How many girls are missing at birth in India?

Trends in Sex Ratio at Birth (2001-12)

The number of girls missing at birth due to the practice of gender biased sex selection was 3.3 lakh girls per year for the period 2007-12. This reflects a decline from an average of 5.8 lakh girls missing at birth per year in the preceding six years. The period between 2004 to 2006 witnessed the first visible signs of change.

Reflection

The decline in the number of girls missing at birth since 2004 needs to be perceived against the backdrop of the legal, policy and programmatic measures taken to address gender biased sex selection in India and community dynamics in response to its consequences.[6] Following the amendment in the Pre-conception and Pre-natal Diagnostic Techniques (PCPNDT) Act in 2003 and with renewed efforts for more intensive Act implementation to curb technology misuse, there has been a shift towards arresting the gender imbalance in sex ratios in a few states.[7]

In addition to implementation of the PCPNDT Act, a comprehensive set of efforts were initiated by the government and civil society organizations to build value of girls, counter gender discriminatory attitudes, and create awareness on the adverse consequences of such discriminatory practices.[8] The outreach on the issue included intensive engagement with a range of stakeholders including policy makers, administrators, the judiciary, medical community, media and community leaders. The growing visibility of gender biased sex selection in the media is an indicator of the enhanced attention and increased volume of discourse around this issue.

[6] 'As a consequence of skewed sex ratio, the modes of reproduction of son preference are being affected in ways that may point to an improved sex ratio and greater gender equality in the future'. Signs of Change? Sex Ratio Imbalance and Shifting Social Practices in Northern India, Larsen and Kaur, Economic & Political Weekly, 31 August 2013, Vol XLVIII, No 35.

[7] A quantitative evaluation of the PCPNDT Act using longitudinal data found a significantly positive impact of the Act on child sex ratio. Arindam Nandi, Anil B. Deolalikar, Does a legal ban on sex selective abortions improve child sex ratios? Evidence from a policy change in India, Journal of Development Economics, Vol. 103, July 2013, Pages 216-228, ISSB 0304-3878, http://dx.doi.org/10.1016/j.jdeveco.2013.02.007

[8] 'In addition to the expected effects of social and economic development, India has strong public policies to increase gender equity and to equalize the value of sons and daughters to their parents, through vigorous media campaigns and legislation, and more recently through financial incentives to parents with daughters'. Das Gupta M, Chung W, Li S. Evidence for an incipient decline in numbers of girls in China and India, Population and Development Review, 2009;35: 401–16.

Gender Biased Sex Selection and Skewed Sex Ratios

Gender biased sex selection is a discriminatory practice against girls that is manifested through sex ratio imbalances at birth. The most dominant contributory factors include deeply entrenched son preference, rapid fertility decline and misuse of technology. Estimates of the number of girls missing at birth are a strong indicator of the scale and magnitude of this discriminatory practice.

Census 2001 pointed to a steep decline in child sex ratio (CSR): a dip to 927 girls (in the 0-6 year age group) for every 1000 boys from 945 in 1991. This brought the issue of sex ratio imbalance into focus. Census 2011 further indicated a decline in child sex ratio to 918 girls per 1000 boys.

While child sex ratio is principally determined by sex ratio at birth, it is also influenced by a number of other factors such as under-enumeration of girls, differential infant and child mortality and age misreporting. Therefore, imbalance in child sex ratio cannot be entirely attributed to the practice of gender biased sex selection. Sex ratio at birth (SRB), defined as the number of girls born for every 1000 boys born is a more refined indicator of the extent of gender biased sex selection as it is not affected by post birth factors such as differential mortality or age misreporting.

This publication estimates the number of girls missing at birth in India over 2001-2012, by comparing the actual number of girls born with the number expected to be born, if the internationally observed value for sex ratio at birth prevailed in India in the absence of sex discrimination.[1]

Trends in Sex Ratio at Birth

Data on SRB in India is provided by the Sample Registration System (SRS) and published by the Office of the Registrar General of India as a three year moving average.[2] The trends in SRB for the period 2000-2013 are presented in Figure 1 and detailed data on SRB for India and large states is shown in Table 2.

The sex ratio at birth declined progressively during the first half of the decade 2000-2010, when it was below 892 girls per 1000 boys, dropping as low as 880 in 2003-2005. Thereafter the SRB improved steadily, reaching 906 in 2007-09.

