

TO WHAT EXTENT IS THE NATIONAL PRE-CONCEPTION AND PRE-NATAL DIAGNOSTICS TECHNIQUES ACT OF 1994 EFFECTIVE?

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ABSTRACT

To What Extent Is The National Pre-Conception and Pre-Natal Diagnostics Techniques Act of 1994 Effective?

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India currently observes an alarmingly low child sex ratio regarding females. The 2011 Indian National Census found that the child sex ratio had reached an all-time low of 914 girls to 1000 boys. The low child sex ratio in India can be attributed to practices of sex selective abortions against female babies. The Indian government acted against this practice in 1994 with The National Pre-Conception and Pre-Natal Diagnostics Techniques (PNDT) Act that was implemented in 1996. The goal of this paper is to examine the effectiveness of The National Pre-Conception and Pre-Natal Diagnostics Techniques (PNDT) Act now that almost three decades have passed since its implementation. Data from the decade of implementation of the act to current times in 2021 will be used in order to create a longitudinal study that examines trends regarding the overall population, child sex-ratios, and overall sex-ratios. Linear modeling will be used to predict future trends for the child sex ratio as this data has been limited due to COVID-19. Information in this thesis will primarily be found from the past three official Indian census as well as multiple National Family Health Surveys. This paper concluded that the PNDT Act has

been ineffective in raising the child sex ratio as the child sex ratio has continuously remained worse than prior to the passage of the PNDT Act and is predicted to stay this way in future years.

DEDICATION

To my friends, family, instructors, and peers who supported me throughout the research process.

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INTRODUCTION

Introduction

Male children have repeatedly been the preferred sex of newborn babies in South Asian countries. India, as a result, has seen a greater population of males than females. This difference becomes larger as age decreases as India has historically had one of the lowest child sex ratios in the world. Despite the quality of life and the status of women increasing (Sehkar and Hatti 2010), this ratio is still dropping (Radhakrishnan 2021). The 2011 Indian National Census found that the child sex ratio had reached an all-time low of 914 girls to 1000 boys compared to 940 to 1000 only a decade earlier (Radhakrishnan 2021). Although The National Family Health Survey completed in 2021 found the ratio increased to 929 girls to 1000 boys (NFHS 2021), this number still demands attention.

The low child sex ratio in India can be attributed to practices of female child infanticide, female child abandonment, and sex selective abortions against female babies. The term “missing girls” was coined to describe the girls that would have been part of the population if it were not for these practices. It is estimated that over 63 million girls are missing from India’s population (2018). India’s patriarchal mindset has created a society where women are seen as inferior and as a family burden.

There are many reasons as to why it is frowned upon to birth a female baby but a few of the most common revolve around cost, culture, and power. Primarily, it is customary in India for a female’s family to pay her future husband for marriage to occur. Despite a ban on this payment in 1961, the practice remains, and the value of dowries is constantly growing (BBC 2011). Many families save their entire life to afford this payment and still often come up short. Furthermore,

females often do not enter the workforce and therefore bring in no income or support to the family, especially when the parents reach old age. It is customary in Indian culture for sons to become the caregivers of their parents, another reason for their strong preference within the country. Lastly, females are incapable of continuing their family name. The son will carry forward the lineage, but the daughter will get married and go off to another family (BBC 2011). According to Finke, there is a saying in India, “bringing up a daughter is like watering a plant in another’s courtyard” (Finke 2018).

Even if a young girl were to be born, she can still face neglect. Many female babies do not receive the same advantages that their male counterparts do especially regarding health care. This includes immunizations, access to general health care, as well as access to education. Neglect of these sorts is more common in lower income families (Radhakrishnan 2021). Radhakrishnan shares the story of a man who denies care for his young daughter diagnosed with Hodgkin Lymphoma. He believed that her condition meant she had no hopes of marrying and would remain as weight the family had to carry. Neglect of this kind can result in death within the first few years of life and further contribute to the low child sex ratio. The distress of having a female baby has reached farther depths than can be imagined.

India’s patriarchal mindset is detrimental to not only women’s rights but the country as a whole. Currently, the gender ratio for all ages is 1020 females to 1000 males (NFHS 2021). However, if things do not change for young women, this will not always be the case. A larger male population will further deepen these forbearing societal practices. "It will mean a stronger masculine and macho culture," says Den Boer, co-author and lecturer in International Politics at the University of Kent (Prasad and Ramesh 2007). There is also predicted to be an increase in bride trafficking as there will not be enough women to marry the overpopulation of males

(Prasad and Ramesh 2007). According to Nandi and Deolalikar, two states in India, Haryana and Punjab, are already experiencing bride trafficking. India will continue to face the consequences of these issues if adequate measures are not taken to correct the gender gap they are facing.

