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Research Article

Association of socioeconomic status with sex ratio at live birth in individuals living in the slums of Sholapur city, India

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Abstract

Background: The existence of female feticide in India is well known. However, limited data are available on the association of socioeconomic status (SES) on sex ratio at live birth in disadvantaged populations, despite the fact that 33% of the population of India live on less than $1.25 per day.

Objective: To study the association of SES with sex ratio at live birth in individuals living in the slums of Sholapur city, India.

Materials and Methods: We used the data collected as a part of a social work intervention in the slums of Sholapur city, Maharashtra, from January 2007 to August 2011. Two measures of SES were used, location of birth (government hospital compared to private hospital) and eligibility for means-tested financial support after delivery.

Results: Data were available for 1391 infants. The infants born in government hospitals were more likely to be male compared to those born in private hospitals (sex ratio of 1.45 compared to 1.14, respectively, p = 0.03). Similarly, infants whose parents were eligible for post-delivery financial support had a trend to a higher sex ratio (1.47 compared to 1.18, p = 0.057). Maternal age was independently and inversely associated with sex ratio at live birth with a linear relation (OR per year increase in maternal age 0.96, 95% CI 0.93–1.00, p = 0.03).

Conclusion: In this particular population, two measures of less affluent SES were associated with higher sex ratio at live birth. However, care should be taken while generalizing these observations to other disadvantaged groups living in India, but this represents an area of research where more epidemiological work is required, as these differences perpetuated over generations may have substantial demographic consequences.

KEY WORDS: Socioeconomic status, sex ratio, female feticide, India

Introduction

The excess of male births in India[1–3] is well recognized as highly likely to be the result of selective feticide of female fetuses.[4–7] This may be due to the cultural importance placed on having male offspring in this society. Adoption of this practice probably varies with socioeconomic status (SES) as the cultural pressures and financial incentives may vary depending on individual autonomy, particularly of females. However, the data available on this topic are limited and inconsistent, probably as a consequence of different study populations and methodologies used.[1,8,9] In particular, limited data exist on the many disadvantaged individuals who live in urban slums and represent a relatively neglected sector of Indian society.

This is an important area of research because first, increased knowledge of selective feticide practice in society may inform future interventions that aim to reduce the future prevalence of these events; and second, differentials in gender-selective feticide between socioeconomic sectors of society could be expected to have accumulative effects over time on the demographic structure of Indian society.[10] We used data from a social work program based in the slums of Sholapur city, Maharashtra, to test the hypothesis that SES is

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a determinant of sex ratio at live birth in a disadvantaged stratum of Indian society, which is the main objective of the study. At the onset of labor, most individuals select to deliver their baby in either a public hospital, which is free of charge, or a private hospital, which requires further costs. After delivery, there is means-tested government financial support for those individuals whose income is below a certain threshold. We have used the choice of place of obstetric delivery and eligibility for government financial support to permit distinction of relative affluence among the study population.

Materials and Methods

Study Settings

The Halo Medical Foundation is a nongovernmental international organization that provides social services to individuals who live in slum areas of Sholapur city, Maharashtra, India. This involves a number of interventions including the adoption of pregnant women living in these areas, providing support through women self-help groups and community support during pregnancy. As part of the evaluation of this process, women who become pregnant are adopted by a self-help group and data are recorded on the outcome of pregnancy including sex of the offspring at live birth, birth weight, and place of birth, which may be in a government hospital or a private hospital depending on personal preference and ability to pay for the latter. Other data routinely collected for the women involved in the Maternal and Neonatal Health (MNH) project include the eligibility for financial support from the government after delivery, which is a means-tested process, permitting women with economic status classified as Below Poverty Line (BPL) to receive financial support mainly after delivery. We used these routinely collected data from the MNH project during the period from 2007 to 2011, provided in an anonymized format for the analyses. This is a retrospective cross-sectional observational epidemiological study. A completed STrengthening the Reporting of OBservational studies in Epidemiology checklist is attached (Supplementary 1). Ethics approval was obtained from the Prognosis Management and Research Consultants Pvt. Ltd. for this retrospective study in May 2013.

Data Analysis

The data were initially inspected for any implausible values and cleaned if required. The initial analyses provided sex ratios at live birth stratified for the two measurements of SES: eligibility for postnatal means-tested financial support from the government and giving birth at a government hospital compared to a private hospital. The main analysis used χ^2-tests to identify differences between the sex ratios in these categories. Logistic regression analysis was used to adjust for maternal age, and likelihood ratio testing was used to determine whether the associations observed with maternal age were linear or not. We also assessed the association of these two measures of SES with birth weight. Stata 12.0 (StataCorp, College Station, TX) was used for all analyses.

