

Summer Project Report

By

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ACRONYMS/ABBREVIATIONS

ASFR	Age Specific Fertility Rate
CHC	Community Health Center
CPR	Contraceptive Prevalence Rate
EAG	Empowered Action Group
IIPS	International Institute for Population Sciences
IUD	Intrauterine Device
MMR	Maternal Mortality Rate
MP	Madhya Pradesh
NFHS	National Family Health Survey
NRHM	National Rural Health Mission
PHC	Primary Health Center
PPIUD	Post-Partum Intrauterine Device
RCH	Reproductive and Child Health
SRS	Sample Registration System
ST	Scheduled Tribes
TFR	Total Fertility Rate
UP	Uttar Pradesh

Part- I: A study on fertility and family planning trends in Jharkhand

ABSTRACT

Background:

The fertility rates in India have changed significantly during the past two decades. In India, fertility has declined substantially in most of the states, however, with 2.6 children per woman, Jharkhand continue to have a high fertility rate. The current fertility rate according to NFHS 4 is well above the national average rate.

Data and methods:

Secondary data related to fertility and family planning was drawn from National Family Health Survey (NFHS) and Sample Registration System (SRS). The pattern, extent and differentials in fertility and family planning indicators among currently married women of age group 15 – 49 years based on socio-economic characteristics in India and Jharkhand were analysed. NFHS & SRS data was analysed in excel. To determine the extent of factors associated with the fertility rate regression analysis was performed.

Results:

In Jharkhand, total fertility rate (TFR) is 2.6 children per woman which shows that the overall state has yet to achieve the replacement fertility. The fertility is 1 child more in rural region (1.8 children per woman) of Jharkhand than in the urban region (2.8 children per woman), which is significantly much lower than the substitute. Between 2004 and 2016, Jharkhand's TFR decreased by 22.8% but remains above the national average. Use of contraceptives in Jharkhand has increased between 1998 and 2016. The use of any traditional method in Jharkhand was fairly limited compared with the female sterilization and modern methods.

District fertility in Jharkhand varied from 1.65 to 3.55, with higher fertility in districts with low level of women education in the Northern Jharkhand region. The proportion of sterilization in low and high-fertility groups was 33 and 32 percent, respectively. The impact of education on fertility and contraception is positive. Disadvantageous Muslims and women belonging to Scheduled Caste have a high rate of fertility.

Conclusions and implications:

Total fertility rate is much higher than the substitution point in. In rural areas, the overall fertility rate is higher, due to numerous determinants such as strict patriarchal and sex-based social criteria and systemic socio-economic disparities. Awareness of every family planning method and modern approach in Jharkhand is universal. The results demonstrate the need for effective implementation of expertise, training and quality enhancement of consulting and care services in family planning.

KEYWORDS: Total Fertility Rate, Family Planning, Contraceptive Prevalence Rate, Jharkhand, NFHS

INTRODUCTION

In the past 50 years, India saw a drastic decline in fertility from 5.2 to 2.2 children per woman from 1971 to 2016. Nearly all classes of society –wealthy and poor, educated and illiterate, upper and lower castes, Hindus and Muslims–suffered a fertility decline. Improving child mortality, schooling for women, economic growth and increasing use of modern methods of contraceptive such as pills, IUDs, injectable, female sterilization, lactational amenorrhea, condoms, etc. are considered as important contributions for reducing family size. Between 1992-93 and 2015-16, the usage of any modern method of contraceptives among currently married women aged 15–49 increased from 31.7 percent to 47.8 percent despite doubts about the fact that there has been no growth since 2005-2006. Despite generational declines in total fertility rates (TFR), sub-national fertility and family planning disparities within the states and district remain.

National Population Policy was devised by the government of India in 2000 in order to meet the targeted TFR i.e. 2.1 children per woman and to bring stability in the population of India by 2045. This was only possible by addressing the unmet needs for family planning and by rational mixing of men and women roles. In states of Tamil Nadu and Kerala, very less discrimination is done on the basis of gender and economy. Also, because of rapid social development these two states have achieved a major decline in the fertility rate. From 2005 to 2015, unwanted pregnancy level has experienced a major decline which shows the availability of means to prevent unwanted pregnancy. In UP, MP and Bihar, the fertility rate was above 3.0, while in states such as Maharashtra, Karnataka,

AP, West Bengal, etc. It was far below the replacement level indicating a significant progress in view of emerging population of India. However, in many states in India, fertility rates remained far below substitute levels which show the rate of decline in fertility has been partly due to sluggish socio-economic development, particularly in states with large populations.

