Introduction

Gender Biased sex selection is a discriminatory practice against girls which is a result of a different social and cultural factors prevailing in our country. The United Nations Children's Fund states that systematic gender discrimination caused 50 million women and girls to go missing from India’s population. With the increased misuse of advanced technologies there is a continuous decline in sex ratios and increase in female feticides.

According to NFHS-4 (2015-2016) sex ratio was 991 females per 1000 males. Sex ratio at birth is considered to be more accurate indicator of sex selection as it indicates the factors that come into play before birth. India's sex ratio at birth was 919 females per 1000 males while in rural area sex ratio was 927 and even lower in the urban area i.e., 899. After relentless efforts of activists, a law was passed in Maharashtra known as Maharashtra Regulation of Pre-Natal Diagnostic Techniques (PNDT) Act, 1988. The Pre-Conception and Pre-Natal Diagnostic Techniques (PC-PNDT) law is a prohibitive and regulatory statute which prohibits sex selection while preventing the misuse and over-use of the pre-natal diagnostic techniques. The law was implemented as a solution for the falling sex ratio but Gender biased sex selection is still prevalent in some parts.
of our country not only among urban middle class but in rural areas as well this is due to lower status of the women in society, preference for male child and unawareness about PC-PNDT act its legal implications.[3] The present study thus aim to evaluate the awareness and knowledge among mothers regarding PC-PNDT Act and knowledge of impact of imbalanced sex ratios and the socioeconomic factors affecting the same.

Methodology

A descriptive cross-sectional study was carried out over a period of 24 months i.e., from December 2016 to November 2018. **Study area:** Immunisation OPD of a tertiary health care centre and a primary health centre which are parts of field practice areas of Department of Community Medicine of a tertiary health care centre in a metropolitan city. **Study Participants:** Mothers attending immunization clinic in rural and urban areas. **Inclusion criteria:** 1. All mothers reporting at the immunization clinics. 2. Mothers willing to participate in the study after the informed consent. **Exclusion criteria:** 1. If the mother is not available as an informant. 2. If the mother is accompanied by her in-laws. The purpose of the study was explained to the study participants. Care was taken to ensure privacy during the interview by conducting it in a separate room. All study records were kept confidential. The study was approved by the Institutional Ethics Committee (IEC) (Approved on May 15, 2017). Data collection was done in a separate room to maintain confidentiality.

Sample Size was calculated assuming the son preference in rural area to be 68% and 50% in urban area the sample size was calculated using the formula:

\[ n \geq \frac{z_{1-\alpha/2}^2 \times P \times Q + z_1 - \beta \sqrt{(P_1 \times q_1 + P_2 \times q_2)}}{(P_1 - P_2)^2} \]

Where,
- \( n \) = sample size
- \( z_1 - \alpha/2 = 1.96 \)
- \( z_1 - \beta = 0.84 \)
- \( P_1 = 68\% \)
- \( P_2 = 50\% \)
- \( q_1 = 100 - P_1 \)
- \( q_2 = 100 - P_2 \)
- \( P = (P_1 + P_2)/2 \)
- \( Q = 100 - P \)

Substituting these values in above mentioned formula sample size needed in group 1 = 117 and sample size needed in group 2 = 117. Total sample size needed 234. Participants were selected after obtaining a proper informed consent for those who met inclusion criteria. The mothers fulfilling the inclusion criteria were recruited in the study after the informed consent by using Simple Random sampling method prospectively till the desirable sample size was achieved in each area. Data was compiled using Microsoft Excel 2016 and was coded accordingly. Statistical Analysis was done using SPSS software version 23. Test of significance (Pearson’s Chi-square test) was applied to find out the association between the awareness and sociodemographic factors, rural urban differences and other study variables. \( P \) values < 0.05 was considered to be significant. Numbers, percentages were used to represent data wherever required. Graphical methods used: Bar Diagram.

**Results**

A total of 234 mothers were assessed for their knowledge and awareness regarding prenatal sex determination and PCPNDT Act using a pre-tested questionnaire. Table 1 shows awareness of mothers towards Pre-natal sex determination. Out of 234 mothers only 158 (67.5%) of mothers were aware that sex of the baby can be determined during pregnancy among them 40 (63.49%) mothers from rural area felt that parents should be informed about the sex of the baby before birth as shown in Table 2 infront of when mothers were asked regarding. When mothers were asked regarding the possible methods for sex determination 65 (41.3%) of mothers knew that ultrasonography was the method of sex determination. Out of 48% mothers who said they were aware of the place for sex determination 74% said that it is done in private hospital.