Results

From January 2007 to August 2011, data were available for 1391 live births with the sex of the infant from the slums of Sholapur city. As shown in Table 1, the mean maternal age was 21.5 years (standard deviation (SD) 3.0), and of those who had data available, 452 (33%) were eligible for means-tested government financial support; 623 (45%) had given birth in a government hospital and 721 (52%) in a private hospital. The mean maternal age of those who gave birth in government hospitals was 21.6 years (n = 611, SD = 2.9) and the mean maternal age of those who gave birth in private hospitals was 21.5 years (n = 714, SD = 3.1). The mean maternal age of those who were eligible for post-delivery financial support was 21.1 years (n = 444, SD = 2.7) and

Table 1: Population of pregnant mothers living in Sholapur slums who gave birth during the project period

Parameters	Total population (*N* = 1391)	Summary statistics
Maternal age (years), SD	21.5 (*N* = 1372)	3.0
Mean birth weight (kg), SD	2.67 (*N* = 1354)	0.39
Sex of infant (*N*), %		
Male	777	56%
Female	614	44%
Delivery location (*N*), %		
Government hospital	623	45%
Private hospital	721	52%
Home	37	3%
	(*N* = 1381)	
Eligibility for post-delivery financial support (*N*), %		
Yes	452	33%
No	937	67%
	(*N* = 1389)	

those who were not eligible was 21.8 years (n = 926, SD = 3.1). Infants born in a government hospital had a mean birth weight of 2.62 kg whereas those born in a private hospital had a mean birth weight of 2.71 kg (mean difference 0.09 kg, $p < 0.001$, unpaired t-test). There was no significant difference in birth weights of the infants whose parents were eligible and were not eligible for means-tested post-delivery financial support.

For the total population the male/female sex ratio was 1.27, equating to 559 boys per 1000 live births. The sex ratio for the infants born in government hospitals was 1.45 and for those born in private hospitals was 1.14 (p = 0.03, χ^2-test; Table 2). This gave unadjusted odds ratio of 1.27 (95% confidence interval (CI) 1.03–1.58) for the probability of having a male child for the population who used government hospitals compared to those who used private hospitals. After adjustment for maternal age, this remained significant with an odds ratio of 1.27 (95% CI 1.02–1.58; Table 3). Maternal age was independently and inversely associated with sex ratio at live birth with a linear relation (OR per year increase in maternal age 0.96, 95% CI 0.93–1.00).

The sex ratio for the infants whose parents were eligible for means-tested post-delivery government support was 1.47 and for those whose parents were not eligible for government financial support was 1.18 (p = 0.057, χ^2-test; Table 2). After adjustment for maternal age, this gave an odds ratio of 1.20 (95% CI 0.96–1.52) for the probability of having a male infant for those who were eligible for financial support compared to those who were not.

Discussion

We used data from a population of underprivileged individuals living in the slums of Sholapur city, to study the impact of two measures of affluence, that is, use of private obstetric medical facilities and the absence of eligibility for government support after childbirth, to determine the association of SES with sex ratio at live childbirth in this population. The results show that even in this disadvantaged population, those from less affluent backgrounds have a higher sex ratio at live birth, suggesting a practice of female feticide compared to those from more affluent backgrounds. We also observed that older women were less likely to have male children compared to younger women, which is a novel observation in this population that requires explanation.

The strengths of our dataset include the use of a unique population where the data were prospectively collected with no awareness of the hypothesis to be tested, reducing the risk of bias influencing our observations. Collecting data in a slum

Table 2: Sex ratio of live births stratified by delivery location and eligibility of post delivery financial support

	Measure of socioeconomic status	Sex of infant	Number, %	Sex ratio (males per 1000 live births)
Location of birth	Government hospital	Male	369 (59)	1.45:1 (592)
		Female	254 (41)	
	Private hospital	Male	384 (53)	1.14:1 (533)
		Female	337 (47)	p = 0.03*
Eligibility for post-delivery financial support	Yes	Male	269 (60)	1.47:1 (595)
		Female	183 (40)	
	No	Male	507 (54)	1.18:1 (541)
		Female	430 (46)	p = 0.057*

*χ^2-Test

Table 3: Association of probability of having a male infant by delivery location and eligibility of post-delivery financial support

Parameters	Details	Unadjusted odds ratio (95% CI)	Odds ratio adjusted for maternal age (95% CI)
Location of birth	Private hospital	1	1
	Government hospital	1.27 (1.03–1.58)	1.27 (1.02–1.58)
		p = 0.03	p = 0.03
Eligibility for post-delivery financial support	No	1	1
	Yes	1.25 (0.99–1.56)	1.20 (0.96–1.52)
		p = 0.058	p = 0.11
Maternal age, per year		0.96 (0.92–0.99)	0.96 (0.93–1.00)
		p = 0.02	p = 0.03*

*Adjusted for location of birth

setting is challenging, and the data collection represents the endeavors of a team of social workers who have spent much time working in these areas and gaining the trust of the local communities. Our data are contemporaneous, suggesting that the associations observed are still present in the populations studied and are not historical artifacts. The main analysis was carried out to ascertain the raw association between SES and sex ratio at live birth, but the ability to adjust for maternal age is a further strength of these data as it allows us to explore the impact of maternal age on the causal pathways involved.

