



Banning of fetal sex determination and changes in sex ratio in India

Sex-specific feticide is considered to be relatively common practice in India, where the male:female sex ratio at livebirth was about 1.10 in 2010–12,³ as opposed to a comparable sex ratio of 1.06 for Asian countries in 2010.² These changes have occurred over recent decades, with one study³ of hospital deliveries in New Delhi reporting an increase in the sex ratio at livebirth from 1.06 in 1985 to 1.16 in 2005. In response to the introduction of ultrasound scanning in India in the 1980s, the national government passed a piece of legislation (the Pre-natal Diagnostic Techniques Act) making determination of fetal sex illegal. This legislation became active on Jan 1, 1996, and was strengthened with an amendment that subsequently enforced this law on Feb 14, 2003.⁴ We did a longitudinal analysis to assess trends in male:female sex ratio at livebirth in Maharashtra State, India, over the period that spans both the widespread introduction of ultrasound scanning in India and the subsequent legislation

banning its use for sex-determination of fetuses.

We used data for all livebirths registered from 1980 to 2011 with the Maharashtra State Government Civil Registration System. Because anonymised summary statistics were used, no approval from an ethics committee was required. We used Joinpoint regression analysis to assess changes in temporal trends.

From 1980 to 2011, the total number of livebirths registered in Maharashtra State increased from 1250 643 to 1925 204. The annual sex ratio increased from a baseline of 1.111 in 1980 to a maximum value of 1.238 in 2003, before decreasing to 1.161 in 2011 (figure). We noted an increase in the annual sex ratio at livebirth from 1980 to 2004 of 0.005 units per year ($p < 0.0001$) and a decrease of 0.009 units per year after 2004 ($p = 0.007$). The 95% CIs for the inflexion year for change in trend were from 2002 to 2006.

In the urban population (appendix) we noted a significant increase in the annual sex ratio at livebirth between 1980 and 2006 of 0.005 units per year ($p < 0.0001$) and a decrease of 0.014 units per year after 2006 ($p = 0.02$). In the rural population (appendix) we noted a significant

increase in the annual sex ratio at livebirth between 1980 and 2004 of 0.005 units per year ($p < 0.0001$), with a decrease of 0.011 units per year after 2004 ($p = 0.03$).

This is, to our knowledge, the first analysis of temporal trends in sex ratio at livebirth in Maharashtra State. Our data show a clear increase in the sex ratio at livebirth that peaked in 2003 and 2004 and then decreased in subsequent years.

The strengths of our data are the availability of information on the number and sex of livebirths over 32 consecutive years from a well defined population. Although visual inspection of these data suggests temporal trends, the use of Joinpoint analysis permits optimal fitting of these data without the necessity of previous hypotheses, and most importantly the identification of periods of time when the linear trends change. These periods can then be compared with the timing of known societal interventions such as the introduction of laws banning prenatal sex determination to assist interpretation of these observations. However, these data are applicable to Maharashtra State, and are not necessarily generalisable to other states in India. Since we were using routinely collected data, we were unable to exclude the possibility of misclassification where livebirths might have been classified as stillbirths.

Our analysis of the total population shows a significant increase in the sex ratio at livebirth from 1980 to 2004 and then a subsequent decrease in sex ratio. We consider that the increase in the sex ratio is consistent with the hypothesis of both increasing availability and acceptability of ultrasound scanning during this period, resulting in feticide of females in utero. The reasons for the decrease in sex ratio after 2004 might be a consequence of the legislation banning sex-specific feticide, which was strengthened in 2003, finally having an effect on access to prenatal sex determination. These changes

See Online for appendix

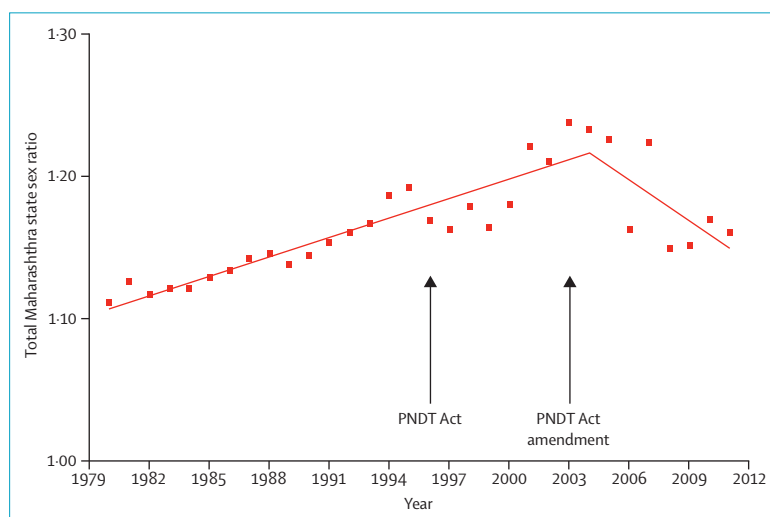


Figure: Total sex ratio in Maharashtra state, India, 1980–2011
PNDT=Pre-natal Diagnostic Techniques

included specifically regulating the sale and use of ultrasound diagnostic technology along with formal oversight by regulatory bodies who have the authority to prosecute offenders at both institutional and individual levels.⁴

In conclusion, we report that the sex ratio at livebirth in Maharashtra State increased substantially from 1980 to 2004 and subsequently decreased. This finding hopefully represents the beginning of a continuing trend that will result in more balanced sex ratios in India in future generations that will be to the benefit of society.

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