There are various reasons behind selecting Jharkhand for this study. The 2011 census shows that Jharkhand's population is approximately 33 million with a decadal growth rate of 22.4 percent, which was 40 years ago in Kerala and Tamilnadu. The growth rate is a bit higher than the national level (17.6%). Only 1% down the decadal rate of growth in 2001-11 is a matter of concern for the state. The state of Jharkhand is predominantly rural with a population of 76.5 per cent of 30.5 million people living in cities, and a tribal population of over one-quarter (28 per cent). Infrastructure is not well developed, and only 45% of villages have electricity. Moreover, Jharkhand being a poor state with high fertility rate, high MMR and Child mortality rate, high unmet needs, low literacy and low life expectancy are a major challenge for the government and policy makers. Regrettably, there has been very little research in this field. Therefore, this research aims to analyse the patterns and disparities in Jharkhand's indices of fertility and family planning.

This paper discusses Jharkhand's decline in fertility rate and the regional variations in order to explain current progress and identify areas in order to achieve sustainability or acceleration of fertilization. Firstly, the decline in fertility rate in Jharkhand as compared to India in general with the emphasis on improvements in contraceptive coverage and demand met for family planning was compared. In the districts of Jharkhand, fertility and family planning for populations was analysed. Districts with high fertility and low contraceptive uses were identified. To address the needs and demand of families, family planning through various policies and programmes plays an important role.

LITERATURE REVIEW

Study done in Haryana to determine the social and biological factors related to the fertility trends in Jat women. This study explained that mean age at first marriage, son preference, level of education, poverty are some of the factors related to the change in pattern of fertility. Other variables such as occupation, per capita income, menarche age

and birth control practices does not affect the fertility level. (Chandiok k, Mondal PR, Mahajan C, Saraswathy KN, 2016) [10]

Study conducted in tribal society of Assam to assess the education-fertility linkage shows that the education level of both husbands and wives has shown a significant reduction in the fertility rate. Moreover, it concludes that the crucial years of women's education required to have a declining impact on fertility is 5.3. (Mahanta Amarjyoti, 2016) [22]

Study done in India to analyse the changing trends in fertility with the application of “Bongaarts’ model” proved beneficial to understand the variation in pre-transition fertility. This model provided a base to understand the important factors that determine fertility at moderate and low levels. (Dharmalingam A., Rajan S, and Morgan S.P., 2014) [17]

Study done in India based on NFHS data revealed the variations and similarities in the various facets of fertility trends among different regions in India. Most of the decrease in fertility is attributed to fall in births in the third and higher classes. Such political imbalances will help to fuel migration to low-performing regions from high-fertility regions, resulting in social tensions. (Spoorenberg T., Dommaraju P., 2012) [11]

A study in India using NFHS data to estimate the values of near fertility determinants for major states investigated variations of fertility-related factors. This study explained that the frequency of intercourse between couples decreased once their son gets married. The study also indicates that the expected fertility in many states of the country is close to or below the replacement level whereas the actual fertility in those regions is quite high. The issue of strong son preference must be explored so as to advance the family planning. (Leela Visaria, 1999) [15]

Study done to understand the level and pattern of infertility and childlessness in India concluded that infertility rate shows a positive relationship to age at first marriage. The study also proves that in urban areas the rate of infertility is high. While studying the factor Religion, Muslim women shows the high fertility rate. The fertility rate decreases with the increase in literacy level. (Ganguly S., Unisa S., 2010) [12]

Study conducted to study the differential pattern of fertility in Muslims and non- Muslims in India focussed on the socioeconomic factors related to high fertility among Muslim women. Muslims’ prefer temporary methods of contraception instead of sterilization. The

results indicate that increased availability of temporary methods and expansion of family planning facilities in the private sector could increase use of contraceptives and decrease fertility for Muslims in India. (Mishra, Vinod K., 2004) [9]

Study carried out in Uttar Pradesh to determine the effect of family planning on urban poor women has demonstrated that women in slum areas are more likely to become sterilized rather than use modern contraceptive methods such as condoms and pills. Poorer women report unmet family planning needs. (Speizer et.al. 2012) [3]