There are some limitations of our data that need consideration. The MNH scheme has been well received by the local communities in Sholapur but no data exist on the number of women who live in these areas but refused to enter the scheme. Estimates from local workers are that the response rate was very high, and we consider it unlikely that the associations we observed are spurious ones due to differential response bias. It is difficult to generalize our observations to other populations in India, as there are many geographical, cultural, and material differences that may impact on the practice of feticide, and this is illustrated in the wide range in sex ratios for second female birth stratified by state in India.[1] We acknowledge the importance of data for other descriptive variables of our population such as parity and on other social determinants of health such as sex of previous children, birth order, religion, income, education, occupation, drinking water supplies, latrine availability, and toxoplasmosis infection,[9] and hence were unable to explore the association of these factors with the sex ratio at live birth. This would have increased the ability to examine the roles these factors have in the causal pathways under study, but the absence of these data does not invalidate the associations observed. Finally, our choice of two measures of SES was opportunistic, as these were the two measures collected as part of the evaluation of the MNH project. It is important to note that individuals who were classified as requiring means-tested financial support after delivery (BPL) could still have the opportunity of accessing private health-care facilities with the help of post-delivery financial support; however, the allocated funds are not sufficient to cover the costs of all private care. Thus, we are confident that these represent valid measures of SES as the eligibility for financial support is means tested against current assets, while giving birth in a private hospital will require extra discretionary financial spending to access this facility. In addition, births from private hospitals resulted in babies with a significantly higher mean birth weight than those in government hospitals, providing corroborative support for the use of this measure as a marker of more affluent SES.[11] However, it is important to consider that these factors are relative to each other.

The mean sex ratios observed in our population was 1.27, with stratification by location of birth giving ranges of 1.14 for those born in private hospitals to 1.45 for those born in government hospitals. To put these figures into context, the global sex ratio for 2010 was 1.05 and for Asia as a whole was 1.06.[12] Previous studies of the impact of SES on sex ratio at live birth in India have necessarily used different populations and a variety of measures of affluence and education to define this exposure from an epidemiological perspective, thus direct comparisons of those with our data will be not appropriate. The largest study by Jha *et al*.[1] used data from the Special Fertility and Mortality Survey from 1998 and showed that individuals with higher education were less likely to give birth to a second female infant than those from illiterate or less educated background irrespective of religion or urban–rural location of residence, an observation that is not consistent with our data. However, Clark[8] used data from the First National Family Health Survey from 1992–1993 to report that couples who had not received an education at school prefer and have a higher proportion of sons. A recent detailed and broader analysis at national level by Jha *et al*.[1] suggested that the female birth decline was more prevalent in women educated for more than 10 years compared to women with less or no education; however, we found that women holding BPL cards, likely to be less educated, might have preference for a male offspring. Results of this study are based on a small sample size, hence we suggest that a further analysis with higher number of samples in the same geographic population of Maharashtra could be valuable to confirm the findings.

Our data are broadly consistent with those of a recent analysis of the 1998–1999 and 2005–2006 Indian National Family and Health Surveys by Gaudin,[13] suggesting that higher absolute and relative wealth are associated with lower son preference, as anticipated by hypotheses based on broader macroeconomic theory. Agrawal[14] used data from India's Second National Family Health Survey to explore the associations between sociological exposures and attitudes and usage of induced abortion in India in 1998–1999. These data show that among the 90,303 ever-married women surveyed, experience of induced abortion was more prevalent among the most affluent quintile of the population (5.8%) compared to the lowest quintile (1.0%). A survey of 217 adults living in Delhi explored the sociocultural determinants of female feticide. These data suggested that in this population, preference for son was often driven by practical economic necessity and the fear of not being able to earn resources required for the marriage of female offspring.[15]

The average maternal age of our study population was 21.5 years, representing a society where women marry and start having children at an early age. The inverse association of maternal age with the probability of having a male infant was unanticipated but requires consideration. The most likely explanation is that as we have not adjusted for parity, the older pregnant mothers have already had children and as the sex ratio in this community is high, they already have a high probability of having male children. Hence, we speculate that the requirement or desire for further male offspring in older mothers is less and hence female feticide is less prevalent in older mothers. This is consistent with an analysis of the National Family Health Survey in 1992–1993, which showed that smaller families has a higher proportion of boys than larger families.[8]

Conclusions

In summary, we report an association between a less affluent SES and a higher sex ratio at live birth, a measure that would be consistent with a higher prevalence of female feticide in these sectors of society. These data suggest that even within a population of relatively underprivileged individuals who live in the slums of Sholapur city, Maharashtra, there exist socio-economic differences in the adoption of sex-specific feticide. Longitudinal data are required to increase our knowledge of the trend of sex ratio at live birth in this culture and in particular, to assess the impact of the legislative intervention (Pre-Conception and Pre-Natal Diagnostic Techniques Act of 1994, amended in 2003) designed to prevent female feticide. The Act is in practice in the study area. This may have implications for the demographic structure of Indian society[10] if these differences are widespread and multiplied over a period of generations, as poverty in India remains prevalent with an estimated 376 million individuals (33% of the population) living on less than $1.25 (purchasing power parity) per day in 2010.[16]

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