Among 158 mothers who knew that prenatal sex determination can be done, 91 (57.6%) knew that it is illegal to do sex determination. Out of 91 (57.6%) mothers who knew that doing sex determination is illegal, 27 (29.67%) said that doctors are punished for doing sex determination, 14 (15.38%) said that parents are punished while only 50 (54.94%) knew that both doctor and parents are punished for doing pre-natal sex determination. Out of 91 (57.6%) mothers who knew that doing sex determination during pregnancy is illegal, 57 (62.63%) knew about the punishment given for the offence.

158 mothers were aware that prenatal sex determination can be done out of which 39 (24.68%) mothers were graduates and 21 (13.29%) mothers were educated till intermediate. A significant association was seen between awareness about legality and educational status of mother where 91 (57.6%) of the mothers who knew that doing sex determination is illegal, 26 (28.57%) were graduates and 29 (31.86%) were intermediate.

Out of 158 mothers who knew that sex determination can be done majority were from socioeconomic class three 52 (32.91%) and class four 86 (54.43%).

As shown in Figure 1 Out of total 234 respondents, 145 (61.96%) were aware of the fact that number of girl child in India is decreasing. Major source of information was television for both urban and rural respondents 102 (74.34%) followed by Newspaper in 45 (31.03%) respondents.

**Discussion**

This cross-sectional study was done to assess the awareness about pre-natal sex determination among mothers attending immunisation clinic at urban and rural health care centres.
234 mothers were interviewed, in which 117 mothers were taken from rural area and 117 from urban area. Out of 234 mothers who were interviewed almost 68% women were aware that pre-natal sex determination can be done during pregnancy. Here awareness among urban mothers was 81% which was more as compared to rural mothers which was 54% similar findings were obtained by Vinod Vedpathak et al. who did a study in Beed district of Maharashtra were 74% of the women were aware about pre-natal sex determination. Awareness about pre-natal sex determination was found to be slightly more in the study done by Sonal R deshpande et al. and Priyanka Sachdeva et al. were 80.5% and 93% respectively while8–10 63% of the mothers from rural and 25% from urban area wanted to know the sex of the baby before birth which shows although the awareness about pre-natal sex determination facility was less in rural area but still more no of mothers from rural area were interested to know the sex of the baby before birth similar to the findings of Ishita Sarkar et al. and Shamima Yasmin et al. who found that almost 60% and 35% respectively of the study population were of opinion that Parents should be informed during pregnancy regarding the sex of the baby before birth.11,12

On being asked about the method by which the sex of the baby can be determined awareness in urban area was found to be double of that in rural area similar to the results of Sonal Deshpande et al. who found that only 25% women were aware that ultrasound is used for antenatal sex determination while in a study done by Kanyadi Suhasini et al. who did a study in north Karnataka found that awareness was 14% in rural area and 71% in urban area and Gupta RK et al. found that awareness that ultrasound is used was 58% in rural area and 72% in urban area.13–16 Out of 158 mothers 48% said that sex determination is done in private hospital however in a study done by Shidhaye P R et al. awareness was found to be much more i.e., 75% may be due to the study setting which was done in a metropolitan city as shown in Figure 2 infront of among 158 mothers almost.13

Among 158 mothers, almost 58% knew that doing sex determination is illegal although awareness was again less in rural mothers and similar results were obtained by Kanayadi Suhasini et al. who found that awareness was 45% in rural area 86% in urban area. In a similar study done by Puri et al. and Nimbanwrat et al. awareness was 65% and 33.4% respectively.13,16,17

Among mothers who knew that doing sex determination is illegal only 12% of them knew the correct punishment for the offence while in a study done by Ashish Srivastav et al. in Lucknow awareness was only 1.6%.18 Educational status of mother and her knowledge about availability of facility of sex determination and its legality was found to be significantly associated. Similar results were seen by R Kansal who did a study on ANC mothers in Meerut found a significant association between awareness that prenatal diagnostic tests are illegal and education status as 100% of the intermediate pass women, 78.7% of high school pass women, and 73.3% of illiterate women were aware about the illegality of prenatal diagnostic tests while S Srivastav et al. showed that awareness was equal in illiterate as well as literate mothers.19,20 Here,