The National Pre-Conception and Pre-Natal Diagnostics Techniques Act of 1994

Many Indian families maintain the belief that having a daughter would be a detriment to their household. As a result, women often find ways to avoid this fate. One method is with sex selective abortions. According to the Guttmacher Institute, the definition of sex selective abortions is: “abortions performed because of the predicted sex of the fetus” (Guttmacher Institute 2020). Sex selective abortions have become more popular over the last half century due to increases in fetal technology. The invention of ultrasound technology has allowed for families to learn the sex of their child as early as twelve weeks with 90% accuracy (Santiago-Munoz 2016). Other modern medical technologies include amniocentesis, chorionic villi biopsy, and fetoscopy that have been created to assess the condition of the embryo or of the fetus, for female feticide and antenatal gender discrimination (Abrejo et. al 2009).

Although it is difficult to determine the exact reason a family may seek an abortion, there is strong evidence to infer that sex selective abortions are taking place, especially within India (Arnold 2004). According to the United Nations Population Fund, when many more boys are born than girls, it is a sign that sex selection is taking place (UNPF 2020). They also state that gender-biased sex selection can be measured using sex ratio at birth (UNPF 2020). Evidentially, this type of abortion can be assumed as one of the main forms of sex selection that contribute to the low child sex ratio in India.

India has acknowledged and attempted to combat this issue by creating a national ban against sex selective abortions. This ban is now known as The National Pre-Conception and Pre-

Natal Diagnostics Techniques (PNDT) Act of 1994, and it was originally implemented in 1996. This act was created to “prevent misuse of preconception and prenatal diagnostic techniques for determining the sex of the foetus and to prevent disclosure of the sex to the pregnant woman or her relatives” (Reproductive Rights 2020). It was amended in 2003 to explicitly deter the use of ultrasound scans to make a sex determination before birth (Bhaktwani 2012). The act explicitly states in chapter three “No person conducting pre-natal diagnostic procedures shall communicate to the pregnant woman concerned or her relatives the sex of the foetus by words, signs or in any other manner.” (Rao 1996).

This act includes strict limitation on when and why pre-natal diagnostic testing can be performed as well as limitations on who can perform these tests. Punishments for offenses of this act include imprisonment, fines, loss of medical statuses, etc. Punishments for medical personnel are included in chapter seven and can include “imprisonment for a term which may extend to three years and with fine which may extend to ten thousand rupees and on any subsequent conviction, with imprisonment which may extend to five years and with fine which may extend to fifty thousand rupees.” (Rao 1996). Similar punishments can also be placed on the families that are seeking these tests.

However, according to the Guttmacher Institute, evidence from the global context indicates that sex-selective abortion bans do not work to prevent sex selection, because these bans do nothing to challenge the phenomenon of son preference, or its underlying causes and they are difficult to enforce. (Guttmacher Institute 2020). As a result, the effectiveness of the PNDT Act can be called into question. Although this act has a central supervisory board as well as other special regulation boards to monitor and enforce this act, recent reports on the Indian child sex ratio suggest that this act may not be fulfilling its goals. Many families can bribe

medical personnel to provide them with this information which has created a phenomenon of child sex ratios being lower in urban areas. Urban settings, higher education of mothers, and economic prosperity can increase the incidence of sex-selective abortion (Das Gupta 1987; George 2006). It has been approximated that the business of sex-selective abortion is worth approximately \$100 million (George 2006). Furthermore, there is low judicial inertia in processing crimes. 400 cases have been registered since 1994 yet only a handful of convictions have occurred (Nagpal 2013). In addition, the criminalization of the practice has aided the increase of private clinics throughout the country. Private clinics allow for sex-selective abortions to be cheap and accessible, often in unsafe conditions (Ganatra 2008; Kishwar 1995; Sarkaria 2009).

Research

“The 2020 State of World Population Report indicates that more than 140 million females are considered missing today as a consequence not only of gender-biased sex selection but also of postnatal sex selection.” (UNPF 2020). This quote from the United Nations Population Fund Website demands attention and emphasizes that this issue cannot be overlooked. Women face discrimination solely based on their gender often before they even took their first breath. According to Sabu George, “the foetal stage has become the riskiest time in an Indian woman’s life, as one in seven girls are eliminated before birth because of their sex” (George 2006). Women’s rights have made substantial strides over the past century in many countries, but this progress is meaningless if many women are not born to experience it.

