

Skewed sex ratio in India, an overview of the present state of affairs

Proporciones asimétricas entre sexos en la India: estado de la cuestión

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Abstract

There were 37 million more males than females in India in 2011. We review the present state of affairs as a follow up of an earlier review on the 'impact of prenatal technology on the sex ratio in India'. Government schemes such as 'Beti Bachao Beti Padhao' (BBBP) to address the problem of the skewed sex ratio, have led to limited improvement. The assessment reports, however, show that the schemes have failed because of inadequate implementation. In fact, two recent government reports show that the sex ratio at birth has increased since 2011. Sex selection continues unabated as the illegal sex selection teams continue to change their methods to avoid detection by the authorities. The emergence of non-invasive prenatal technology poses a further threat to the sex ratio in India, China and beyond. There is now empirical evidence linking the increase in violence against women to the sharp increase in sex ratio since the 1990s in India. The negative social consequences of too many men affecting both men and women are likely to worsen and will continue into the next century. Improving the economic and social status of women is the only answer in the long run but further deterioration of the sex ratio must stop. In spite of the setbacks, the BBBP scheme which addresses both these issues is the best hope. However, as for previous schemes, adhering to the guidelines and enforcing the laws remains the greatest challenge.

Keywords: Skewed sex ratio, Sex selection in India, NIPT for sex selection, Too many men.

Resumen

En 2011, en la India había 37 millones de hombres más que de mujeres. Analizamos el estado de la cuestión, siguiendo un estudio anterior sobre el "impacto de las tecnologías prenatales en la proporción entre sexos en la India". Acciones gubernamentales como "Beti Bachao Beti Padhao" (BBBP) que abordan el problema de la proporción asimétrica entre sexos han producido pocas mejoras. No obstante, los informes de evaluación muestran que estas acciones no han tenido éxito dada su mala implementación. De hecho, dos informes gubernamentales recientes muestran que la desproporción entre sexos ha aumentado desde 2011. La selección por sexo continúa sin cesar, a medida que los equipos clandestinos que practican abortos cambian continuamente de métodos para evitar ser interceptados por las autoridades. La emergencia de las tecnologías no invasivas de detección prenatal representa otra amenaza a la proporción entre sexos en la India, China, etc. Ahora existen pruebas empíricas que relacionan el aumento de la violencia en contra de las mujeres con el fuerte aumento de la desproporción entre sexos a partir de los años '90 en la India. Las consecuencias sociales negativas del número excesivo de hombres, que afectan tanto a los hombres, como a las mujeres, es probable que aumenten y continúen en el próximo siglo. Mejorar el estado económico y social de las mujeres es la única respuesta a largo plazo, pero debe detenerse el aumento de la desproporción entre sexos. A pesar de los obstáculos, el programa BBBP que aborda ambos problemas es la mejor solución. No obstante, como en acciones anteriores, el mayor desafío sigue siendo el respeto de las guías y la aplicación de las leyes.

Palabras clave: Proporciones asimétricas entre sexos, Selección de sexo en la India, Análisis de detección prenatal no invasivo, Índice de masculinidad demasiado alto.

Introduction

The 2011 Census of India revealed that there were 37 million more males than females in India. Shortly after these results were known, we published an overview of the impact of prenatal technologies on the sex ratio in India, including causes and consequences of the skewed sex ratio in favour of males (Madan and Breuning, 2014). Here we present the current state of affairs following the introduction of new programmes for addressing the problem and update the reader on the information that has become available since 2013.

A note on terminology

The Sex Ratio (SR) is the ratio of males to females in a population. In general, this is about 1:1. It is usually expressed as the number of males per 100 females. The Sex Ratio at Birth (SRB) is usually about 105 but due to higher postnatal mortality of males, the SR is later expected to become close to 100. In India the SR was expressed as the number of females to 1000 males in the first official census held in British India in 1881 (History of Census, n.d.) and continues to be expressed in the same way. In this paper we use the SR as the number of males per 100 females and give the Indian SR in parentheses wherever appropriate. The Child Sex Ratio (CSR) has been given for the age group of 0 to 6 years in the Census data for the last 6 decades since 1961 (Census of India, 2011). This is helpful in the absence of birth registration. Data available since 2012 gives the SRB.

The problem

The 2011 census of India revealed that the SR was 106 (943) and that the CSR was 109 (919) (Census, 2014). The SR had been going up slowly since 1901 but the CSR had increased sharply since the introduction of prenatal technologies in the 1970s from 104 (962) in 1981 to 109 (919) in 2011. In some parts of Northern India the CSR was alarmingly high, e.g., 120 (834) in the state of Haryana and 115 (871) in Delhi (Census of India, 2011). Furthermore, the problem had spread over a period of 20 years from a handful of states to most parts of the country (Jha et al., 2011). In 30 of the 35 states and union territories the CSR in 2011 had arisen with respect to 2001; it was skewed in 24 of these, including seven that hitherto had normal values (Census of India, 2011).

One of the root causes for the skewed sex ratio is a strong traditional preference for sons; women have a low status and are considered a financial burden in the highly patriarchal society (Madan and Breuning, 2014).