Study conducted to examine the determinants of fertility rates and decline in fertility in India based on education and infant mortality. Lesser the preference of son, lower is the fertility. The indicators of change and growth such as urbanization, reduction in poverty and male literacy are not correlated with fertility in any significant way. (Dreze Z, Murthi M, 2004) [21]

Study done to establish the relationship between fertility and religion in India focussed mainly on Muslim women. Longer reproductive span, shorter post-partum amenorrhoea and post-partum abstinence, less inclined to use modern contraceptive methods are some of the reasons for higher fertility in Muslims than non-Muslims. (Moulasha, Rao, 1999) [18]

Study done in north-eastern states of India to determine the fertility trends focussed on socio-demographic characters. A strong correlation between fertility and infant mortality was observed. This was also noted that the length of breastfeeding is positively associated with fertility. This study suggested that the schooling and age of the mother at marriage had a substantial effect on fertility reduction. (Dey S, Goswami S, 2017) [4]

Study done in Uttar Pradesh and Bihar to determine the role of gender in use of contraceptives focussed on son preferences. 83% women in UP and 87% in Bihar who do not have a son desires for more children. So it is inferred that the son choice has an important effect on the adoption of any form of family planning. (Ranjana K, Awdhesh Y, 2012) [19]

Study done in Karnataka to trace the transition in fertility levels focussed on health and demographic indicators. The socio-economic backwardness of the region marked by

inadequate access to mass media and weak women's status explained the slow decline of fertility in northern districts of Karnataka. (Sekher, Raju, Sivakumar, 2001) [13]

Study done in Madhya Pradesh to assess high fertility level focussed on the scheduled tribes. The ST women often show a clear preference for male child. ST women in MP do not use any kind of contraceptives even if they no longer want a child. Reproductive and children's health (RCH) services in tribal areas targeted specifically at young tribal mothers must be improved. (Kalyan, Arvind, 2006) [20]

Study conducted in Bihar to explore the trends and determinants of unmet needs for family planning highlights the need for successful adoption of information, awareness and communication programs and improvement in the quality of family planning-related therapy and care services. (A. Kumar, Aditya Singh, 2013) [6]

Study conducted in Manipur to explore how the socio-economic and demographic factors influence family planning activities. The study showed that married women during their reproductive period basically practice rhythm method and withdrawal process. Pills and contraceptives still operate at a high pace but the level of female sterilization is steadily decreasing. (Gogoi, Hazarika P., Chanu, Hazarika J, 2017) [14]

Study carried out in India to explore the knowledge and use of contraceptives among women focussed on the scheduled tribes of India. Tribal women have significantly lower understanding and use of temporary contraceptive methods compared to the non-tribal. The study shows that Jharkhand is especially faced with an unsatisfied need for family planning. (Prusty, 2014) [7]

Study conducted in rural India to analyze the factors and their ability to predict future fertility focussed on unintended births and contraceptive use. The study indicates that the need for additional children could be more effective in forecasting potential births than the optimal family size. (Roy, Sinha, Patel, Mohanty, Koenig, 2008) [16]

Study conducted to analyse the fertility behaviour in women with respect to income and education level shows that there is a strong inverse relationship between the level of education and fertility but there is no such relationship between the level of income and fertility. (Kaur H, 2000) [23]

Studies carried out in Indian women to assess the knowledge and understanding of fertility among infertile women showed that knowledge of fertility and reproduction was poor. This also found that in advanced age, less than half of women recognized the need for assisted fertility care and donor oocytes. (Mahey R. et. al. 2018) [24]

OBJECTIVES

Research Question:

What are the different socioeconomic factors, affecting the fertility rate in currently married women of age group 15 – 49 in Jharkhand?

What is the knowledge, attitude and practice of currently married women of age group 15 – 49 towards family planning in Jharkhand?

The specific objectives of the research are:

- To assess the status of fertility and family planning use in the state of Jharkhand
- To assess the differentials in fertility and family planning use with respect to selected socioeconomic characteristics in the state of Jharkhand
- To ascertain the time trends in fertility and family planning use in the state of Jharkhand.

METHODOLOGY

Study Design: Analysis of secondary data collected from NFHS and SRS.

Data Source: Various rounds of National Family Health Survey (NFHS) conducted in between 1998 to 2016 and Sample Registration System (SRS) data were used to do the analysis.