This paper was written in order to bring light to these events and determine if sex-selective abortion bans are aiding in the termination of gender-biased sex selection. The National Pre-Conception and Pre-Natal Diagnostics Techniques (PNDDT) Act of 1994 was specifically

chosen to investigate considering India sees some of the worst gender-biased sex selection in the world. The history of female infanticides can also be traced back to a survey in India in 1871 when it was noted that there was a very revealing abnormal sex ratio of 940 women to 1000 men (Lemoine and Tanagho 2007). Due to this, it is evident that India is a perfect candidate to examine for this thesis.

The goal of this paper is to examine the effectiveness of The National Pre-Conception and Pre-Natal Diagnostics Techniques (PNDT) Act of 1994. The most recent National Family Health Survey that was completed in 2021 will be used to determine if progress has been made since the 2011 national census. As stated previously, this census observed one of the lowest child sex ratios that India has seen. This paper will be one of the first to investigate this progress following the most recent publication of updated child sex ratios in the country. Information from this investigation will not only be applicable to India but all countries around the world that face issues regarding gender-biased sex selection. If this ban yields positive results, other countries that face similar issues can implement similar policies. On the other hand, if the ban does not yield positive results, India as well as other countries can find alternative methods to reducing gender biased sex-selection.

Statistical analysis will be used within this paper to analyze trends between variables such as the overall population, child sex-ratios, and overall sex-ratios. R Studio will be the main statistical software used and will create all the tables and figures seen in the data section. Data from the year of implementation of the act in 1996 to current times in 2021 will be used in order to create a longitudinal analysis. This information will primarily be found from the past three official Indian census as well as multiple National Family Health Surveys. Furthermore, this

paper will focus on both rural and urban areas as urban areas are increasing in sex-selective practices considering their access to doctors and ability to pay for diagnostic testing.

This thesis was anticipated to be one of the first papers written that included the 2021 Indian national census data. However, due to the COVID-19 outbreak, this data has not yet been released to the public and may not be published until 2024. This lack of information created significant drawbacks for this research considering that it would be the most up to date data on the child sex ratio in India. Although there are recent National Family Health Surveys that have been completed, this data is collected from a sample of the population and may not represent all of India. As a result, this thesis will be updated once the new census data has been released. Until then, the data from the National Family Health Surveys will be used to analyze the current state of the child sex ratio in India as well as make predictions for what the 2021 census data will be.

This thesis anticipates that The National Pre-Conception and Pre-Natal Diagnostics Techniques (PNDT) Act of 1994 has not been effective in preventing gender biased sex-selection. The record low child-sex ratio of 2011 causes worry about the overall effectiveness of the act. However, it is hard to predict the act's effectiveness in preventing gender biased sex-selection from worsening. There is a possibility that without the act, the situation for young females in India could be much worse. This thesis also anticipates that urban areas which obtain more wealth will consistently have a lower child sex ratio than rural areas. This hypothesis is important to prove as certain enforcement issues may need to be addressed. India is a large country with an extremely large population and there might not be a "one act fits all". If urban areas are finding the means to escape following the act, this needs to be identified and addressed. Finally, this thesis anticipates that the statistical predictions created from previous data will predict a decrease in the child sex ratio since the 2011 census.

1. LITERATURE REVIEW

The effectiveness of the National Pre-Conception and Pre-Natal Diagnostics Techniques (PNDT) Act of 1994 has been studied before by many authors. The alarming child-sex ratio in India has created an increase in scholars and humanitarians that want to investigate the gender discrimination and sex-selection that is occurring. This section will analyze three published articles from the past decade that also study the effectiveness of the PNDT Act and the implications of sex-selective practices. These articles have greatly inspired this paper and created frameworks that will allow the effectiveness of the ban to continue to be analyzed over time.

1.1 Does a Legal Ban on Sex-Selective Abortions Improve Child Sex Ratios? Evidence from a Policy Change in India

Arindam Nandi and Anil B. Deolalikar investigate The National Pre-Conception and Pre-Natal Diagnostics Techniques (PNDT) Act of 1994 in their article “Does a legal ban on sex-selective abortions improve child sex ratios? Evidence from a policy change in India”. Nandi and Deolalikar used a political framework to investigate the 1991 and 2001 censuses for improvements in gender ratios among children. They state that this issue is “a matter of grave policy concern, not only because it violates the human rights of unborn and infant girls but also because it deprives the country of the potential economic and social contribution of these ‘missing women’.” (Nandi and Deolalikar 2013).

Nandi and Deolalikar used both village and town level data from the national censuses. This allowed them to create a longitudinal study in which they used a treatment-effect analysis framework to analyze the data. They focused on two main variables: sex ratio at birth and gender-specific mortality rates among children ever born. The second variable is important

because unwanted girls that are not aborted are often deprived of certain necessities and can increase the infant/child mortality. The authors also considered variables such as time, availability of private doctors, infrastructural variables, and public health facility availability.