In 2011 there were > 37 million more males than females in India (Census of India, 2011). Population estimates from 2017 show that the figure has risen to 49 million (World fact book, 2018). Predictions for the 'marriage squeeze' (number of men seeking to be married per 100 women) present a gloomy picture (UNFPA, 2012). It will go up to >150 for about three decades with a peak in 2050. The

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percentage of single men at age 50 will rise and will peak at about 10% in 2065; the problem of marriage squeeze will persist till at least the end of the century (UNFPA, 2012 pp 50-54; Hesketh et al., 2011; Guilмото 2015 p220). The above figure of > 50% more men than women seeking marriage partners is for the whole of India. The marriage squeeze is likely to be far worse in populous states and in those with long standing skewed sex ratios (Kaur, 2013). The various dire consequences of 70 million (50 million below age 20) more men than women in India and China have been well documented. These involve adverse effects not only on the physical and mental health of women but also on the wellbeing of men, who are marginalized and suffer from depression with no prospect of a normal family life (Aravamudan, 2007; UNFPA, 2012; Kaur, 2013, 2016; Madan and Breuning, 2014; Guilмото, 2015; Zhou and Hesketh, 2017). Other far reaching social and economic consequences of too many men, as a result of more than 30 years of sex selection, are only now starting to emerge; these may go far beyond the borders of China and India (Denyer and Gowen, 2018). Stopping further deterioration of the SR and at the same time improving the status and value of women is a matter of urgency.

Addressing the problem

India has many laws to protect women and to prevent female infanticide and foeticide: The Infanticide Regulation Act (1870); The Child Marriage Restraint Act (1929, amended 2006); The Dowry Prohibition Act (1961, amended 1985); The Pre-Natal Diagnostic Techniques, PNDT, Act of 1994 amended to the Pre-Conception Pre-Natal Diagnostic Techniques, PCPNDT, Act (2003) making sex selective abortion illegal (Madan and Breuning, 2014; Jejeebhoy et al., 2015). The Population Council has reviewed the various governmental initiatives and schemes to address the problem of sex selection and to raise the value of women in the last 30 years. Progress in bringing about any meaningful change has been limited (Jejeebhoy et al., 2015; ACHR, 2016). Poor implementation of the PCPNDT Act and other schemes has meant that the CSR in 2011 had further deteriorated with respect to 2001; but without the PCPNDT Act the CSR would have been even more skewed (Nandi and Deolalikar, 2013).

When in 2014 the new Prime Minister addressed the issue in his first independence-day speech on 15 August 2014 (Modi, 2014), it appeared that, after decades of calls for a better implementation of the laws by activists, social workers, doctors, scientists, and other professionals in India, a turning point had been reached. On 22 January 2015 the Prime minister launched a social programme 'Beti Bachao, Beti Padhao' (Save the Daughter, Educate the Daughter, BBBP) in the state of Haryana, which has the lowest SR in the country. The pilot programme was started in 100 gender critical districts. It was later extended to 161 districts and about three years later, in November 2017, to 640 districts of India (ACHR, 2017a). The objectives of the BBBP scheme were "to prevent gender biased sex selective elimination, to ensure survival and protection of the girl child and to ensure education of the girl child and her participation" (BBBP, 2017). Besides the actions aimed at balancing the SRB, the BBBP scheme includes a wide range of measures to raise the status of women. These moves are promising and a good step in the right direction.

Both Haryana and Punjab, two of the states with the most skewed SR, have reported significant improvement in the SRB. However, the BBBP scheme has been declared a failure, as reported by the Asian Centre of Human rights (ACHR) (ACHR 2017a;

2017b) and by the RGIC (Rajiv Gandhi Institute for Contemporary Studies) Policy watch (RGIC, 2017). The reports have described the extent of and the reasons for the failure of the BBBP scheme. These include failure to follow the guidelines, inadequate enforcement of the PCPNDT Act, inadequate monitoring and reporting, divergence/

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non-utilization of funds, undermining of the scheme by outside fraudsters, insufficient support for NGO workers and manipulation of figures of SRB to claim success. An audit carried out by the Comptroller and Auditor General of

India (CAG) found that the SRB in a number of districts was considerably worse than the figures claimed by the authorities in Haryana (ACHR, 2017a). Nevertheless, there has been some improvement in the SRB in many districts, which may also be partly due to some of the earlier schemes (ACHR, 2017a).

As far as the position of women is concerned, the rate of child marriage has improved from 47% in 2006 to 27% in 2016; it is 29% in urban areas but still 48% in rural areas (UNICEF, 2016). On the other hand, in the ranking of the World Economic Forum gender gap index in 2017, India has slipped to 108th place out of 144 countries (from 87th in 2016) (W.E.F., 2017). India has still a long way to go in the improvement of the lives of women.

We will have to wait for the final assessment of the outcome of the BBBP till the next census in 2021. As with previous schemes, despite the commitment of the authorities, stopping further deterioration of the SR and at the same time changing the mind-set of the population of 1.3 billion remains a formidable challenge. The BBBP scheme has, in any case, raised the public awareness of the problem.

On 28 January 2015 the Supreme Court of India ordered internet search engines Google, Yahoo, and Microsoft to block advertisements for clinics that provide prenatal sex-determination services; in September 2016 the companies agreed to do so (ACHR, 2017b). In April 2017 finding a balance between the right to information and compliance with the law on advertising was still being worked out and as of December 2017 the matter was still not settled (Scroll Staff, 2017).

Sex selection goes on unabated

According to a report of the Ministry of Home Affairs the general SRB of India has increased from 110 (909) in the period 2011-13 to 111 (898) in 2014 -2016; in urban areas it is 112.5 (889) (Statistical report, 2016). A health report of NITI Aayog (National Institution for Transforming India, a policy commission of the Government of India) released in February 2018 shows that in 17 out of 21 large states the SRB has risen in the period 2013-15 with respect to 2012-14 (Niti Aayog, 2018). These data show that prenatal sex selection continues.