The SRS was set up in 1964 to estimate fertility and mortality at national and state level. The SRS includes an ongoing listing of important events in a village/urban sample. The quality of the data was considered good. SRS Data on TFR was used to evaluate degree and patterns in fertility. The Sample Registration System (SRS) aims primarily at providing quick and valid estimates of annual vital levels of states and nation. “The

Sample design adopted for SRS is a **Uni. stage stratified simple random sample** without replacement". [2]

The NFHS is an extensive survey of multiple rounds carried out in a representative sample of households across India. **Multi-stage sampling design** was implemented. Since 1992-93, there have been four rounds of the survey till 2015–16. The design of the sample remained identical in NFHS 2 and 3 which made the comparison easier. NFHS 4 data was not comparable to the data of the previous rounds because of huge difference in the sample size. NFHS provide information on background characteristics of the households interviewed, fertility rates, birth order, child and maternal mortality and the family planning practices in addition other socio-economic characteristics on national and state level.

In Jharkhand the survey collected information from 1614, 2983 and 29046 women (age 15 – 49) in NFHS 2, 3 and 4 respectively. Survey response rates for women stood at 95%. Jharkhand has experienced certain organizational changes throughout the period, including reorganizing district borders in geographical terms, forming new districts and separating districts from each other to form a different state. Jharkhand was separated from Bihar in 2000. Taking these changes into account, the analysis of trend for NFHS is restricted to the recent three rounds of survey. Districts of Bihar state was excluded from NFHS 2 survey that was conducted in 1998-99. The total fertility rate in the NFHS-4 districts (2015–16) was taken for District level fertility analysis in Jharkhand. [1]

Study Population: The study population consists of currently married women in the age group (15-49 years) from Jharkhand and India

Variable Description: The variable of interest is Total Fertility Rate. The independent variable considered in this study are; level of schooling among women, proportion of Muslim women, proportion of women residing in urban area, and proportion of women who belongs to the Scheduled Caste and wealth index.

“Total Fertility Rate (TFR) is an over-all summary measure of fertility and is obtained by summing the age-specific fertility rate for each age of the childbearing span. In other words, total fertility rate is the number of children which a woman of hypothetical cohort would bear during her life time if she were to bear children throughout her life at the Age

Specific Fertility Rates for given year and if none of them dies before crossing the age of reproduction”, according to IIPS.

Data Analysis Technique:

Data Refining: IBM SPSS Statistics 22 was used to check outliers, normality of variables and multicollinearity by calculating VIF values.

Data analysis: Multiple Regressions was performed on SPSS to determine the relation between independent and dependent variables.

