Community

A descriptive Study on the Sex Ratio at Birth in Institutional Deliveries at Jabalpur, Madhya Pradesh, India

SANJEEV KUMAR GUPTA, DINESH KUMAR PAL, RAJESH TIWARI, PRASHANT GUPTA, LOKESH AGRAWAL, RADHA SARAWAGI

ABSTRACT

Background and Objectives: The sex ratio at birth and the sex ratio in the population should remain constant without manipulation. However, several parts of the world, particularly some Asian countries including India, have shown a low sex ratio at birth due to the preference for a son and due to sex selective abortion. The objectives of our study were, to find out the sex ratio at birth in institutional deliveries and the factors which were associated with a low sex ratio.

Methods and Material: In the present study, the secondary sex

ratio was analyzed from the birth records of all the deliveries which were conducted at the Medical College Hospital and Elgin Hospital, Jabalpur, during the period from January 1st 2008 to December 31st 2008.

Results: During the study period, 5967 institutional deliveries took place, of which 2807 were female births, thus giving an overall sex ratio of 888.

Conclusion: In our study, a trend towards a higher sex ratio was seen with a higher educational status. The sex ratio was lower in the rural population and it decreased with parity.

Key Words: Sex ratio, Institutional delivery, Literacy Rate, Parity, Religion.

INTRODUCTION

The sex ratio at birth (SRB) is an important demographic indicator that was initially studied in the late 17th century[1]. The sex composition of a population is determined, in part, by the number of male births which are relative to the number of female births. In humans, the sex ratio at birth is commonly assumed to be 100 boys to 105 girls (which is sometimes shortened to "a ratio of 105"). However, the sex ratios at birth or among infants may be considerably skewed by sex-selective abortion and infanticide. The Central Intelligence Agency (CIA) has estimated that the current world wide sex ratio at birth is 107 boys to 100 girls [2].

The sex ratio at birth also affects the critical demographic measures, for example, the "doubling-time" of a population increases as the ratio of males to females at birth increases [3,4]. The data on the sex ratio at birth is necessary to understand the trends in infant morbidity like low birth weight and mortality, since male infants are more susceptible to illness and have higher infant mortality rates than females [5,7].

Rising sex ratios in India have been recorded since the early 1980s, and have since continued increasing alarmingly. The impact of this early rise is already visible among the adult population of several Indian districts [8]. The sex ratio at birth which is biased against female births can result in a gender imbalance, which in turn can have grave implications on the society in the form of lack of marriage-ability of the excess male population, thus resulting in social unrest, a demand driven increase in prostitution, kidnappings of women, etc [9,10].

The sex ratio at birth can be affected by sex-selectivity at birth [11]. The SRB for India for the period from 2004-06 (3 years average) has been estimated to be 892. It varies from 895 in the rural areas to 881 in the urban areas. In the rural areas, the highest and lowest SRBs are in the states of Tamil Nadu (970) and Delhi (810)

respectively. The SRB in the urban areas varies from 962 in Kerala to 800 in Punjab [12].

The various factors which are associated with declining sex ratios are social, economic and cultural in nature. Health institutions represent the health related behaviour of the population. It was thought that the sex ratio at birth would give some idea about the overall picture of the sex ratio in the society.

MATERIAL AND METHODS

This study was undertaken at the Medical College Hospital and the Elgin Hospital which are tertiary care government teaching hospitals in Jabalpur, Madhya Pradesh (MP), to find out the sex ratio at birth in institutional deliveries. It was a retrospective, record based, observational study. The birth records of all the deliveries which were conducted at the above mentioned institutes during the study period were analyzed by using the study variables i.e. literacy rate, religion, parity and residential status.

Statistical analysis:

The sex ratio at birth and the factors which were associated with them were analyzed by using the Chi square (c2) test of significance. The F-test statistics, Mcnemar's test and ANOVA were applied wherever they were relevant. The 5% and 1% levels of significance were used.

Ethical clearance:

The ethical clearance for conducting the study was taken from the ethical committee of the institution i.e. NSCB Medical College and Elgin Hospital, Jabalpur, with the assurance that confidentiality would be maintained and that the information which was obtained for this study would not be used for any other purpose except for academic purposes.