In their conclusion, Nandi and Deolalikar state that a possible absence of the law would have led to at least 106,000 fewer female children. This suggests that there is a positive impact from the implementation of the ban. However, they include in their research that an estimated 450,000 to 540,000 sex-selective abortions are taking place in India every year. As a result, the PNMT Act has only made a small dent in solving the problem. The authors also believe that this ban has not created any additional harm to young girls and has the possibility to continue to eliminate sex-selective practices. However, the authors acknowledge the 2011 census in their introduction and admit that the child sex ratio from that year has created backwards progress in this area. Lastly, the authors believe that the act has been more effective in rural areas than urban areas. They state that this is likely due to these areas being socioeconomically disadvantaged and not having access to the same medical resources and loopholes that wealthy families in modern areas have.

1.2 Disappearing Daughters and Intensification of Gender Bias: Evidence from Two Village Studies in South India

T.V. Sekher and Neelambar Hatti use a case study approach to examine the sex-selection process within South India. Their 2010 journal article titled “Disappearing Daughters and Intensification of Gender Bias: Evidence from Two Village Studies in South India” investigate the low-fertility regions of Karnataka and Tamil Nadu. The purpose of this paper is to identify why discrimination towards girls is increasing despite improvement in the status of women. The authors also investigate reasons that fertility is decreasing among certain areas in the nation.

Sekher and Hatti point out a regional trend that northern states are seeing a decreasing trend in the child sex ratio. They believe this is largely due to cultural differences as well as a push toward smaller family sizes. According to the paper, “a substantial decline in fertility presupposes a desire for fewer children as well as access to the means to limit the family size” (Sekhar and Hatti 2010). The authors argue that there has been an increase in son preference although fertility is declining. Contrary to the previous article by Nandi and Deolalikar, this paper believes that the increase in son preference is nation-wide and affects rural and urban areas equally. Due to these factors, a cycle of masculinity is being created. More males are being born and thus roots for a male-based society grow deeper. Sekher and Hatti believe that The National Pre-Conception and Pre-Natal Diagnostics Techniques (PNDT) Act of 1994 has been a failure in reducing sex-selective practices and that only social changes can solve the recurring issue.

When investigating the regions of Karnataka and Tamil Nadu, the authors identify a few main reasons as to why discrimination is increasing. The largest reason identified in the paper is the dowry that families pay for their daughter to marry. This creates a large financial burden for the families especially those living in small villages such as the ones in these regions. Paying a dowry originally was only done by families higher in the caste system but is now trickling down into lower castes. The included a quote from an interview with a villager: “Earlier in this village, scheduled castes never used to give dowry. After seeing Gowdas, they also started. Some people believe that paying more dowry is a prestige issue for the family. They sell their land or borrow money to give dowry.” (Sekhar and Hatti 2010). The remainder of the paper investigates land ownership rights of women as well as educational rights. The authors found that these factors also increase discrimination levels toward women.

The authors conclude that reproductive technologies are allowing for families to decrease their family size while also ensuring that they receive an ideal gender composition for their family to avoid the associated burdens that are believed to be tied to women. They state that the cost of access to this technology, despite the limitations from the PNDT Act, is justified in comparison to the high price of the female dowry and education. This indicates that policy changes are not going to affect these practices and that the status of women, especially in rural areas, needs to increase for any change to be made.

1.3 Sex-selective Abortion in India: Exploring Institutional Dynamics and Responses

The final article is written by Sugandha Nagpal in 2013. Nagpal believes that are explanations to the practice of sex-selective abortions that go beyond the high price of dowry and low social value of women. Her paper focuses on institutional structures, specifically, state population control policies and the unchecked utilization of reproductive technologies. She emphasizes the importance of addressing this issue as he claims that this issue is spreading. The article states: “since 1996 there has been emerging evidence of sex-selection among Asian immigrants in Canada, UK and USA” (Nagpal 2013).

Like the previous article, Nagpal identifies a trend in northern Indian states have a higher rate of sex-selective practices which is concerning since women typically have a higher status in these states. However, the author identifies that once institutional structure that may be causing this is the difference between exogamous and endogamous marriages. The exogamous marriage structure is where couples are unrelated, and a dowry is common. The endogamous structure is where couples are often cousins, and a dowry is not always necessary. This is because the couple typically stays close to the family home and the families can support each other after the marriage. South Indian women typically subscribe to the endogamous structure and as a result,

receive more autonomy. According to the paper, “they have typically experienced greater freedom to choose their marriage partner, ability to assert some right over property, perceived economic value due to female labor participation, and social value due to the ability to contribute to the natal household post-marriage” (Nagpal 2013). However, endogamous marriages are also decreasing in South India and therefore the overall child-sex ratio is continuing to decline.