Although the focus is on getting the SRB in balance, particularly in the north-western states of Punjab, Haryana, Gujarat and Maharashtra with high rates of prenatal sex selection, it is important to keep in mind that SR depends also on postnatal sex selection. A recent large study published in the Lancet estimates excess mortality of girls in the age group 0 – 5 years to be 239,000 per year in the period 2000–2005.

However, four large northern states, Uttar Pradesh, Bihar, Madhya Pradesh and Rajasthan, account for two-thirds of this number. It is noteworthy that sex-selective abortions and excess postnatal female mortality are observed in different regions, mostly in the north-western and northern part of India (Guilmoto et al., 2018). Prenatal sex selection has accelerated the change in SR but it did not replace the excess female mortality; large scale postnatal neglect of unwanted girls leading to death continues to contribute to the female deficit. The impact of excess female mortality remains considerable and is equivalent to the impact of prenatal sex selection (Bongarts and Guilmoto, 2015). The ancient cultural desire to have at least one son is indeed very strong in India. Many families continue to have children till they have at least one or the desired number of boys. The annual economic survey of India published in January 2018 estimates the number of unwanted girls in India to be 21 million (Economic survey 2017-18, 2018). This does not affect the SRB but is likely to become apparent in the CSR or SR, as these girls are vulnerable to neglect.

There are indications that prenatal sex selection is going on unabated. Bhattacharya and Singh (2016, 2017) have shown that each time the government has introduced a new law or applied stricter rules for enforcing the laws, the teams providing illegal services for sex selection changed their tactics to avoid detection by the authorities. The latest adaptation to police raids as a result of the BBBP scheme is that mobile teams equipped with ultrasound machines and abortion kits operate in the night. The clandestine sex determination and the hurried abortion, if the foetus is a female, are often carried out in the dark with poor visibility. The team leaves before waiting for the abortion process to complete with the advice to go to the hospital in case of complications. This can have disastrous consequences for the health of the woman who is often under pressure from the husband's family to undergo the ordeal.

The use of drugs to change the sex of the foetus is widespread in India, especially in the states of Punjab and Haryana in Northern India (Bandyopadhyay and Singh, 2007). These sex selection drugs (SSDs) are in the form of Ayurvedic herbs or as tablets or powder derived from these herbs and are easily available from doctors, quacks, faith healers and grocery stores. The overall use is in 0.5% of pregnancies; in 10% if the first child is a girl and 40% if there are two girls. Women are made to believe that the sex of the child can be changed by taking these SSDs at around two months of pregnancy. The use of these drugs may not affect SRB but has been linked to the risk of congenital malformations (increased threefold) and still birth (increased 2.5 times). Still births occur in one in five mothers exposed to SSD. Chemical analyses of these SSDs showed high levels of testosterone and phytoestrogens (Neogi et al., 2015, 2016, 2017). The use of SSDs illustrates the intensity of desire for sons.

The rich and the educated, who most avail of the prenatal sex selection technology (Deshpande, 2009; Jha et al., 2011; Madan and Breuning, 2014), will still have access to advertisements from the Middle East and Thailand via their social network abroad. Media reports show that many Indian and Chinese couples go abroad for sex selective abortions (Straus, 2010, Kaye and Jittapong, 2014).

The non-invasive prenatal test (NIPT) has been misused for sex-selective abortions in India since 2006 when the first commercial DNA kits for gender prediction became commercially available on the internet (Aravamudan, 2007 pp 83-86; Raaj, 2006). The Gender Mentor kit (popularly called Jantar Mantar in Punjab after the name of 18th century astronomical observatories in India, meaning instrument of calculation) was

openly advertised on the internet; a sample of blood from the pregnant woman could be sent to a laboratory in the US and the result could be obtained within a few days. The accuracy of this test was disputed and the Gender Mentor is no longer on the market. In the meantime, other prenatal sex determination DNA test kits for around the 8th week of pregnancy are available on the market (Ossipenko and Szczepura, 2011). Early detection by use of home kits provides an ideal system for two reasons: first the sex determination is separated from abortion, which is legal (whereas abortion for sex selection is illegal); the second is that termination can take place before any registration of pregnancy. This way the sex selective abortion remains undetected by the authorities. While most companies specifically state that they do not supply to India and China, some others supply worldwide (Ossipenko and Szczepura, 2011). Even if the banning of adverts becomes effective, rich and educated couples in India will be able to get hold of such kits via their relatives abroad (Raaj, 2006); these kits could also be manufactured easily in India (Ossipenko and Szczepura, 2011). It should be mentioned that the NIPT test is used in India and in China for legitimate purpose of detecting genetic diseases (Verma IC, 2014, Guijie, 2016). It is the illegitimate misuse of NIPT that is a matter of concern. One cannot expect any empirical evidence of misuse of NIPT in a scientific article. This is an illegal and of necessity a clandestine activity, as has been the case for the misuse of ultrasound technology, which is still being used illegally for prenatal sex selection for more than 20 years. Any evidence will have to come from investigative journalism. There are media reports of misuse of NIPT for sex selection in Australia (Puddy, 2015) and Montenegro (Balkan insight, 2017); there also indications of its misuse in China (Pinghui, 2014) and India (Express news, 2014).