Results:

In the present study, a total of 5967 deliveries took place in these hospitals, with 3160 male and 2807 female births, giving an overall sex ratio of 888. More than 80% mothers belonged to 20-29 year age group, from rural as well as urban areas. [Table/Fig 1]

Nearly 1/4th of the mothers were illiterate. The level of literacy was relatively low among the mothers from the rural areas.[Table/Fig 2] A majority of the mothers who came from the urban (88.19%) and rural (89.93%) areas were Hindus. [Table/Fig 3]

The sex ratio was highly dependent on the literacy status, which was statistically significant (p< 0.01), showing a high degree of negative correlation.[Table/Fig 4]

The highest sex ratio at birth was observed among Christians (1178), followed by Muslims (953) and Hindus (879). These variations among different religions was due to chance, but they were statistically not significant [Table/Fig 5]

The sex ratio at birth was 909 for urban mothers and it was 820 for rural mothers, which showed high statistical significance (p< 0.01). There was a significant and negative correlation of SRB with the rural population. [Table/Fig 6]

There were 926 females per 1000 males for the 1st birth order, but the sex ratio was unfavourable towards females in the 2nd, 3rd and 4th birth orders. [Table/Fig 7]

DISCUSSION

In our study, we tried to investigate the influence of various factors such as parity, female literacy, religion and rural and urban background on the sex ratio at birth.

In the present study, the SRB (888) was found to be below the national average in this study, but the SRB for the first born child was close to the national average. As per the census of the year 2001, the sex ratio in India was 933 per 1000 boys, where it was 976 in 1961, just four decades back. The sex ratio in Madhya Pradesh was 919 per 1000 males, which was much below the national average of 933. According to NFHS 3, there was an accelerated decline in the sex ratio at birth from 1993-97 to 2000-04 [13, 14].

More than four fifth of the mothers belonged to the 20-29 year age group, who were from rural as well as urban areas. 24.79% of the mothers were found to be illiterate in the present study. The level of literacy was relatively low among the mothers from rural areas. According to the census of the year 2001, the female literacy in MP was 50.28% and in Jabalpur, it was 59.47 % [13]. The National Family Health Survey-II (NFHS-II) revealed that the maximum population (77.8%) in the rural area of Madhya Pradesh (M.P.) was illiterate and that only 5% had attained education up to class five [15]. The literacy rate in our study population was higher. This could be explained by the fact that both the hospitals which were involved in the study were tertiary care hospitals and that the patient population did not represent the whole community.

The analysis showed that the SRB was lowest among the illiterate population [863 girls per 1000 boys] and that it increased with the increasing educational status of the women. The highest SRB was seen among those with education up to the higher secondary level [944 girls per 1000 boys]. However, there was a decrease in the SRB among women with undergraduate education or above [902 girls per 1000 boys]. A similar observation was also made in other studies from India [9,16]. This could be explained by the fact that the women with higher education opted more for sex selection

Age of mother (in years)	Urban		Rural		Total	
	No	%	No	%	No	%
15-19	326	7.05	116	8.64	442	7.41
20-24	2379	51.45	664	49.44	3043	51
25-29	1442	31.18	383	28.52	1825	30.58
30-34	377	8.15	130	9.68	507	8.5
≥ 35	100	2.16	50	3.72	150	2.51
Total	4624		1343		5967	

[Table/Fig-1]: Age wise distribution of mothers.

Education of the mother	Urban		Rural		Total	
	No	%	No	%	No	%
Illiterate	1058	22.88	421	31.35	1479	24.79
Primary	797	17.23	262	19.51	1059	17.75
Middle	1098	23.74	345	25.69	1443	24.18
High school	845	18.27	181	13.48	1026	17.19
Higher secondary	412	8.91	78	5.81	490	8.21
Undergraduate but completed higher secondary	27	0.58	5	0.37	32	0.54
NA	387	8.378.37	51	3.80	438	7.34
Total	4624		1343		5967	

[Table/Fig-2]: Distribution of mother in relation to their literacy status

Religion of the mother	Urban		Rural		Total	
	No	%	No	%	No	%
Hindu	4078	88.19	1288	95.90	5366	89.93
Muslim	482	10.42	53	3.95	535	8.97
Christian	59	1.28	2	0.15	61	1.02
Others	5	0.11	0	0	5	0.08
Total	4624		1343	5967	5967	

[Table/Fig-3]: Religion wise distribution of mothers.