The National Pre-Conception and Pre-Natal Diagnostics Techniques (PNDT) Act of 1994 is also mentioned throughout this paper. Nagpal states agrees with the previous article that the act has not been effective in reducing sex-selective abortions in the short term. She also takes a feminist standpoint and brings attention to the fact that the PNDT Act infringes on women’s rights to make appropriate decisions regarding reproduction. However, she claims that “the presence of a law around sex-selection is necessary to initiate sensitive institutional and policy-based responses to sex-selection in the long term” (Nagpal 2013).

In Nagpal’s conclusion, she emphasizes that policies focused on changing social relations should be a future direction for India. She states, “it is important to initiate policies that create equal opportunities in education, employment and inheritance for women” (Nagpal 2013). South Korea has implemented policies that target these areas and that this may be a source of inspiration for India’s policymakers. Lastly, she emphasizes the importance of education and awareness towards the negative effects of sex-selective abortions. Community based initiatives are another solution she mentions that could help to restructure societal norms.

1.4 Conclusion

All three articles, address and examine the National Pre-Conception and Pre-Natal Diagnostics Techniques (PNDT) Act of 1994 in some form. The three articles claim there is some level of failure in reducing sex-selective abortions, but two articles maintain that there are

benefits resulting from the act. The range of opinions on the act suggest that more data and analysis is needed to determine the extent of success that the act is has. The difference in variables among each article also suggests that there are a wide variety of reasons that sex-selection is occurring. As a result, it would imply that the PNDDT Act is not addressing all variables and more solutions need to be researched. These inconsistencies lead to the importance of this thesis as well as the importance of more research being done on this topic. These papers have also set up multiple ways in which the issue of sex-selective abortions can be viewed. This allows for future researchers to build off this research and analyze their variables over time.

2. DATA

2.1 Data Collection

Data for this thesis has been collected from the official Indian censuses as well as National Family Health Surveys conducted throughout the nation. All data in this thesis comes from official reports and maintains a high level of validity. The bulk of the data used in this thesis is from after the implementation of the National Pre-Conception and Pre-Natal Diagnostics Techniques (PNDT) Act which occurred in 1996. However, data from prior to this year is sometimes referenced to establish overarching trends.

2.2 Census Data

For this thesis, data has been collected from the 2001 and 2011 national censuses. As stated in the introduction, due to COVID-19, data from the 2021 census has not been published. This data would have been beneficial in contributing to the longitudinal aspect of the data as it would have given an idea of how the child sex-ratio has changed over the last 10 years. Although there is other data available that can provide this information, census data is ideal as it examines the entire country and comes from an official source. Once this data is released, more analysis can be completed and more solutions to the problem can be created. Until then, predication models can be created to attempt at predicting what the census results would be. Also, this paper is still contributing to the research on this topic as it is one of the only papers that includes data from the 2011 census.

2.3 National Family Health Survey Data

In addition to census data, data from multiple National Family Health surveys is also included and evaluated. Surveys from 2005, 2015, and 2019 is included in this paper. Although

this data comes from official sources, it is created by using sample sizes in the population and is not as ideal as census data. Also, there were two National Family Health Surveys completed before 2005 but this data is not available to the public, However, this data is more recent than the census data as there is a National Family Health Survey from 2019-2021 that was able to be published before the outbreak of COVID-19. The inclusion of this data can attempt to make up for the missing 2021 census data until it is published.

2.4 Overall Sex Ratio

To start off, the overall sex ratio of India can be evaluated to see what trends are occurring. The overall sex ratio accounts for the entire population of India including all age groups. Figure 2.1 shows the progression of the overall sex ratio starting from 1901 to 2011. The data in this figure is created using solely census data.

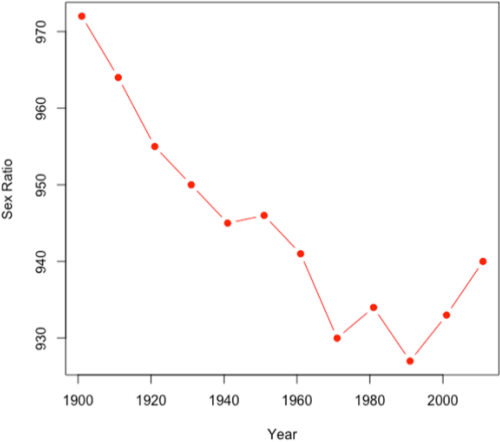


Figure 2.1: Overall Sex Ratio in India Over Time - Census

This trend is important to analyze because the child-sex ratio can impact the overall sex ratio in the long run. If less females are being born each year, India will start to see a more male

dominated country. However, based on this data it appears that the overall sex ratio is improving, especially since the implementation of the PNDT Act in 1996.