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[1] 'Variations in pre 1980 SRBs were minor across countries, with the exception of sub-Saharan African countries. It is assumed that sex selective abortion was not practiced until 1980.' The average SRB for 93 countries without sex discrimination (excluding African countries) for the period 1975-80 was 105.4 boys for every 100 girls born. This has been termed as the natural sex ratio at birth by Bongaarts and Guilmoto in their paper, 'How many more missing women? Excess female mortality and prenatal sex selection, 1970-2050', Population and Development Review 41(2): 241-269, June 2015. This natural SRB translates to 948.7 girls born for every 1000 boys born as per the definition of SRB used in India.

[2] Sample Registration System Statistical Reports for various years (2001- 2013), Office of the Registrar General and Census Commissioner, India.

According to the recent SRS report, the SRB for India for 2011-2013 is 909 girls born for every 1000 boys born. From 2008 to 2011, the SRB seems to have stagnated, ranging between 906 and 908.[3]
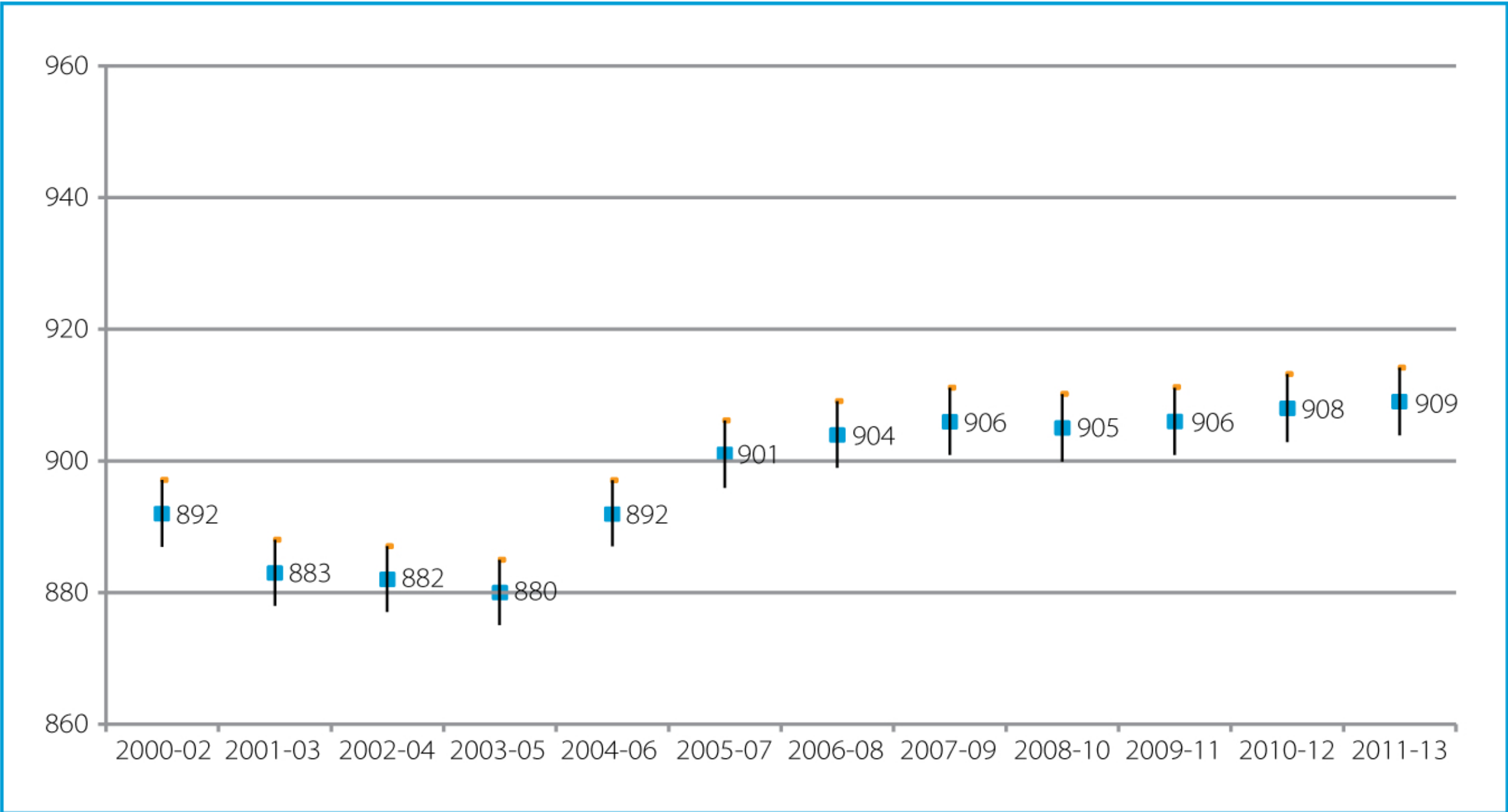
Source: SRS Annual Statistical Report, ORGI