The emergence of non-invasive prenatal technology poses a further threat to the sex ratio in India, China and beyond.

In a testimony before the Congressional-Executive Commission on China in December 2015, Reggie Littlejohn, President of the Women's Rights without Frontiers, stated: "Where brutal son preference meets non-invasive, early sex determination of a foetus, inevitably baby girls will be selectively aborted" (Littlejohn, 2016). Indeed, strong son preference poses the greatest challenge in India.

NIPT in the world setting

Studies have been done in a number of countries (including India, China, Vietnam, Azerbaijan, Armenia, Georgia, Albania, Kosovo, and Montenegro) where sex selection has taken root following the availability of prenatal technology. Three essential preconditions were identified for selective abortions of girls to occur: 1) reduction in fertility, 2) availability of techniques of prenatal sex determination and 3) son preference (Guilmoto and Duthe, 2013; Guilmoto, 2015 pp 207-208; UNFPA, 2015). As the first two factors also occur in most western societies without large scale sex selection, son preference is the driving force for sex selective abortions.

The negative social consequences of too many men affecting both men and women are likely to worsen and will continue into the next century.

Demographic and Health Surveys of 61 countries have shown that nearly half of these countries, including those in the Middle East, North Africa and Sub-Saharan Africa, have a strong preference for sons (Bongarts, 2013). At

present most have normal SRB, the fertility rate is high, abortion is forbidden and/or prenatal technology is not available. If nothing is done to raise the gender equality in these countries, they have a potential for prenatal sex selection in the future, if and when reduced fertility becomes the social norm and political, economic and technical conditions allow it (Bongarts; 2013; Bongarts & Guilmoto, 2015). Countries such as Afghanistan, Pakistan, Bangladesh and Nigeria already show a deficit of females in the population despite normal SR at birth. This deficit is attributed to increased female mortality due to postnatal discrimination in nutrition and medical care or abandonment (Bongarts and Guilmoto, 2015), a situation akin to that in India and China before the advent of prenatal diagnosis.

International guidelines to prevent gender biased sex selection emphasize that efforts to limit sex selection should not limit economic, social and/or geographical access to prenatal technology for health reasons for all individuals (WHO, 2011; UNFPA, 2014, 2015). These are still applicable though they date before the rapid globalization of NIPT technology.

The global market for NIPT is driven by industry (Kamenova, 2016). The improving health facilities and the advantages of NIPT provide significant growth opportunities for the NIPT market in developing countries (Market watch, 2015). Ethical considerations and the need to regulate the use of NIPT have been stressed by many authors (Chapman and Benn, 2013; Allyse et al., 2015; Dondorp et al., 2015; Minear et al., 2015). NIPT is already commercially available in 60 countries worldwide (Allyse et al., 2015) including those with a strong son preference. These countries need to start raising gender equality and putting strict regulations for the use of NIPT now and remain vigilant that the regulations are adhered to. Once the trend for misuse of the techniques sets in, it will be very difficult to turn the clock back as is the case in India and China.

Linking increase in crime against women to increase in SR

One form of crime against women that is a direct result of an increased SR is trafficking of women and girls (Lai-Wan et al., 2006; Davis, 2006; Stöckl et al., 2017). Reports by the United Nations and the Asian Centre for Human Rights on human trafficking in India (UNDOC, 2013; ACHR, 2017c) describe kidnapping or buying of girls in poverty-ridden villages in the Eastern and Northeastern states

There is now empirical evidence linking the increase in violence against women to the sharp increase in sex ratio since the 1990s in India.

of India for selling as brides or as bonded labor in North Indian states of Punjab and Haryana with the greatest shortage of women. Two studies have analyzed the violence against women from conception to old age in the extremely patriarchal societies with very low status of women in these two states (Vidushy, 2016; Parihar et al., 2015). Both studies link the skewed SR with the increase in the rate of crime against women.

A few studies have found a link between the skewed SR and violent crime in general (Dreze and Khera, 2000; Edlund et al., 2013; Barua et al., 2017). Although increase in violence against women has been repeatedly mentioned as one of the possible consequences of skewed SR, most authors have been cautious because of insufficient evidence. However, since the high-profile fatal gang rape case in India in 2012 (Verma JS et al., 2013) that caused national outrage and got international attention, there is a spotlight on the rising crime against women. Data from the National Crime Records Bureau (NCRB) shows an increase in the reported crimes of all types against women since the 1990s (Mangoli and Devarmani, 2014; Verma A et al., 2017; Mallapur, 2015). It should be mentioned, however, that only 1% of domestic and 6% of the crime outside home is reported (Gupta, 2014). The increase in the rate of crime against women since the 1990s is now being increasingly correlated to the increase in the SR since the 1990s. However, empirical data specifically linking the two was lacking up till now. Recently Amaral and Bhalotra have provided the first causal evidence (Amaral and Bhalotra, 2017). They have matched the reported crime data from NCRB and the SR from the Census data in 258 districts spread over India over the period 1971-2011. They estimate that increase in the youth (age 20-24) SR can account for about a third of the increase in gender-based violence since 1995.

Conclusion

According to the assessment reports, the various government policies since the last census in 2011 have failed to produce any significant improvement in the sex ratio. In

Improving the economic and social status of women is the only answer in the long run but further deterioration of the sex ratio must stop.

fact, two sets of figures released by the government at the beginning of 2018 show that the SRB continues to increase. Sex selection goes on unabated. Its negative effects on the lives of both men and women and on

the society as a whole are likely to get worse and will continue into the next century. The extent of possible social and economic consequences of too many men is only just beginning to come to light.