RESULTS

Rates and Patterns in TFR: Scenario of India and Jharkhand

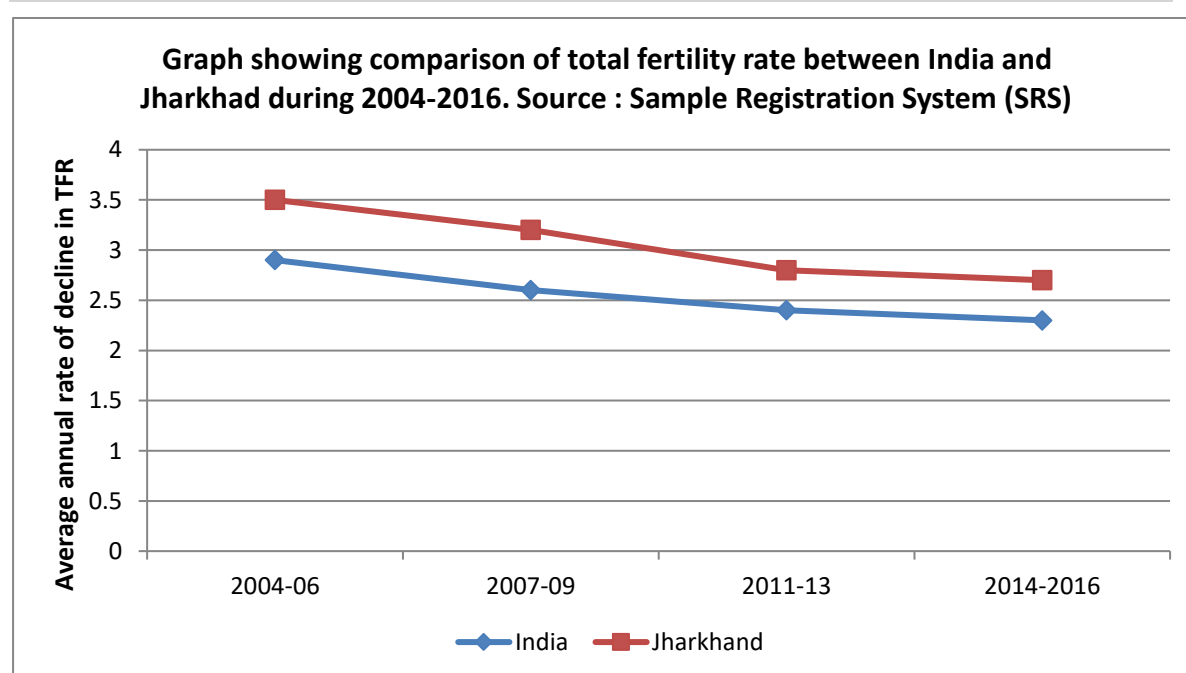


Fig 1 – Mean annual rate of decline in TFR in India and Jharkhand, (2004-2016)

Fig 1 indicates that the rate of decline in TFR in Jharkhand always exceeded pace of decline in India but it is much above the replacement level fertility (according to Sample registration system), which resulted in converging the gap in fertility rate between Jharkhand and India. The relative decline in fertility (22.8%) from 2004 to 2016 in Jharkhand is more than that of India (20.6%).

The TFR of 2.55 in Jharkhand according to NFHS – 4 (2015–16) continued to be considerably higher than the country’s TFR of 2.18 in 2015–16. Over the six years from NFHS-2 to NFHS-3 fertility fell by 0.6 children per woman. Further, in the 10 years duration from NFHS-3 to NFHS-4, it worsened by 0.8 percent. Markedly, in Jharkhand the fertility level is very less than that of Bihar (3.4 births per woman). Till 2020, Jharkhand and Bihar were not separated and Jharkhand belonged to Bihar.

Rates and Patterns in TFR: According to Residency

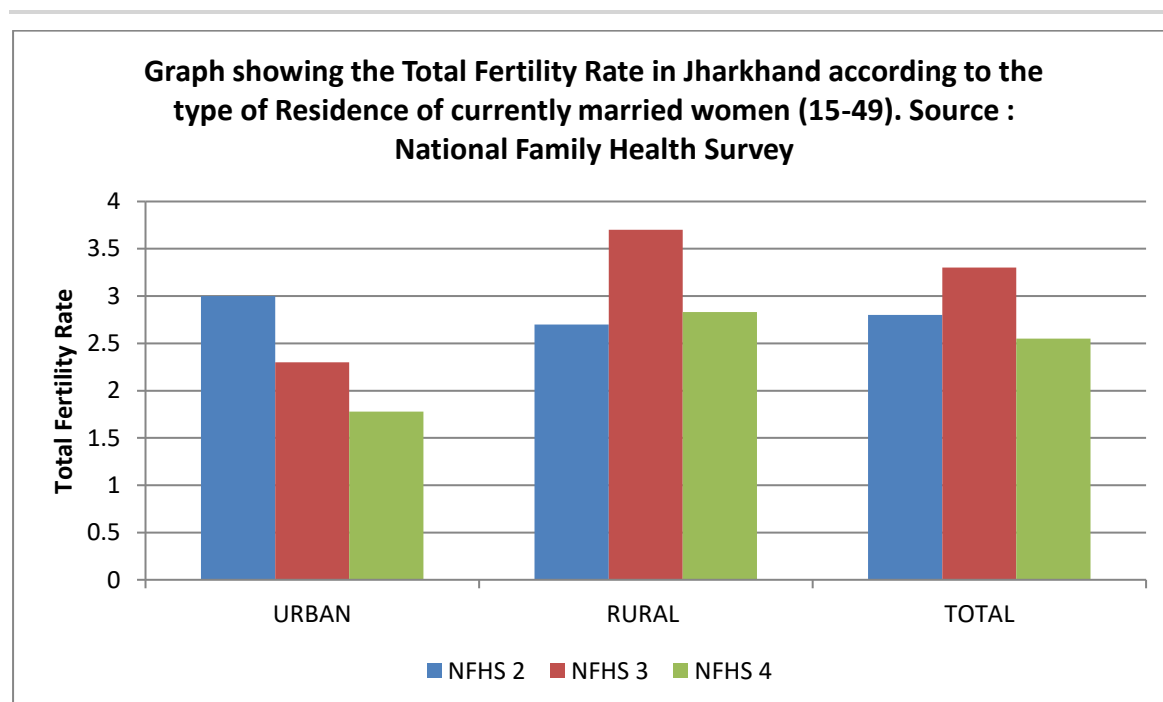


Fig 2 – Total Fertility Rate in Jharkhand according to residence.