Number of Girls Missing at Birth

As mentioned earlier, the number of missing girls can be computed from the difference between the actual SRB and the natural SRB. In other words, it is the difference between the actual number of girls born and the number of girls who would have been born if the SRB was 948.7 girls per 1000 boys. The resultant gap represents the estimated number of girls missing due to sex selection.

Since the data on SRB provided by the Sample Registration System (SRS) are based on a sample, it is subject to sampling and non-sampling errors. Hence the number of missing girls can be considered as an estimate at best, and not the precise value. Even allowing for such errors, the phenomenon of imbalance in sex ratios at birth is a reality, as reflected in the large numbers of missing girls.

It is estimated that 4.56 lakh girls were missing at birth, on an average, annually during 2001-2012. Table 1 presents the estimates of the annual number and percentage of girls missing at birth in India during this period. The table also unpacks the estimates of missing girls by dividing the period into two halves: 2001-06 and 2007-2012. It provides the lower and upper limits of estimates within which the number of missing female births is likely to range. During 2001-06, the estimated number of missing girls ranged between 5.1 and 6.5 lakhs, while in the latter half, the range is between 2.6 and 4 lakhs. The analysis clearly indicates that the estimation based on lower and upper limits of SRB confidence intervals for the two halves of the period 2001-12, is not overlapping.

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[3] Some caution is to be exercised in interpreting the trends as the SRS sample units were changed in 2004, which could have possibly caused some distortion. But a rise in SRB between 2004-06 and 2007-09 is clearly visible and this cannot be attributed to change in the sample since the estimates for 2004 onwards are based on the same set of sample units.

[4] In order to meaningfully trace trends, the lower and upper limits of sex ratio at birth based on 95% confidence internal have been computed. For example, the observed sex ratio at birth is 909 for 2011-13. The calculated lower and upper limits of the range for this period are 904 and 914. Therefore, one can say with 95% confidence that the actual value of sex ratio at birth lies between the range of 904 and 914. Confidence intervals are a preferred way of giving estimates because it indicates the precision and reliability of an estimate.

This implies a significant positive shift in the SRB and a resultant decline in the estimated number of missing girls at birth during 2007-2012.

The estimated number of missing girls was much higher during the first half of the period 2001-2006 at 5.83 lakh girls missing annually, as compared to 3.29 lakh girls missing each year during 2007-12. Table 1 also computes the proportion of female births (out of total female births) that did not occur annually due to gender biased sex selection. On an average, female births were nearly 4% less than they should have been each year during the period 2001-2012. The magnitude was higher during the first half (4.7%) than the 2.6% missing female births during 2007-12.

Table 1: Estimates of Missing Girls at Birth in India, 2001-12 (Range and Percentage)