What is to be done? Many authors point out that banning of sex selective abortions in India is not the answer as it: drives the procedure underground exposing women to monetary exploitation; affects the social, physical and psychological wellbeing of women; increases the number of unwanted girls and the ill treatment of the girls and their mothers; makes it difficult for women to obtain legal abortions; interferes with the legitimate work of detecting genetic defects (Kishwar, 1993; Eklund and Purewal, 2017; Das Gupta, 2017, Bashar et al., 2018). The authorities still need to address these issues urgently. Indeed, there is a general consensus that real change in the long run can come only with targeted education of the population and improving the status and the social value of girls and women but that is an extremely slow process, while time is of the essence. It is, therefore, essential to enforce the laws to put a stop to any further deterioration of the sex ratio at the same time as implementing programmes meant to change the mind-set of the population.

In spite of the setbacks, the BBBP scheme which addresses both these issues is the best hope. However, as for previous schemes, adhering to the guidelines and enforcing the laws remains the greatest challenge.

Excess mortality of girls needs to be given as much attention as prenatal sex selection. At present the BBBP scheme is, in spite of the drawbacks, the best hope provided there is full compliance with the guidelines (ACHR, 2017a). Those in authority need to remain as committed in the long term as all the activists and workers in health and social care are and have been.

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References

- ACHR. (2016). The State of the PCPNDT Act: India's losing battle against female foeticide. *Asian Centre for Human rights*. Retrieved from <http://www.achrweb.org/>
- ACHR. (2017a). Beti Bachao Beti Padhao: India is in a state of denial. *Asian Centre for Human rights*. <http://www.achrweb.org/>
- ACHR. (2017b): Universal Periodic Review: India Fails Female Foeticide Test. *Asian Centre for Human rights*. <http://www.achrweb.org/>
- ACHR. (2017c). Female foeticide and India's bride bazar: The case of Haryana. *Asian Centre for Human rights*. <http://www.achrweb.org/>
- Allyse, M., Minear, M.A., Berson, E., Sridhar, S., Rote, M., Hung, A., & Chandrasekharan, S. (2015). Non-invasive prenatal testing: a review of international implementation and challenges. *Int J Womens Health* 7, 113–126. Retrieved from <https://doi.org/10.2147/IJWH.S67124>
- Amaral, S., & Bhalotra, S., (2017) Population sex ratios and violence against women: The long-run effects of sex selection in India. Retrieved from <https://www.iser.essex.ac.uk/research/publications/working-papers/iser/2017-12.pdf>
- Aravamudan, G. (2007). *Disappearing Daughters: The Tragedy of Female Foeticide*. Penguin Books New Delhi, India.
- Balkan insight. (2017). Montenegro's Open Secret: Illegal Gender-Tests for Unborns. Retrieved from <http://www.balkaninsight.com/en/article/montenegro-s-open-secret-illegal-gender-tests-for-unborns-09-27-2017>
- Bandyopadhyay, S., & Singh, A. J. (2007). Sex selection through traditional drugs in rural north India. *Indian Journal of community medicine* 32, 32-34. doi: 10.4103/0970-0218.53390

Barua, R., Goel, P., & Sane, R. (2017). The Effect of Age-Specific Sex Ratios on Crime: Instrumental Variable Estimates from India. *National Institute of Public Finance and Policy New Delhi working paper 214*. Retrieved from <http://www.nipfp.org.in/publications/working-papers/1807/>

Bashar, M. A., Bhattacharya, S., & Singh, A. (2018). Unsafe abortions in India: removing the bottlenecks. *Int J Med Public Health* 8, 42-44. doi:10.5530/ijmedph.2018.1.9

BBBP. (2017). Beti Bachao Beti Padhao (Save the daughter educate the daughter) social campaign of the Government of India. Retrieved from www.wcd.nic.in/sites/default/files/BBBP_0.pdf

Bhattacharya, S., & Singh, A. (2016). Changing strategies of female foeticide in India: a never ending story. *Int J Community Med Public Health*. 3, 2672-2676. Retrieved from <http://www.ijcmph.com/index.php/ijcmph/article/view/273>

Bhattacharya, S., & Singh, A. (2017). 'The more we change, the more we remain the same': female feticide continues unabated in India. *BMJ Case Rep*. doi:10.1136/bcr-2017-220456

Bongaarts, J. (2013). The Implementation of Preferences for Male Offspring. *Popul Dev Rev* 39, 185–208. Retrieved from

<https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1728-4457.2013.00588.x>

Bongaarts, J., & Guilmo, C.Z. (2015). How Many More Missing Women? Excess Female Mortality and Prenatal Sex Selection 1970–2050. *Popul Dev Rev* 41, 241–269. Retrieved from <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1728-4457.2015.00046.x>

Census. (2014). Census 2011 final data of planning commission. *Databook Dec 2014* Retrieved from <http://Census 2011 final data Databook Dec 2014 307 pdf>

Census of India (2011). Gender Composition of the population. Retrieved from http://www.censusindia.gov.in/2011-prov-results/data_files/india/Final_PPT_2011_chapter5.pdf

Chapman, A.R., & Benn, P.A. (2013). Noninvasive prenatal testing for early sex identification: A few benefits and many concerns. *Perspect Biol Med* 56, 530–547. DOI: 10.1353/pbm.2013.0034