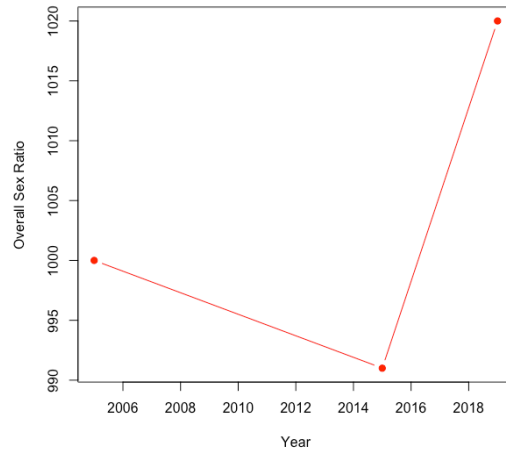


Figure 2.2: Overall Sex Ratio in India Over Time – National Family Health Survey

Figure 2.2 examines the same variable, but it uses data from the National Family Health Survey. This data shows that the overall sex ratio decreased slightly in 2015. However, it ultimately shows that the overall sex ratio is the highest it has ever been in India’s history at 1020 females per 1000 males. However, it is possible that this data is slightly high especially considering that it found the overall sex ratio to be 1000 females per 1000 males in 2005 yet the census data in 2001 and 2011 did not even come close to this.

When data from both sources are combined, a linear regression model can be created to predict how the overall sex ratio will change. A simple linear regression between the year and overall sex ratio predicts that the 2021 overall sex ratio will be about 965. This is a large drop from what the National Family Health Survey data was reporting but it would still be a significant increase from 940 females to 1000 males as reported in the 2011 census.

2.5 Child Sex-Ratio

Next, the child sex ratio from both data sources is crucial to examine as it relates heavily to the thesis. The national census did not start reporting this data until 1951. Figure 2.3 gives a visual trend of the child sex ratio since 1951. The data in this figure is solely from national census data.

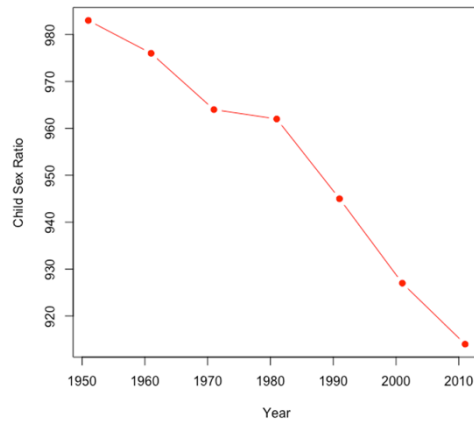


Figure 2.3: Child Sex Ratio in India Over Time

Figure 2.3 shows that the child sex ratio in India has only been decreasing over time with the most recent census data in 2011 being the worst to date. This sharp decline in the child sex ratio over the last half century is evidently an imminent threat to the gender breakdown of the

country. Table 2.1 shows the reported child sex ratio from the national census as well as from the National Family Health Surveys.

	Child Sex Ratio
2001 National Census	927
2011 National Census	914
2005-2006 NFHS	918
2015-2016 NFHS	919
2019-2021 NFHS	929

Table 2.2: Child Sex Ratio in India Over Time from Multiple Sources

Table 2.1 shows that the child sex ratio has begun to slightly increase after 2011. Figure 2.4 provides a visual of the changing child sex ratio.

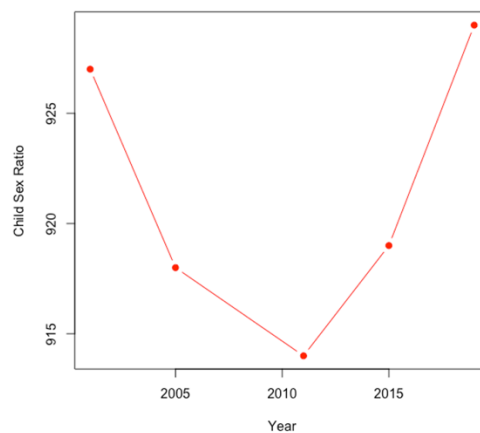


Figure 2.4: Child Sex Ratio in India Over Time from Multiple Sources

It may appear that the child sex ratio is beginning to improve, it should be noted that the child sex ratio is still significantly lower than it was in 1991, prior to the passing of the PNDDT Act. Table 2.2 shows the change in child sex ratio since the 1991 census and demonstrates that

there is still a negative change. However, the most recent child sex ratio as reported by the National Family Health Survey is the lowest that it has been since the 1991 census.