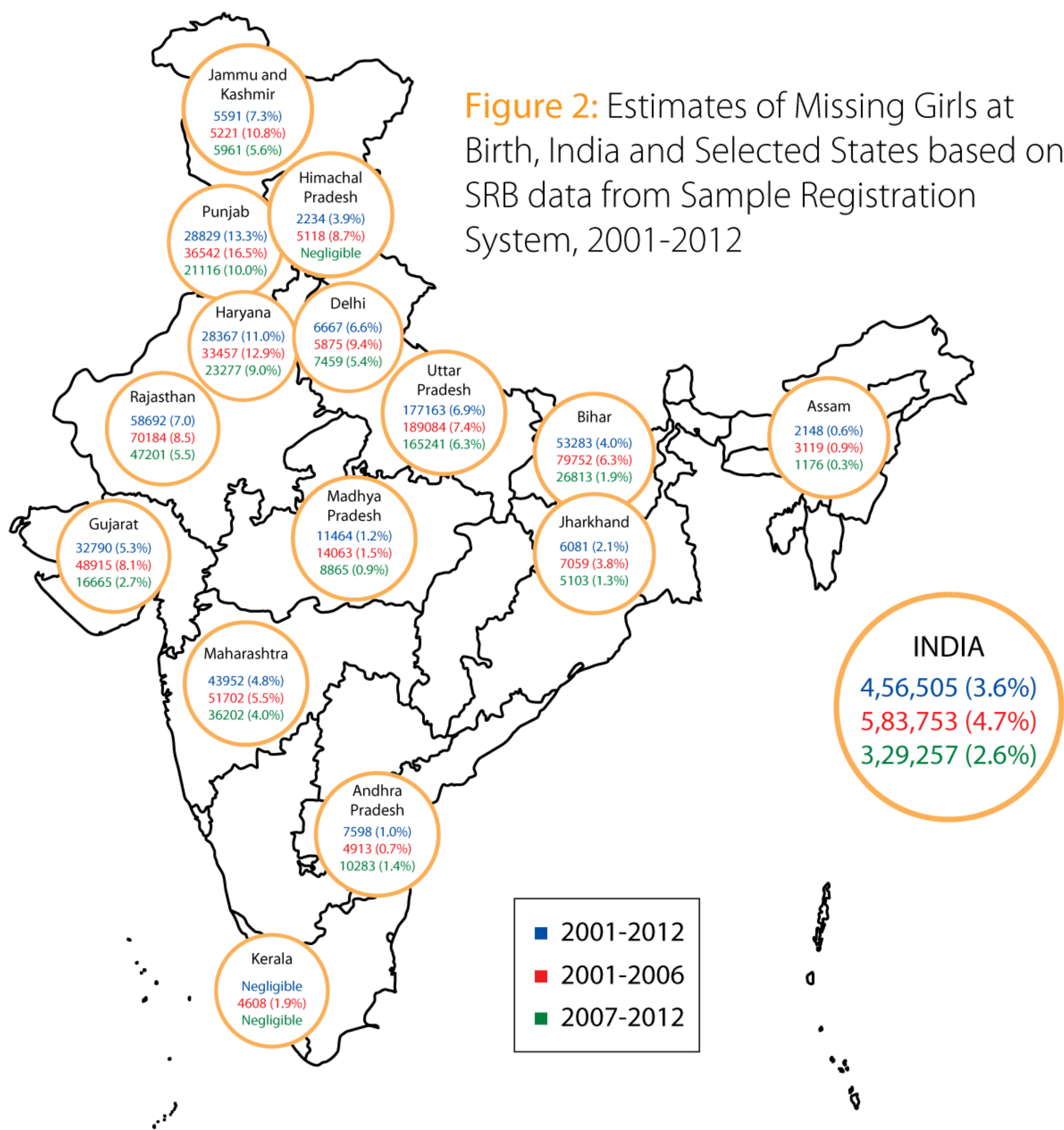| Range calculated based on Confidence Interval (CI) of SRB Estimates[5]	2001-2012		2001-2006		2007-2012	
	Annual number of female births that did not occur each year due to prenatal sex selection	% of missing female births (out of the total female births)	Annual number of female births that did not occur each year due to prenatal sex selection	% of missing female births (out of the total female births)	Annual number of female births that did not occur each year due to prenatal sex selection	% of missing female births (out of the total female births)
Upper limit of the range	528,863	4.2	655,872	5.3	401,854	3.2
Actual number	456,505	3.6	583,753	4.7	329,257	2.6
Lower limit of the range	384,151	3.0	511,638	4.1	256,664	2.0

State Level Estimates of Missing Girls

In the period 2001-2012, the states of Uttar Pradesh, Bihar, Rajasthan and Maharashtra together accounted for more than 70% (3.3 lakh out of 4.56 lakh) of the girls missing at birth annually in India (Figure 2). Even during the second half of the period (2007-2012), the share of missing girls from these four states continued to be high at nearly 85% of the all-India total: 2.75 lakh out of 3.29 lakhs. While the numbers are large due to the large size of these states, there is a perceptible dip in numbers missing for the two time periods, from 2001-06 to 2007-12 for each of these states.

Punjab and Haryana saw the highest proportion of female births that did not take place annually out of the total female births; acute at 17% for Punjab and 13.4% for Haryana during the first half of the period. However, these states, too, saw an improvement in the trends for the period 2007-12.

