TRENDS IN SEX-SELECTIVE ABORTION IN INDIA: ANALYZING PARITY-LEVEL SEX RATIOS USING NATIONALLY REPRESENTATIVE SURVEY DATA

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Abstract:

This study examines the changing patterns of birth order-wise sex-ratio in India from 1981 to 2020, using data from five rounds of the National Family Health Survey (NFHS). The Conditional Sex Ratio (CSR) was calculated across different birth orders, with particular emphasis on second-born children when the first-born was female using the birth file of the survey. The study found the overall sex ratio was relatively stable over the study period and this is also true for the first order birth of sex ratio. However, there were significant declines in the conditional sex ratio for second-born children when the first-born was female. Variations in the sex ratio at birth, particularly for second and third order born children, were influenced by the sex of previous children. Socioeconomic factors such as women's education, wealth, and place of residence were found to significantly influence these trends. The conditional sex ratio was more skewed towards male for women who belonged to the richest quintile, most educated groups, those form urban areas, and identified as part of the Sikh community, compared to their counterparts in other categories. This study highlighted the importance of further examining the role of fertility trends, along with women's empowerment and education, as important factors in addressing the skewed sex ratio.

Introduction:

The sex selective abortion, particularly female fetuses, is a practice observed in several Asian countries, including India. Between 1980 and 201, around 3 to 12 million sex-selective abortions occurred in India [1]. This concerning trend was further highlighted by census 2011, which reported a sex ratio of female to male around 919 girls for per 1000 boys (aged 0-6 years). The deviation of sex ratio from the expected normal range of natural sex ratio is alarming and has led to highlight the common issue of skewed sex ratio or missing girls. The Literature shown that various factors contributed to this decline in sex ratio or imbalance in sex ratio in the population; including many factors such as gender preference, family size, declining fertility rate, prenatal age, prenatal occupation, birth order, and wars [2].

In Indian, society girl child face significant discrimination due the influences of socioeconomic, cultural, and historical factors. Culturally preference of son is prominent, and leading to occurrence of female foeticide and infanticide. The decline in sex ratio in patrilineal societies further highlights the issue of gender preference [3].

In 1970s, the medical test such as amniocentesis and ultrasound came into the reality for diagnosis of genetic abnormalities, but over the time these technologies were misused for the detection of sex of child among Indian population and it became widespread in 1985 [4]. To address this issue government of India passed the Pre-conception and Prenatal Diagnostics Techniques Act in 1994 to regulate the illegal detection of sex and sex-selection abortions. Despite legislative efforts, deeply rooted cultural beliefs continue gender-based discrimination.

The NFHS survey shown the total fertility rate declining i.e NFHS-2.0 compared to the NFHS-1 i.e. 3.4; similarly the recent study highlighted the significant impact of decline in fertility rates on sex ratio at birth (SRB).The decrease in fertility rates has led to a disproportionate desire for sons over daughters, exerting pressure on women to prioritize having sons, especially at parity levels where couples may feel compelled to favor male offspring. Furthermore, the trend towards smaller families has contributed to the rise in sex selective abortions [5].

However, this study aims to analyze changing patterns of sex ratio at birth (SRB) in different order of parity or order of birth and explore the socioeconomic determinants driving these changes by examining four decades of birth history data from 1981 to 2020. We also aim to provide insight

into the complexity of sex-selective abortion using conditional ratios for the second order birth where first order birth was female.

Methodology:

We analyzed birth history data from five rounds of the National Family Health Survey (NFHS), Indian version of Demographic Health Surveys conducted during 1992-93 to 2020-21. NFHS surveys collect information from a large sample of married women aged 13-49 across India, covering various aspects of health and demographics.

The first round of NFHS-1 was conducted in 1992-93, which surveyed 89,777 women across 25 states, subsequent rounds expanded in both size and coverage. In 1998-99, NFHS-2 interviewed 90,303 women from 26 states, followed by NFHS-3 in 2005-06 with 124,385 women across 29 states. NFHS-4 conducted in 2015-16 covered 699,686 women in 36 states, and NFHS-5 conducted in 2020-21 surveyed 724,115 women across 36 states and union territories.

Our statistical analysis draws from the entirety of this pooled birth history data from five rounds of NFHSs to examine the sex ratio at birth, focusing particularly on birth order. To mitigate recall bias and improve data accuracy, we limited our analysis to births occurring up to ten years before each survey round. We also excluded multiple births to ensure consistency, as twins or higher-order multiples could skew the results. Using a hypothetical birth cohort approach, we grouped births into five-year intervals spanning from 1981 to 2020.

Traditionally, the natural sex ratio at birth ranges between 950 and 975 females per 1000 males, exhibiting minimal variation. However, this overall sex ratio at birth is influenced by decrease in fertility rate and reduced family size, which may not adequately reflect patterns of sex-selective abortion, which tend to vary based on birth order and the sex composition of previous children [6, 7]. To capture these nuances, we computed the conditional sex ratio by birth order, measuring the number of female births per 1000 male births (pf/[1-pf)*1000), where pf is the proportion of female births to total births (N) [1,7] . This conditional sex ratio approach is helpful to provide an indirect way to measure the sex-selective practices persistent in the population, when we cannot directly address the sex selective abortion in the population due to short fall of direct data on it.