	Child Sex Ratio	Change since 1991 Census
1991 National Census	945	0
2001 National Census	927	-18
2011 National Census	914	-31
2005-2006 NFHS	918	-27
2015-2016 NFHS	919	-26
2019-2021 NFHS	929	-16

Table 2.2: Change in Child Sex Ratio in India since 1991

Although the results of the 2022 national census have not been released to the public, linear regression models can be used to calculate the predicted child sex ratio in 2022. Using all previously reported child sex ratios from national census and National Family Health Surveys, linear modeling predicts that the child sex ratio in 2022 would be 911. The linear modeling code used to calculate this number can be found in Appendix A of this report. A child sex ratio of 911 would be a significant decline in improvement from the 2019-2021 National Family Health Survey as well as since the 1991 national census. It would be the lowest reported child sex ratio to date.

Linear modeling that only considers data from 1991 onwards finds that the predicted child sex ratio in 2022 would be 914. This is slightly higher than 911 but is still significantly lower than the child sex ratio of 929 reported in 2019. It would also be the same as the national census in 2011 that was considered the lowest child sex ratio seen by India thus far. These results will be discussed and analyzed in the next section of the report.

3. DISCUSSION

3.1 Overall Sex Ratio

When looking at the overall sex ratio of India, this number is steadily increasing each year. This means that the number of women per 1000 males is increasing. The most recent overall sex ratio as reported in the 2011 census was 940 females per 1000 males. The National Family Health Survey found that there were 1020 females per 1000 males in 2019. However, the National Family Health Survey is only a sample of the population and therefore this number may be slightly higher than the national overall sex ratio. Regardless, this high number is a positive sign for India's society. Having a large ratio of females to males can help to reduce the patriarchal society that India has created. Prabir Bhattacharya writes, "This increase in female life expectancy is tilting the sex ratio away from its male bias." (Bhattacharya 2014).

Although India has deep roots in being a patriarchal society, this is a step in the right direction towards increased women's rights and increased value in women. Also, this reduces some of the risks that are associated with having a low child sex ratio. It was previously mentioned that a low child sex ratio can create problems regarding bride trafficking and a more masculine culture. This high overall sex ratio that is currently being observed can soften these effects if not reduce them completely. However, this high sex ratio needs to be observed by all regions in India. According to Madan Mohan and the 2001 census, there is a wide range of sex ratio amongst Indian states with the lowest being 861 in Haryana to the highest being 1058 in Kerala. This can create problems for females depending on where they are born in the country. Mohan does admit that practically every state has seen improvement in their sex ratio and is hopeful that this will continue to increase over time.

3.2 Child Sex Ratio

The child sex ratio in India has seen little improvement since the passing of the National Pre-Conception and Pre-Natal Diagnostics Techniques (PNDT) Act of 1994. This act was implemented in 1996 meaning that 26 years have passed and allowed the act to be taken into effect. The national census in 2011 reports the lowest child sex ratio to date and this number represents the entire nation and is the most accurate number that has been published. The National Family Health Surveys have reported higher child sex ratios since the 2011 census but once again, these results come from a sample size of the total population and might not represent the nation. This is especially important to note considering that many nations especially urban areas, have lower child sex ratios than other areas. The 2011 national census reported that the urban child sex ratio was 902 while the rural child sex ratio was 919. However, this is another issue within itself.

It largely appears that the National Pre-Conception and Pre-Natal Diagnostics Techniques (PNDT) Act of 1994 has not been effective in increasing the child sex ratio. 28 years after the passing of legislation is a large amount of time, especially considering the act was fully implemented 26 years ago. If an act has not yielded positive results after almost three decades, either the legislation needs to be amended once more or a new route of action needs to be taken. Furthermore, the act did not need to make India have the highest child sex ratio in the world. It did not even need to yield major improvement. It simply should have been able to not make the child sex ratio worse than it was prior to the passing of the act. As the data section shows, the most recent reported child sex ratio from the National Family Health Survey is still 16 females younger than it was in 1991, prior to the passing and implementation of the act. This places India

as one of the last countries in the world in terms of child sex ratio despite their legislation to improve it.

Previous research has found that the National Pre-Conception and Pre-Natal Diagnostics Techniques (PNDT) Act of 1994 may have some effectiveness in reducing the problem at hand. Researchers such as Arindam Nandi and Anil B. Deolalikar found that the child sex ratio would be worse than it currently is without the implementation of the act. As stated in the literature review, they wrote “We find that a possible absence of the law would have led to at least 106,000 fewer female children.” (Nandi and Deolalikar 2013). This theory is a possibility and may very well be true. However, the 2011 census data was not taken into consideration when this research was conducted and so the law may not be as effective as the authors first calculated. Regardless, it is very likely that the act has helped many girls that would have otherwise been aborted. The number of girls helped just simply is not large enough to support the act having overall effectiveness.