Education of the mother	Male		Female		Total	Sex ratio at birth
	No	%	No	%		
Illiterate	794	25.12	685	24.40	1479	863
Primary	562	17.78	497	17.7	1059	884
Middle	760	24.05	683	24.33	1443	899
High school	545	17.24	481	17.13	1026	883
Higher secondary	252	7.97	238	8.47	490	944
Undergraduate but completed higher secondary	16	0.50	16	0.57	32	1000
Graduate and above	231	7.31	207	7.37	438	896
Total	3160		2807		5967	

[Table/Fig-4]: Sex ratio at birth in relation to literacy status.

Regression Statistics of Table-4					
Multiple R	0.82238				
R Square	0.676309				
Adjusted R Square	0.611571				
Standard Error	340.4492				
Observations	7				
r (p< 0.01)	0-.82				
ANOVA					
	df	SS	MS	F	Significance F
Regression	1	1210846	1210846	10.44*	0.02315
Error	5	579528.2	115905.6		
Total	6	1790374			
	Coefficients	Standard Error	t Stat	P-value	
Intercept	9571.032	2700.526	3.544136	0.01649**	
Literacy Status	-9.58239	2.964706	-3.23215	0.02315*	

*Significant at 0.05
** Significant at 0.01
Sex ratio is highly dependent on Literacy Status. The value of R-square is 0.82238; indicate that approximately 82% variations in sex ratio are explained by the literacy status of respondents. The value of F-ratio is significant at 5% level of significance reveal that the systematic variation is considerably more than should be explained by chance.

Religion	Male		Female		Total	Sex ratio at birth
	No	%	No	%		
Hindu	2856	90.38	2510	89.42	5366	879
Muslim	274	8.67	261	9.30	535	953
Christian	28	0.89	33	1.18	61	1178
Others	2	0.06	3	0.11	5	1500
Total	3160		2807		5967	

[Table/Fig-5]: Sex ratio at birth in relation to religion.

Regression Statistics of Table-5					
Multiple R	0.6549642				
R Square	0.4289781				
Adjusted R Square	0.14346715				
Standard Error	2400.49348				
Observations	4				
ANOVA					
	df	SS	MS	F	Significance F
Regression	1	8657917	8657917	1.502493	0.345035802
Error	2	11524738	5762369		
Total	3	20182655			
	Coefficients	Standard Error	t Stat	P-value	
Intercept	8357.23849	5728.154	1.458976	0.281964	
Religion	-6.089125	4.967624	-1.22576	0.345036	

Residence	Male		Female		Total	Sex ratio at birth
	No	%	No	%		
Urban	2422	76.65	2202	78.45	4624	909
Rural	738	23.35	605	21.55	1343	820
Total	3160		28.7		5967	888

Mcnemar's test ~ $\chi 2$ = 2608.7 p< 0.01

[Table/Fig-6]: Distribution of sex ratio in relation to their residing areas.

Parity	Male		Female		Total	Sex ratio at birth
	No	%	No	%		
1	1502	47.53	1391	49.55	2893	926
2	1042	32.97	920	32.78	1962	883
3	430	13.61	348	12.40	778	809
≥4	120	3.79	97	3.45	217	808
	3094		2756		5850*	

[Table/Fig-7]: Sex ratio at birth (SRB) in relation to their parity status. .

Regression Statistics					
Multiple R	0.982679				
R Square	0.965657				
Adjusted R Square	0.948486				
Standard Error	272.2237				
Observations	4				
ANOVA					
	df	SS	MS	F	Significance F
Regression	1	4167430	4167430	56.23**	0.017321
Error	2	148211.5	74105.73		
Total	3	4315641			
	Coefficients	Standard Error	t Stat	P-value	
Intercept	-15900.4	2319.327	-6.85559	0.0206*	
birth in relation to parity	20.27187	2.703246	7.499084	0.01732**	

*Significant at 0.05
** Significant at 0.01
Sex ratio is highly dependent on parity. The value of R-square is 0.982679; indicate that approximately 98% variations in sex ratio are explained by the birth in relation to parity of respondents. The value of F-ratio is significant at 1% level of significance reveal that the highly systematic variation is considerably more than should be explained by chance.

due to the preference for a son and a small family size. The NFHS III data also showed that 56% of the women and 59% of the men considered the ideal family size to be two children or less, but that there was a consistent preference for sons over daughters among both women and men. About one- third of the women and one-quarter of the men wanted more sons than daughters, but only 2% wanted more daughters than sons [17]. It showed that though female education could lead to some decrease in the gender disparities, it was not enough. Hence, with increased female education, there had

to be an increased awareness regarding the adverse consequences of the declining sex ration, particularly among females.