Results:

Table 1 presents the trend in the conditional sex ratio by birth order from 1981 to 2020. Overall, the sex ratio remained relatively stable throughout the study period, with slight deviations from the expected range of 950-975. This trend was consistent for first-born children as well. However, we observed a decline in the sex ratio for second-born children, especially when the first-born was a girl. For example, the sex ratio for second-born children whose first-born was female was 973 between 1981 and 1985, but it dropped to 838 between 2001 and 2005. There was a slight improvement in the ratio between 2016 and 2020, with a conditional sex ratio of 883 boys per 1,000 girls. A similar trend was observed for third-born children when the previous two children were girls. The sex ratio for third-born children varied depending on the sex of the older siblings. When both older siblings were girls, the sex ratio dropped significantly to 841. In contrast, the ratio was higher at 1012 when both older siblings were boys and 900 when one older sibling was a boy and the other was a girl. These findings, particularly for second-order births when the first-born is female, indirectly suggest the potential presence of sex-selective abortion practices in the population, despite the absence of direct data.

This study also calculated the conditional sex ratio (CSR) for different socioeconomic groups. Table 2 presents the CSR and overall sex ratio for two time periods—1981-2005 and 2006-2020—along with the percentage change in CSR during these periods. We found that the CSR varied by place of residence, with rural areas showing only slight changes compared to urban areas. Additionally, the CSR differed among women with higher education and those from wealthier families. Women with higher education experienced a decline in CSR during both time periods compared to women with lower education. The table also shows a decrease in the sex ratio across all wealth groups, with the wealthiest group experiencing the largest change in CSR. This suggests that economic status may influence sex-selective practices. Furthermore, the Sikh community showed a decline in CSR compared to other religious groups.

Conclusion:

Overall, this study found variation in the sex ratio by parity over the period from 1981 to 2020. The overall sex ratio remained relatively stable during this period, and the same pattern was observed for first-order births. However, the sex ratio for second-order births declined when the

first-born was female, and the same trend was observed for third-order births. Similarly, we found variation in the sex ratio based on socioeconomic characteristics such as place of residence, women's level of education, and wealth status. These findings indirectly suggest the presence of sex-selective practices in the population.

This study highlights the need for educational campaigns targeting communities and groups with low sex ratios, raising awareness about the importance of the girl child and the harmful impacts of sex-selective practices on society. Additionally, strengthening incentive programs such as maternity benefits for mothers who give birth to a girl, educational scholarships for girls, vocational training programs for girls, and economic incentives for parents of girls could help address these issues. Improved healthcare services and the empowerment of women are also crucial for eradicating such practices.

Limitations:

- The study used the conditional sex ratio as an indirect measure of sex-selective abortion, which does not directly measure the practice.
- Multiple births, such as twins, were excluded from the analysis, which could affect the results.
- The lack of direct data on abortion rates, especially sex-selective abortions, limited the ability to measure the practice accurately.
- Changes in fertility preferences, declining fertility rates, and contraceptive use may have influenced the trends in sex ratios.

Ethical Approval

This study received ethical approval from ICMR-NIRRCH (IEC No: D/ICEC/Sci-47/49/2024 dated 19/03/2024). The study utilized publicly available secondary data published by the National Family Health Survey, the Government of India, and the Demographic and Health Surveys Program. Consent was obtained from the study participants by the respective organizations. Therefore, obtaining consent for participation in our research study is not applicable.

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Table 1: Conditional Sex Ratios at birth (proportion of female births to total births) by birth order, 1981-2020.

Birth of order/Sex of Earlier Child	Overall			First -Born			Second - Born- First born male			Second - Born- First born Female		
		95% CI			95% CI			95% CI			95% CI	
Years	Mean SRB	LL	UL	Mean SRB	LL	UL	Mean SRB	LL	UL	Mean SRB	LL	UL
1981-1985	928	909	947	923	904	943	850	780	855	973	891	1062
1986-1990	929	913	946	939	922	955	953	899	954	922	868	980
1991-1995	930	915	946	938	923	953	948	899	950	912	864	963
1996-2000	931	915	947	960	945	976	969	918	970	854	808	902
2001-2005	914	903	926	946	935	957	973	919	974	838	791	888
2006-2010	917	908	927	931	923	939	981	953	981	868	842	894
2011-2015	920	913	927	927	921	933	979	956	980	875	855	896
2016-2020	928	918	939	936	928	945	992	963	992	883	857	910