Himachal Pradesh presents a unique picture, with an almost restored natural sex ratio at birth. Starting from a situation similar to its neighbours, Punjab and Haryana, with nearly 9% of the female births in the state not occurring due to sex selection in the first half of the period, the state has seen a reversal with negligible percentage of missing female births during 2007-12.

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[5] The annual estimates of missing female births for the three time periods of 2001-12, 2001-06, 2007-12, have been calculated with reference to the upper and lower limits of the confidence interval of the average SRB for the respective time periods. In other words, the upper limit of the range for the annual number of missing female births in the period 2001-12, i.e., 5.28 lakhs, has been calculated with reference to the lower limit of the confidence interval of the average SRB for the period 2001-12.

Figure 2: Estimates of Missing Girls at Birth, India and Selected States based on SRB data from Sample Registration System, 2001-2012

Note: The numbers represent annual number of female births that did not occur each year due to prenatal sex selection for the three time periods. The percentages denote missing female births out of the total female births. For Delhi, J&K and Jharkhand, the estimates are for the period 2004-12, since crude birth rate is not available for the relevant period. Prior to 2004, the estimates for MP, Bihar and UP also include the number of missing girls for Chhattisgarh, Jharkhand, Uttrakhand respectively, as separate estimates for sex ratio at birth for these newly carved out states were not available.

Missing Female Births: Annual Trends

Figure 3 maps the pattern in the annual number of girls missing at birth in India, for the period 2001-2012. The red line depicts the trends in estimates based on actual SRB, while the blue and green lines point to the range within which the estimate is likely to be located. The initial years of this period witnessed a substantial number of girls missing at birth each year, with the figure peaking to an estimated 7 lakhs in 2004. Thereafter, the number of girls missing at birth saw a declining trend in each successive year, with sharp declines noted till 2006, at which time it appears to have plateaued. Estimates for the year 2012 are encouraging. Approximately, 2.9 lakh girls were missing at birth due to sex selection, lower than the average of 3.3 lakhs for 2007-12 and well below the average for the entire period 2001-12 (4.56 lakhs).

Figure 3: Annual Trends in Estimated Numbers of Girls Missing at Birth in India (in lakhs), 2001-2012
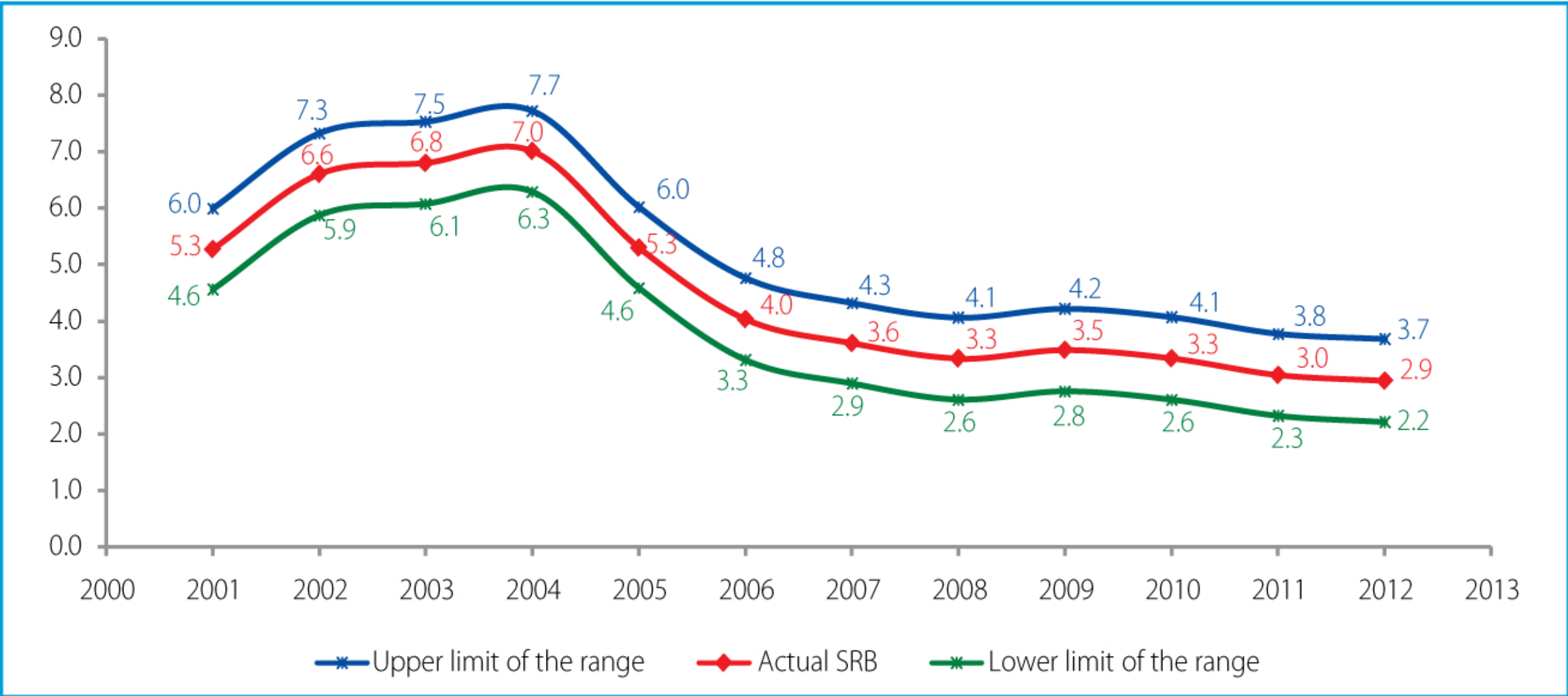
Table 2: Sex Ratio at Birth in India and Large States, Sample Registration System, 2000-2013