Das Gupta, M. (2017). Is banning sex-selection the best approach for reducing prenatal discrimination? *Working paper Maryland Population Research Center pwp-mprc-2017-003*. Retrieved from <https://www.popcenter.umd.edu/research/working-papers/papers/pwp-mprc-2017-003/view>

Davis, K. (2006). Brides, Bruises and the Border: The Trafficking of North Korean Women into China. *SAIS Rev Intl Affairs*, 26, 131-141. doi.org/10.1353/sais.2006.0004

Denyer, S. & Gowen, A. (2018). Too many men. *Washington Post* 18 April 2018. Retrieved from https://www.washingtonpost.com/graphics/2018/world/too-many-men/?utm_term=.33f18ccc4f24

Deshpande, J.D., Phalke, D.B., & Phalke, V.D. (2009). Prenatal sex determination: issues and concerns. *Pravara Med Rev* 1, 4–6. Retrieved from <http://www.pravara.com/pmr/pmr-1-1-2.pdf>

Dondorp, W., de Wert, G., Bombard, Y., Bianchi, D.W., Bergmann, C., Borry, P.,... et al. (2015). Non-invasive prenatal testing for aneuploidy and beyond: challenges of responsible innovation in prenatal screening. *Eur J Hum Genet* 23, 1438–1450. doi: 10.1038/ejhg.2015.57

Dreze, J., & Khera, R. (2000). Crime, gender, and society in India: Insights from homicide data. *Popul Dev Rev* 26, 335-352. Retrieved from <https://pdfs.semanticscholar.org/60c4/fcf94bf733f0c77296d4bd1e2e90fd9ca6e.pdf>

Economic survey 2017-18. (2018). Gender and Son Meta-Preference: Is Development Itself an Antidote? *Economic survey 2017-18, chapter 7*. Retrieved from <https://www.scribd.com/document/375811915/102-118-Chapter-07-ENGLISH-Vol-01-2017-18>

Edlund, L., Li, H., Yi, J., & Zhang, J. (2013). Sex ratios and crime: Evidence from China. *Rev Econ Stat* 95, 1520-1534. Retrieved from www.columbia.edu/~le93/EdlundLiYiZhang13.pdf

Eklund, L., & Purewal, N. (2017). The bio-politics of population control and sex-selective abortion in China and India. *Feminism & Psychology* 27, 34–55. DOI: 10.1177/0959353516682262

Express News Service. (2014). To check foeticide, BMC to act against path labs that facilitate blood tests. *Express news service*. Retrieved from <http://indianexpress.com/article/cities/mumbai/to-check-foeticide-bmc-to-act-against-path-labs-that-facilitate-blood-tests/>

Guijie, Q., Jianping, Y., Baosheng, H., Heng, L., Wanru, G., Chong, S., & Lirong, Y. (2016). Noninvasive prenatal testing in routine clinical practice for a high-risk population. *Medicine* 95, 41(e5126). Retrieved from <http://dx.doi.org/10.1097/MD.00000000000005126>

Guilmoto, C.Z. (2015). The Masculinization of Births, Overview and Current Knowledge. *Population 70 number 2 English edition, Translated by James Tove*. Retrieved from [DOI: 10.3917/popu.1502.0201](https://doi.org/10.3917/popu.1502.0201)

Guilmoto, C.Z., & Duthé, G. (2013). Masculinization of births in Eastern Europe. *Population and Societies* n° 506 n° ISSN 01847783. Retrieved from <https://www.ined.fr/en/publications/population-and-societies/>

Guilmoto, C.Z., Saikia N., Tamrakar V., & Bora J.K. (2018). Excess under-5 female mortality across India: a spatial analysis using 2011 census data. *Lancet Glob Health* 6: e650–58. Doi: [https://doi.org/10.1016/S2214-109X\(18\)30184-0](https://doi.org/10.1016/S2214-109X(18)30184-0)

Gupta, A. (2014). Reporting and incidence of violence against women in India. *Research Institute for Compassionate economics*. Retrieved from <http://riceinstitute.org/research/reporting-and-incidence-of-violence-against-women-in-india/>

Hesketh, T., Lu, L., & Xing, Z.W. (2011). The consequences of son preference and sex-selective abortion in China and other Asian countries. *CMAJ* 183:1374-7. DOI: <https://doi.org/10.1503/cmaj.101368>

History of Census of India.(n.d.). Drop-in-Article on Census - No.5. *Office of the Registrar General & Census Commissioner, India, Ministry of Home Affairs, Government of India*. Retrieved from http://censusindia.gov.in/Ad_Campaign/drop_in_articles.html

Jejeebhoy, S.J., Basu, S., Acharya, R., & Zavier, A.J.F. (2015). Gender-biased sex selection in India: a review of the situation and interventions to counter the practice. *Population Council, New Delhi, India*. Retrieved from https://assets.publishing.service.gov.uk/media/57a0897eed915d3cfd000284/61192_India_Lit_Review_Sex_Selection.pdf

Jha, P., Kesler, M.A., Kumar, R., Ram, F., Ram, U., Aleksandrowicz, L., Bassani, D. G., Chandra, S., & Banthia. J. K. (2011). Trends in selective abortions of girls in India: analysis of nationally representative birth histories from 1990 to 2005 and census data from 1991 to 2011. *Lancet* 377, 1921–1928. [doi.org/10.1016/S0140-6736\(11\)60649-1](https://doi.org/10.1016/S0140-6736(11)60649-1)

Kamenova, K., Ravitsky, V., McMullin, D., & Caulfield, T. (2016). 'Media portrayal of non-invasive prenatal testing: a missing ethical dimension'. *Journal of Science Communication* 15. Retrieved from https://icom.sissa.it/archive/15/02/JCOM_1502_2016_A03

Kaur, R. (2013). Mapping the Adverse Consequences of Sex Selection and Gender Imbalance in India and China. *Econ Polit Weekly* 48 (35), 37-44.