### Table 1: Awareness among mothers regarding Pre-natal sex determination

| Method to know sex during pregnancy | Rural (n=117) | Urban (n=117) | Total (n=234) | Statistical analysis |
|------------------------------------|--------------|--------------|--------------|----------------------|
| Yes                                | 63 (53.84%)  | 95 (81.19%)  | 158 (67.5%)  | P<0.01               |
| No                                 | 50 (42.73%)  | 16 (13.67%)  | 66 (28.2%)   |                      |
| Don’t know                         | 4 (3.41%)    | 6 (5.12%)    | 10 (4.3%)    |                      |

### Table 2: Awareness about methods and place for pre-natal sex determination

| Method to know sex during pregnancy (n=158) | Rural (n=63) | Urban (n=95) | Total (n=158) | Statistical analysis |
|--------------------------------------------|--------------|--------------|---------------|----------------------|
| USG                                        | 16 (25.39%)  | 49 (51.57%)  | 65 (41.13%)   |                      |
| Blood test                                 | 5 (7.93%)    | 17 (17.89%)  | 22 (13.9%)    |                      |
| DNA test                                   | 2 (3.17%)    | 5 (5.26%)    | 7 (4.4%)      |                      |
| Don’t know                                 | 40 (63.49%)  | 24 (25.26%)  | 64 (40.50%)   |                      |

*Percentages in brackets are column percentages*
Kavithai et al. also found that 96.5% of the literates were aware of the Act as compared to only 3.5% of the illiterates.\[21\]

Thus educating women as well as men right in the schools about dangers of female feticide and skewed gender ratio can be helpful. It also was seen that awareness about facility and illegality of sex determination was more among mothers belonging to socioeconomic class III and IV. More than 60% of mothers in our study were aware about the decreasing no of girl child in our country while Ashish Srivastav et al. found it to be 72% in his study while in a study done by Kaushal A et al. awareness was only 33%.\[18,22\] Television was major source of information for both urban and rural mothers followed by newspaper similar to findings of Adadawani Roma S et al.\[23\] Thus, Mass media can be used as a tool to educate people regarding the effect of declining sex ratio and gender imbalance on individuals, families and on our society. Mothers who were aware about the fact, that girls are decreasing in our country majority of them said that it would be difficult to propagate the family and it would be difficult to find brides similar to findings of Kumar Nithin et al.\[24\]

### Conclusion

In our study more number of mothers from urban area were aware about the availability of facility of sex determination and many of them were also aware that it is illegal, therefore less number of mothers in urban area as compared to rural area were interested to know the sex of the baby before birth. The law alone cannot halt the decline in sex ratio what is required is to increase the awareness specially among mothers and promoting gender equality and this can be achieved by increasing the awareness among general public regarding the consequences of adverse sex ratio.

Primary care physicians can play an important role in creating awareness about all the Government run Incentive programmes for families who have adopted single girl child. They are the first point of contact for mothers reporting to the immunisation clinics. This opportunity can be utilised by physicians to educate mothers about the PC-PNDT act and these campaigns can be made more effective through films and other media depicting the importance of PC-PNDT Act for the society and creating awareness about the legal consequences and punishments which both the doctors and relatives can face if they are not abiding by the law and are going for pre-natal sex determination and opting for abortions of female foetuses in desire to have male child. We have to ensure effective implementation of PCPNDT Act so that families and doctors deter from sex determination and sex selective abortions. It is most important and essential as it was seen in the study that those mothers who knew about sex determination many of them did not knew that, it is illegal.

### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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### Conflicts of interest

There are no conflicts of interest.

### References

1. Pande R, Malhotra A. Son Preference and daughter neglect in India. What happens to living girls? Washington, DC: International Centre for Research on Women, 2006.
2. Female foeticide in India. C2007. Available from: http://www.unicef.org/india/media_3285.htm. [cited on 2008 Jun 26].
3. IIPS. National family health survey (NFHS-4), 2015-16. Mumbai: International Institute for Population Studies. Available from: http://www.mohfw.nic.in/nfhs4/index.htm. [Last accessed on 2020 Aug 1].
4. Varade Y, Balsarkar G, Bandekar P. A study to review sex ratio at birth and analyze preferences for the sex of the unborn. J Obstet Gynaecol India 2014;64:23-6.
5. Annual Report on Implementation of the Pre-conception And Pre-natal diagnostic techniques (prohibition of sex selection) act 2005 Ministry of Health and Family welfare.
6. Handbook on Pre-Conception and Pre-Natal Diagnostic
Rawat, et al.: Prenatal Sex determination awareness mothers

Techniques Act, 1994 And Rules With Amendment. Ministry of Health and Family Welfare Govt. Of India 2006.

