206,982	2,864,416	17,821,610
Total	2,362,025	27,892,047	422,135	5,822,956	36,499,163
UCI	0.5163	0.5124	0.5112	0.5085	0.5119
M/T	0.5157	0.5122	0.5097	0.5081	0.5117
LCI	0.5151	0.5120	0.5082	0.5077	0.5116

Fig. 1. M/T by sibling order. From top to bottom: Asian or Pacific Islander, White Black or African American, American Indian or Alaska Native.

Weighted mean age for each birth order, ordered by race, was Asian or Pacific Islander > White Black or African American/American Indian or Alaska Native. The differences between adjacent means were all significant (almost all p < 0.0001 - Table 2). The mean maternal age spread followed the same order (Table 3), with the least age spread occurring in Asian or Pacific Islander births. The overall mean age range by race decreased with increasing birth order (Table 2). (See Table 4.)

There were no temporal trends in M/T for total births, for the totals of each race, or for any of the birth orders by race, with one minor exception (American Indian or Alaska Native, 4th order births, Chi2 for increasing linear trend = 4.7, p = 0.03).

4. Discussion

Three mathematical models have been proposed as potential explanations, individually or in combination/s, to interpret the probability of a male birth across the birth order of the same couple and across couples [3,4]. Lexis variation assumes that M/T is constant