Kaur, R. (2016). Too many men and too few women: Social consequences of Gender imbalance in India and China. *Orient BlackSwan Private Limited*, New Delhi India.

Kaye, B., & Jittapong, K. (2014). In Thailand, baby gender selection loophole draws China, HK women to IVF clinics. *Reuters Health news*. Retrieved from <https://www.reuters.com/article/us-thailand-ivf-gender-selection/in-thailand-baby-gender-selection-loophole-draws-china-hk-women-to-ivf-clinics-idUSKBN0FK2H020140715>

Kishwar, M. (1993). Abortion of female fetuses: is legislation the answer? *Reprod Health Matters* 2, 113–115.

Lai-wan, C.C., Blyth, E., & Hoi-Yan, C.C. (2006). Attitudes to and practices regarding sex selection in China. *Prenat Diagn* 26, 610–613. Doi:10.1002/pd.1477

Littlejohn, R. (2016). Two-Child Policy Abuses: WRWF Files Complaint Against China at the United Nations. *Womens rights without frontiers Retrieved from <http://www.womensrightswithoutfrontiers.org/blog/two-child-policy-abuses-wrwf-files-complaint-against-china-at-the-united-nations/>*

Madan, K., & Breuning, M.H. (2014). Impact of prenatal technologies on the sex ratio in India: an overview. *Genet Med* 16, 425–432. Doi:10.1038/gim.2013.172

Mallapur, C. (2015). Crimes against women reported every two minutes in India. *Scroll In* 5 Sept 2015. Retrieved from <https://scroll.in/article/753496/crimes-against-women-reported-every-two-minutes-in-india>

Mangoli, R.N., & Devarmani, N. G. (2014). A Critical Evaluation of Violence against Women in India *International Journal of Criminology and Sociological Theory* 7, 1-10. Retrieved from <https://ijcst.journals.yorku.ca/index.php/ijcst/article/download/39714/35962>

Market watch. (2015). Global Non-Invasive Prenatal Testing (NIPT) Market is Expected to Grow at 17.6% CAGR During 2015 – 2020. *Market Watch. Retrieved from <https://www.marketwatch.com/story/global-non-invasive-prenatal-testing-nipt-market-is-expected-to-grow-at-176-cagr-during-2015---2020-2015-11-19-82033153>*

Minear, M.A., Alessi, S., Allyse, M., Michie, M., & Chandrasekharan, S. (2015). Noninvasive Prenatal Genetic Testing: Current and Emerging Ethical, Legal, and Social Issues. *Annu. Rev. Genomics Hum Genet* 16, 369–98. doi:10.1146/annurev-genom-090314-050000

Modi, N. (2014). Narendra Modi's first Independence Day speech: Full text. *India Today* 15 August 2014. Retrieved from <http://indiatoday.intoday.in/story/narendra-modi-independence-day-speech-full-text-red-fort/1/377299.html>

Nandi, A., & Deolalikar, A.B. (2013). Does a legal ban on sex-selective abortions improve child sex ratios? Evidence from a policy change in India. *J Dev Economics* 103, 216–228. DOI: 10.1016/j.jdeveco.2013.02.007

Neogi, S. B., Negandhi, P.H., Ganguli, A., Chopra, S., Sandhu, N., Gupta, R. K., Zodpey, S., Singh, A., Singh, A., & Gupta, R. (2015). Consumption of indigenous medicines by pregnant women in North India for selecting sex of the foetus: what can it lead to? *BMC Pregnancy and Childbirth* 15, 208. doi: [10.1186/s12884-015-0647-4](https://doi.org/10.1186/s12884-015-0647-4)

Neogi, S. B., Negandhi, P., Chopra, S., Das, A. M., Zodpey, S., Gupta, R. K., & Gupta, R. (2016). Risk Factors for Stillbirth: Findings from a Population-Based Case–Control Study, Haryana, India. *Paediatric and Perinatal Epidemiology*, 30, 56–66. doi: 10.1111/ppe.12246

Neogi, S. B., Zodpey, S., Negandhi, P., & Gupta, R. (2017). Use of Sex Selection Techniques for Social Reasons: A Menace. *Indian Pediatr* 54: 99-101. Retrieved from <http://www.indianpediatrics.net/feb2017/feb-99-101.htm>

NITI Aayog. (2018). Sex Ratio. *National Institution for Transforming India, Government of India*. Retrieved from <http://niti.gov.in/content/sex-ratio-females-1000-males#>

Osipenko, L., & Szczepura, A. (2011). Non-invasive fetal sexing: medical test or a new tool for sex selection? *Diversity in Health and Care* 8, 37–44. Retrieved from <http://diversityhealthcare.imedpub.com/noninvasive-fetal-sexing-medical-test-or-a-new-tool-for-sex-selection.php?aid=1911>

Parihar, A., Devi, N., Kaur, A., & Sharma, S. (2015). Crime against women in Haryana: An analysis. *Int J Humanities and Social Science Invention* 4 (11), 16-24. Retrieved from <http://www.ijhssi.org>