State	Sex Ratio at Birth from Sample Registration System											
	2000 - 02	2001 - 03	2002 - 04	2003 - 05	2004 - 06	2005 - 07	2006 - 08	2007 - 09	2008 - 10	2009 - 11	2010 - 12	2011 - 13
Andhra Pradesh	945	932	916	917	917	915	917	919	920	915	914	916
Assam	945	904	915	907	920	939	933	931	928	926	922	920
Bihar	870	861	863	865	881	909	914	917	912	910	909	911
Chhattisgarh	$	$	964	947	961	969	975	980	985	991	979	970
Delhi	na	na	835	831	847	871	877	882	884	880	884	887
Gujarat	844	862	855	844	865	891	898	904	903	909	909	911
Haryana	804	807	821	829	837	843	847	849	848	854	857	864
Himachal Pradesh	826	803	851	858	872	931	938	944	942	938	939	943
Jammu and Kashmir	na	na	816	824	838	854	862	870	873	880	895	902
Jharkhand	#	#	865	872	888	927	922	921	919	915	918	913
Karnataka	952	943	923	915	917	926	935	944	943	945	950	958
Kerala	911	892	889	912	922	958	964	968	966	965	966	966
Madhya Pradesh	920	922	916	911	913	913	919	926	921	920	921	920
Maharashtra	899	887	878	872	879	871	884	896	895	893	896	902
Odisha	944	934	944	932	934	933	937	941	938	946	948	956
Punjab	775	776	797	801	808	837	836	836	832	841	863	867
Rajasthan	890	855	838	839	855	865	870	875	877	878	893	893
Tamil Nadu	926	953	946	943	955	944	936	929	927	926	928	927
Uttar Pradesh*	864	853	859	862	874	881	877	874	870	875	874	878
West Bengal	949	937	931	926	931	936	941	944	938	941	944	943
INDIA	892	883	882	880	892	901	904	906	905	906	908	909

$ Madhya Pradesh and Chhattisgarh combined; # Bihar and Jharkhand combined; * Uttar Pradesh and Uttarakhand combined; na: not available

Methodology*

The number of missing girls at birth has been computed from the difference between observed numbers of girls born during a period and the number of girls that would have been born if the natural sex ratio at birth was as per observed norm, i.e. 948.7. Firstly, estimated number of total births was calculated using projected mid-year population (from Census) and crude birth rate (from SRS) in each middle year of a three year period for which sex ratio at birth is available from SRS. Since there is evidence that the SRS underestimates SRB by about 2 percent, the SRS estimates were adjusted upward by a factor of 1.02. These estimates were then used to calculate total number of male and female births and finally, expected numbers of female births were computed based on assumed natural sex ratio at birth and estimated number of male births. The difference between the estimated number of girls born and the number of girls expected to be born under a natural sex ratio regime, is the estimate of the number of girls missing at birth due to prenatal sex selection.

*The methodology is obtained from the paper by Kulkarni, P. M. (2007), 'Estimation of missing girls at birth and juvenile ages in India'. A paper prepared for the United Nations Population Fund (UNFPA), India.