3.3 Predicted Child Sex Ratio

As previously mentioned, India has not yet released their census data due to COVID-19. As a result, a recent child sex ratio that accounts for the entire nation has not yet been published. Despite this, linear modeling using all the previous child sex ratio data estimates that the child sex ratio of India will continue to decline and not improve. It should be noted that this calculation is very surface level and does not account for all the factors that would contribute to a change in the child sex ratio. This modeling solely relies on previous trend lines and does not account for major legislation or events that could possibly affect this trend line. However, the trend in the child sex ratio has only decreased, even since the passing of the act.

The prediction that the child sex ratio will not improve is supported by the World Health Organization. The Maternal, Newborn, Child and Adolescent Health and Ageing section of their website includes a data portal that has a map of the world and the child sex ratio in every country. This map shows child sex ratio predictions up until 2100. Their 2025 prediction is 1.10 male births for every 1 female birth. This is the equivalent of 909 female births for every 1000 male births. This trend continues steadily as their prediction for 2050 is 1.08 male births for every 1 female birth or 925 female births for every 1000 male births. This number is still lower than in 1991 when the ratio was 945 female births for every 1000 male births.

The linear modeling used in this paper as well as research conducted from outside sources such as the World Health Organization reinforces the conclusion that the PNMT Act has not been effective, in any capacity, in improving or at a minimum not reducing the child sex ratio in India.

CONCLUSION

Amartya Sen (1990) argued in his article ‘More than 100 Million Women are Missing’ that the problem of missing women is ‘clearly one of the more momentous, and neglected, problems facing the world today’. Since India has remained a large contributor to the missing women problem, their country must remain in the spotlight until this issue is resolved or reduced. The purpose of this paper was to do just that as well as determine if Indian legislation has had any impact on the issue. As previously stated, it was determined that the National Pre-Conception and Pre-Natal Diagnostics Techniques (PNDT) Act has not been effective in increasing the child sex ratio. This was determined as a result of the child sex ratio continuing to decline since the passing of the act as well as being predicted to decline in the future.

There may be many reasons as to why this act has been found to be ineffective, but I hypothesize that one of the main reasons is due to a lack of enforcement. As mentioned previously, urban areas have lower sex-ratios than rural areas. This may be a result of corruption, paying doctors under the table, etc. Furthermore, the vast size of India’s population makes it hard to create and enforce a “one size fits all” policy. It may be more ideal for each individual state to create their own policies based on their state’s needs. This idea comes from the fact that some states are far worse off and have already begun to see effects of having such low child sex ratios.

Regardless, a new approach to this issue must be taken by the Indian government. It is evident that changing society norms is a non-negotiable option. Nothing will change unless the citizens themselves see the problem and are willing to work together to stop it. However, creating this change is the hard task that the government faces. Legislation may not necessarily be the best option for such a large country. If it is, the legislation will have to be different than

the PNDT Act since it has not had sufficient results. Hopefully India as well as other countries that have similar child sex ratios can find solutions that make it safe for women to be born in these countries. It is true what they say, women's rights are human rights and it starts in the womb.

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APPENDIX: R STUDIO CODE

This appendix includes the R Studio Code that was used to find the predicted child sex ratio for 2022. This code can be copied and pasted straight into R studio. The first section of code includes the entirety of child sex ratio data from the past.

```
predictedcsr <- data.frame(x=c(1951, 1961, 1971, 1981, 1991, 2001, 2005, 2011, 2015, 2019),  
y=c(983, 976, 964, 962, 945, 927, 918, 914, 919, 929))
```

```
model <- lm(y ~ x, data=predictedcsr)
```

```
new <- data.frame(x=c(2022))
```

```
predict(model, newdata = new)
```

```
x2 <- c(1991, 2001, 2005, 2011, 2015, 2019)
```

```
y2 <- c(945, 927, 918, 914, 919, 929)
```

The second section of code includes only child sex ratio data from after 1991 which indicates that the PNDDT Act has been passed and put into law.

```
predictedcsr <- data.frame(x=c(1991, 2001, 2005, 2011, 2015, 2019), y=c(945, 927, 918, 914,  
919, 929))
```

```
model <- lm(y ~ x, data=predictedcsr)
```

```
new <- data.frame(x=c(2022))
```

```
predict(model, newdata = new)
```