7. Bhattacharjya H, Das S, Mog C. Gender preference and factors affecting gender preference of mothers attending antenatal clinic of Agartala. Int J Med Sci Public Heal 2014;3:137-9.

8. Vedpathak V, Kakrani V, Nagaonkar A, Deo D, Dahire P, Kavalkar U. Gender preference and awareness regarding sex determination among pregnant women—a hospital based study. Int J Med Sci Public Health 2013;2:1054-7.

9. Deshpande S, Rathod P, Mankar S, Narlawar U. Awareness and perception regarding PC-PNDT act and gender preference among mothers of under -five attending immunization clinic. Int J Med Sci Public Health 2016;5:1878-82.

10. Sachdeva P, Ray S. Gender preference and awareness regarding foetal sex determination among antenatal women attending a tertiary care hospital in rural Gurgaon. J Med Sci Clin Res 2018;6:255-62.

11. Sarkar I, Dasgupta A. Gender preference and perception of PNDT: A community based study among ever married women in a rural area of West Bengal. Int Arch Integrated Med 2013;2:183-91.

12. Yasmin S, Mukherjee A, Manna N, Baur B, Datta M, Sau M, et al. Gender preference and awareness regarding sex determination among antenatal mothers attending a medical college of Eastern India. Scand J Public Health 2013;41:344-50.

13. Kanayadi S, Kulkarni R, Mallapur M. A community based comparative study on gender prefrences, awareness and attitude regarding sex determination among women of North Karnataka. Natl J Res Community Med 2013;4:296-301.

14. Gupta RK, Langer B, Singh P, Raina SK, Kumari R, Hussain S, et al. Awareness of prenatal sex determination and preconception and prenatal diagnostic techniques act: A comparative study among rural and urban females of reproductive age group (15-45 years) attending a tertiary care teaching hospital in North India. J Curr Res Sci Med 2018;4:21-5.

15. Shidhaye PR, Giri PA, Nagaonkar SN, Shidhaye RR. Study of knowledge and attitude regarding pre-natal diagnostic techniques act among the pregnant women at a tertiary care teaching hospital in Mumbai. J Edu Health Promot 2012;1:36.

16. Pur S, Bhatia V, Swami HM. Gender preference and Awareness regarding sex determination among married women in slums of Chandigarh. Indian J Community Med 2007;32:60-2.

17. Nimbannavar SM, Biradar M. A study to assess gender preference and sex determination in married women attending opd and antenatal clinic in UHTC, KIMS Koppal. Indian J Forensic Community Med 2019;6:10-2.

18. Srivastava A, Singh JV, Singh OP, Singh VK, Singh N. Gender preference, attitude and awareness of young eligible couples towards prenatal sex determination In Lucknow District. Natl J Community Med 2014;5:148-52.

19. Kansal R, Maroof KA, Bansal R, Parashar P. A Hospital-based study on knowledge, attitude and practice of pregnant women on gender preference, prenatal sex determination and female feticide. Indian J Public Health 2010;54:209-12.

20. Shrivastava S, Kariwal P, Kapilasrami MC. A community based study on awareness and perception on gender discrimination and sex preference among married women (in reproductive age group) in a rural population of district Bareilly, Uttar Pradesh. Nat J Commun Med 2011;2:273-6.

21. Kavithai P, Anandaraj R, Puhalenthi K. Awareness regarding pre-conception and pre-natal diagnostic techniques act among women in a rural community of Puducherry. Med J DY Patil Vidyapeeth 2019;12:136-8.

22. Kaushal A, Rana N, Sharma P, Minhas A, Singh M. Knowledge and attitude regarding declining sex ratio and female feticide among married females (15-49 years) residing in a village in Shahpur, Kangra, Himachal Pradesh. Indian J Soc Psychiatry 2019;35:183-7.

23. Roma S D, Thomas T. Knowledge regarding sex- ratio and PCPNDT Act-A Cross Sectional Study. Int J Sci Res 2014;3274-6.

24. Nithin K, Tanuj K, Unnikrishnan B, Rekha T, Prasanna M, Vaman K, et al. Gender preferences among antenatal women: A cross-sectional study from coastal South India. Afr Health Sci 2015;15:560-6.