The highest sex ratio at birth was observed in Christians, followed by Muslims and Hindus Similar findings are noted in some other studies [8,18,19]. It showed that the religion and cultural background influenced the preference for sons, which resulted in decreased SRB.

The sex ratio at birth was 909 for urban mothers and it was 820 for rural mothers. In institutional deliveries, the sex ratio at birth was low in both urban and rural areas as compared to the state average. Studies by other groups also showed that the preference for a son and the discrimination against the girl child were common among the rural population and that it mainly arose out of social attitudes and the society's prejudices, myths and beliefs. The preference for a son has two pronounced and predictable family-level effects on the sex composition of children who were ever born. It could be explained that smaller families had a significantly higher proportion of sons than the larger families and that socially and economically disadvantaged couples not only wanted but also attained a higher proportion of sons, if the effects of the family size are controlled.

A low sex ratio at birth in the rural areas was a point of concern. It possibly reflected an increased access of prenatal diagnostic techniques among the rural population who were possibly more biased against women due to an agriculture based male dominant society [20,21].

There was a decline in the SRB from the 2nd birth onwards. The variation of SRB with the birth order (or parity) was seen in Asia and in all the other countries where the SRB was increased. It showed that after the first child, a large number of couples availed of the prenatal techniques for sex selection. Similar findings were observed in other studies [16,17].

CONCLUSIONS AND RECOMMENDATION

An extremely complex situation is existent regarding the sex ratio at birth in India due to diverse demographic, cultural, and socio economic factors. These have shown a variable influence over the sex ratio in different studies. It is necessary to understand these complex mechanisms before making policies and planning to decrease the gender discrimination.

The effective implementation of a legislation which prevents sex selective abortion should be combined with education with respect to the declining sex ratio and its future consequences. All forms of gender inequality with equal social and economic rights for males and females, including the rights of inheritance, need to be addressed, to strike at the causes for the declining sex ratio. The PCPNDT Act should be effectively implemented, so as to discourage sex selective abortion. The mass media, both print and electronic, should be utilized and community organizations should be mobilized to disseminate the relevant information to prevent female foeticide. The IEC strategy must include celebrity women from different aspects of life. In addition, further studies are recommended to explore the reasons of the unhealthy sex ratio at birth. The women folk from the general population, especially those from the rural areas where two thirds of the Indian population reside and access to information is still a challenge, should be targeted to be educated, which could make both the men and women accept more female births.

Study limitations:

The present study was conducted at two tertiary care hospitals and the patient population did not represent the whole community. Hence, it was not possible to elicit the actual reasons for the preference of sons by a large section of the society.

REFERENCES

[1] Graunt J. Natural and political observations on the bills of mortality. London. 1662.

[2] "CIA Fact Book".The Central Intelligence Agency of the United States. Available at https://www.cia.gov/library/publications/the-world-factbook/geos/xx.html.

[3] Markle GE. Sex ratio at birth: values, variance, and some determinants. Demography. 1974; 11(1):131–42.

[4] Petersen W, Petersen R. Dictionary of demography: terms, concepts, and institutions. New York: Greenwood Press, Inc. 1986.

[5] Stevenson DK, Verter J, Fanaroff AA, et al. Sex differences in the outcomes of very low birth weight infants: the newborn male disadvantage. Arch Dis Child Fetal Neonatal Ed. 2000; 83(3):182–5.

[6] Mathews TJ, Menacker F, MacDorman MF. Infant mortality statistics from the 2002 period linked birth/infant death data set. National Vital Statistics Reports; Hyattsville, Maryland: National Center for Health Statistics. 2004; 53(!0).

[7] Getahun D, Amre D, Rhoads GG, Demissie K. Maternal and obstetric risk factors for sudden infant death syndrome in the United States. Obstet Gynecol. 2004; 103(4):646–52

[8] Guilmoto C Z: Characteristics of the sex- ratio imbalance in India and future scenarios. Available at http://www.unfpa.org/gender/docs/studies/india.pdf

[9] Mitra S. What explains the sex ratio at birth? An exploration into the root causes (July 13, 2007). Available at SSRN [social science research network]: http://ssrn.com/abstract=1000322 [last retrieved on 2011 Jan 10]

[10] Hesketh T, Xing ZW. Abnormal sex ratios in human populations: causes and consequences. Proc Natl Acad Sci U S A. 2006; 103(36):13271-5.