Pinghui, Z. (2014). Zhejiang man arrested for arranging sex tests in Hong Kong for pregnant mainland women. *South China Morning Post April 18, 2014*. <http://www.scmp.com/news/china/article/1486420/zhejiang-man-arrested-arranging-sex-tests-hong-kong-pregnant-mainland>

Puddy, R. (2015). Non-invasive prenatal testing 'being used for gender selection'. *The Australian*. Retrieved from <https://www.theaustralian.com.au/news/health-science/noninvasive-prenatal-testing-being-used-for-gender-selection/news-story/6a45756a3d5f235d700e2370537abb4d>

Raaj, N. (2006). Home sex-test kits sold over the Net. *Times of India*. Retrieved from <https://timesofindia.indiatimes.com/india/Home-sex-test-kits-sold-over-the-Net/articleshow/1889094.cms>

RGIC policy watch. (2017). Implementation Failures: 'Beti Bachao Beti Padhao'. *RGIC policy watch* 5 (39). Retrieved from [http://www.rgics.com/wp-content/uploads/policy-watch/PW_5.39%20\(May%202017\).pdf](http://www.rgics.com/wp-content/uploads/policy-watch/PW_5.39%20(May%202017).pdf)

Scroll Staff. (2017). SC tells Centre's agency to meet internet giants, remove online ads on sex determination. *Scroll In 13 Dec 2017*. Retrieved from <https://scroll.in/latest/861341/sc-tells-centres-agency-to-meet-internet-giants-remove-online-ads-on-sex-determination>

Statistical report. (2016). Trend of birth rate 2016. *Office of the Registrar General & Census Commissioner, India Ministry of Home Affairs, Government of India*. Retrieved from http://www.censusindia.gov.in/vital_statistics/SRS_Reports_2016.html

Stöckl, H., Kiss, L., Koehler, J., Dong, D.T., Zimmerman, C. (2017). Trafficking of Vietnamese women and girls for marriage in China. *Global Health Research and Policy* 2, 28. DOI 10.1186/s41256-017-0049-4

Straus, R.R. (2010). To ensure prized baby boy, Indians flock to Bangkok. *Times of India* 27 Dec 2010. Retrieved from <https://timesofindia.indiatimes.com/india/To-ensure-prized-baby-boy-Indians-flock-to-Bangkok/articleshow/7169495.cms>

UNDOC. (2013). India assessment on Human trafficking. *United Nations Office on Drugs and Crime report 2013*. Retrieved from https://www.unodc.org/southasia/frontpage/2013/July/india_country-assessment-highlights-status-of-victim-assistance-and-criminal-justice-initiatives-on-anti-human-trafficking.html

UNFPA. (2012). Sex Imbalances at Birth: Current trends, consequences and policy implications. *United Nations Population Fund 2012. UNFPA Asia and Pacific Regional Office, Bangkok*. Retrieved from <http://www.unfpa.org/publications/sex-imbalances-birth>

UNFPA. (2014). UNFPA guidance note on prenatal sex selection. *United Nations Population Fund 2014*. Retrieved from https://www.unfpa.org/sites/default/files/resource-pdf/guidenote_prenatal_sexselection.pdf

UNFPA. (2015). Preventing Gender biased sex selection in Eastern Europe and Central Asia. *United Nations Population Fund brief 4*. Retrieved from https://www.unfpa.org/sites/default/files/resource-pdf/GBSS%20Brief_WEB.pdf

Unicef. (2016). Child marriage. *Unicef India*. Retrieved from <http://unicef.in/Whatwedo/30/Child-Marriage>

Verma, A., Qureshi, H., & Kim, J. Y. (2017). Exploring the trend of violence against women in India. *International Journal of Comparative and Applied Criminal Justice* 41, 3-18. <https://doi.org/10.1080/01924036.2016.1211021>

Verma, I.C. (2014). Noninvasive Prenatal Testing: The Indian Perspective. *Journal of Fetal Medicine* 1, 113–118. Retrieved from <https://link.springer.com/article/10.1007/s40556-014-0025-8>.

Verma, J.S., Seth, L., & Subramaniam, G. (2013). Report of the committee on Amendments to Criminal law January, 23 2013. *Government report*. Retrieved via Google: Justice Verma committee Report-PRS.

Vidushy, V. (2016). Crime against women in Punjab: An analysis. *Int J App Res* 2016; 2(5), 445-447. Retrieved via Google: ISSN Print: 2394-7500.

WHO. (2011). Preventing gender-biased sex selection: An interagency statement OHCHR, UNFPA, UNICEF, UN Women and WHO. *Geneva: World Health Organization*. Retrieved from whqlibdoc.who.int/publications/2011/9789241501460_eng.pdf

World fact book. (2018). People and society: India. *The World Fact Book*, Central Intelligence Agency. Retrieved from <https://www.cia.gov/library/publications/the-world-factbook/geos/in.html>

W.E.F. (2017). India slips 21 slots on WEF Gender Gap index 2017. *World Economic Forum: The global gender gap report 2017*. Retrieved from <http://www.thehindu.com/news/national/india-slips-21-slots-occupy-108th-rank-on-wef-gender-gap-index-2017/article19966894.ece>

Zhou, X., & Hesketh, T. (2017). High sex ratios in rural China: declining well-being with age in never-married men. *Philosophical Transactions of the Royal Society B Biological Sciences*. Retrieved from <http://rstb.royalsocietypublishing.org/content/372/1729/20160324>