Birth of order/Sex of Earlier Child	Third - Born- Both earlier male child			Third - Born- Both earlier female child			Third - Born- one earlier male and female child			Fourth born and above		
		95% CI			95% CI			95% CI			95% CI	
Years	Mean SRB	LL	UL	Mean SRB	LL	UL	Mean SRB	LL	UL	Mean SRB	LL	UL
1981-1985	1064	824	1378	974	754	1257	845	692	1027	942	909	976
1986-1990	993	891	1107	890	800	989	940	870	1014	925	896	954
1991-1995	944	843	1057	877	785	979	950	877	1030	938	910	967
1996-2000	995	880	1126	918	821	1025	944	868	1027	926	896	958
2001-2005	902	791	1029	821	733	918	879	804	960	903	879	928
2006-2010	969	890	1054	877	815	943	883	928	1040	909	890	929
2011-2015	987	929	1048	806	768	846	915	878	952	920	902	938
2016-2020	1012	930	1101	841	789	896	900	851	952	921	892	951

Fig. 1: Conditional sex ratio of second order births where first born child was girl by the educational level of mother over time.

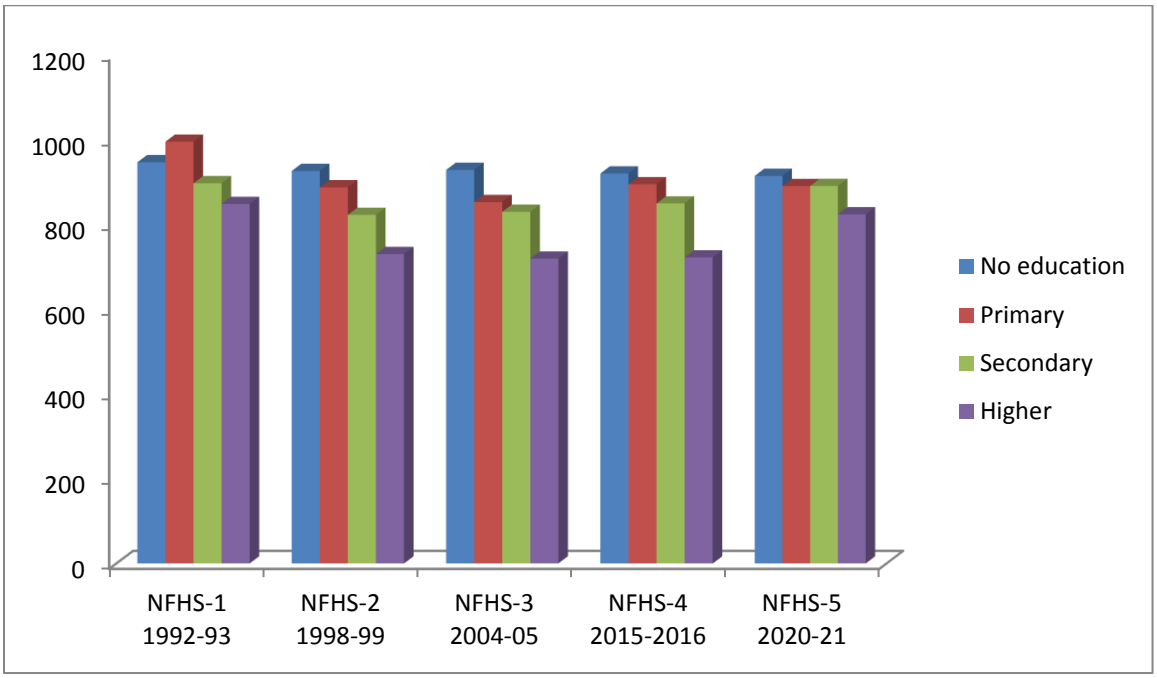

Table 2: Comparison of overall sex ratios, conditional Sex ratio of second-order births where the first-born child was a girl, and percentage change in CSR for the period from 1981-2005 and 2006-2020.

Background	1981-2005			2006-2020		
	Overall Sex Ratio	CSR	% fall in CSR	Overall Sex Ratio	CSR	% fall in CSR
Place of Residence						
Urban	915	851	7.0	906	847	6.5
Rural	929	906	2.5	925	884	4.4
Educational Level						
No education	937	936	0.1	935	923	1.3
Primary	925	914	1.2	921	890	3.4
Secondary	907	840	7.4	916	869	5.1
Higher	885	743	16.0	894	774	13.4
Wealth Index						
Poorest	946	970	-2.5	945	928	1.8
Poorer	946	931	1.6	932	914	1.9
Middle	927	921	0.6	916	890	2.8
Richer	914	871	4.7	908	849	6.5
Richest	889	796	10.5	874	754	13.7
Caste						
Scheduled Caste	928	892	3.9	930	923	0.8
Scheduled Tribe	944	922	2.3	950	899	5.4
Others	919	878	4.5	906	849	6.3
Religion						
Hindu	921	880	4.5	914	871	4.7
Muslim	948	941	0.7	935	910	2.7
Christian	948	957	-0.9	961	894	7.0
Sikh	829	746	10.0	857	736	14.1
Other	927	835	9.9	939	900	4.2