[11] Park K. Textbook of Preventive and Social Medicine 20th ed Jabalpur India Bhanot Publication; 2009.

[12] Govt. of India (2007), Sample Registration System Statistical Report 2008, Report No. 4 of 2007

[13] Office of the Registrar General (2003), India. Available at http://censusindia.gov.in/Census_Data_2001/States_at_glance/State_Links/23_mpd.pdf

[14] The National Family Health Survey (NFHS-3), India, 2005-06 Gender Equality and Women's Empowerment in India. Available at http://www.measuredhs.com/pubs/pdf/OD57/OD57.pdf

[15] The National Rural Employment Guarantee Act (NREGA); Government of India, Ministry of Rural Development; Department of Rural Development; Available from:http://nrega.nic.in/netnrega/writereaddata/state_out/BPL_AC_Photo_1733.html[last accessed on 2009 Nov 26]

[16] Varghese J, Aruldas V, Jeemon P. Analysis of the trends in the sex ratio at birth of hospitalised deliveries in the state of Delhi. Available at http://www.cmai.org/activities/policy_advocacy/pdfs/Analysis%20of%20trends%20in%20sex%20ratio%20at%20birth.pdf [last accessed on 2011 Jan 10]

[17] The National Family Health Survey (NFHS-3), India, 2005-06. Fertility and fertility preferences. Available at http://hetv.org/india/nfhs/nfhs3/NFHS-3-Chapter-04-Fertility-and-Fertility-Preferences.pdf [last accessed on 2011 Jan 10]

[18] Bhat PN, Zavier AJ. Fertility bias and gender decline in northern India. Demography. 2003 ;40(4):637-57.

[19] Lane T. In India, the son preference declines with an ideal family size, but it remains strong. International Family Planning Perspectives. 2004; 30(2).

[20] Bandyopadhyay M. Missing girls and son preference in rural India: looking beyond popular myths. Health Care Women Int. 2003; 24(10): 910-26.

[21] Varma1 GR, Babu BV. Son preference and desired family size in a rural community of the west Godavari District, Andhra Pradesh, India .J. Soc. Sci., 2007;15(1): 59-64

AUTHOR(S):
1.   Dr. Sanjeev Kumar Gupta
2.   Dr. Dinesh Kumar Pal
3.   Dr. Rajesh Tiwari
4.   Dr. Prashant Gupta
5.   Dr. Lokesh Agrawal
6.   Dr. Radha Sarawagi

PARTICULARS OF CONTRIBUTORS:
1.   Corresponding Author
2.   M.D, Professor & Head, Department of Community
      Medicine, NSCB Medical College, Jabalpur,
      Madhya Pradesh, India. Email : paldkjbp@yahoo.co.in
3.   MD, Associate Professor, Department of Community
      Medicine, NSCB Medical College, Jabalpur,
      Madhya Pradesh, India. Email : tiwaridrrajesh@yahoo.co.in
4.   BHMS, Trainee of the course, post graduate diploma
      in clinical research (PGDCR) at Indian Institute of Public
      Health Delhi, India. Email : dr.Prashant25@yahoo.com
5.   Assistant Professor, Department of Community Medicine,
      Mahatma Gandhi Medical College & Research Institute,
      Cuddalore Main Road Pillayarkuppam Pondicherry, India.

      Email- lokesha02@gmail.com
6.   M.D, Associate Professor, Department of Radiology,
      Mahatma Gandhi Medical College & Research Institute,
      Cuddalore Main Road Pillaiyarkuppam Pondicherry, India.
      Email : sarawagi_r@yahoo.co.uk

NAME, ADDRESS, TELEPHONE, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Sanjeev Kumar Gupta
Assistant Professor, Department of Community Medicine,
Mahatma Gandhi Medical College & Research Institute,
Cuddalore Main Road, Pillaiyarkuppam Pondicherry, India.
Ph. : Mobile: +91-7639656802, +91-7639656801
Fax : +91-4132615457
Email : drsanjeev15@gmail.com

DECLARATION ON COMPETING INTERESTS:
No competing Interests.