Figure – 2 indicates that the total fertility rate according to residence, NFHS – 4 data shows that the fertility rate in Jharkhand is 2.55 which is less than the fertility rate ten years ago (3.3 children per woman) in NFHS – 3. The total fertility rate of women in rural area is 2.83 while in urban area it is 1.78 which is quite close to the replacement fertility level. The pace of urban fertility decline is much faster than the pace of rural fertility decline. The total fertility rate in urban area (1.78 children per woman) in NFHS 4 is extremely low than that of NFHS 2 (3 children per woman) and NFHS 3 (2.3 children per woman). This does however indicate a very different trend in rural areas. The fertility increased from 2.7 in NFHS 2 to 3.7 in NFHS 3. Though in NFHS 4 (2.8 children per woman), the rate decreased but it is still above the replacement level.

Rates and Patterns in TFR: According to Caste

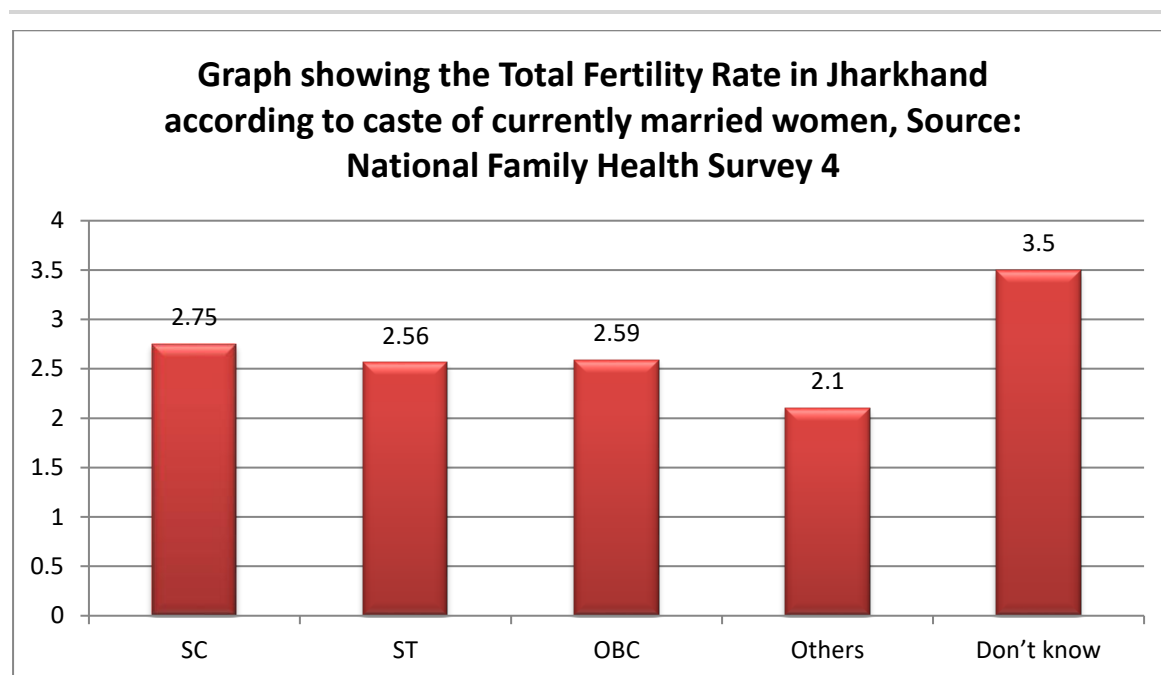


Fig 3 – Total fertility rate in Jharkhand according to the Caste.

The Fertility Rate in Jharkhand is above the national average. In many states the fertility rate is much lower than that of Jharkhand. Figure 3 indicates that women belonging to the deprived category have higher Fertility rates (scheduled caste women with 2.75, scheduled tribe with 2.56 and women belonging to other backward class with 2.59) that those women who belong to the advantaged group according to NFHS – 4.

Rates and Patterns in TFR: According to Level of Education

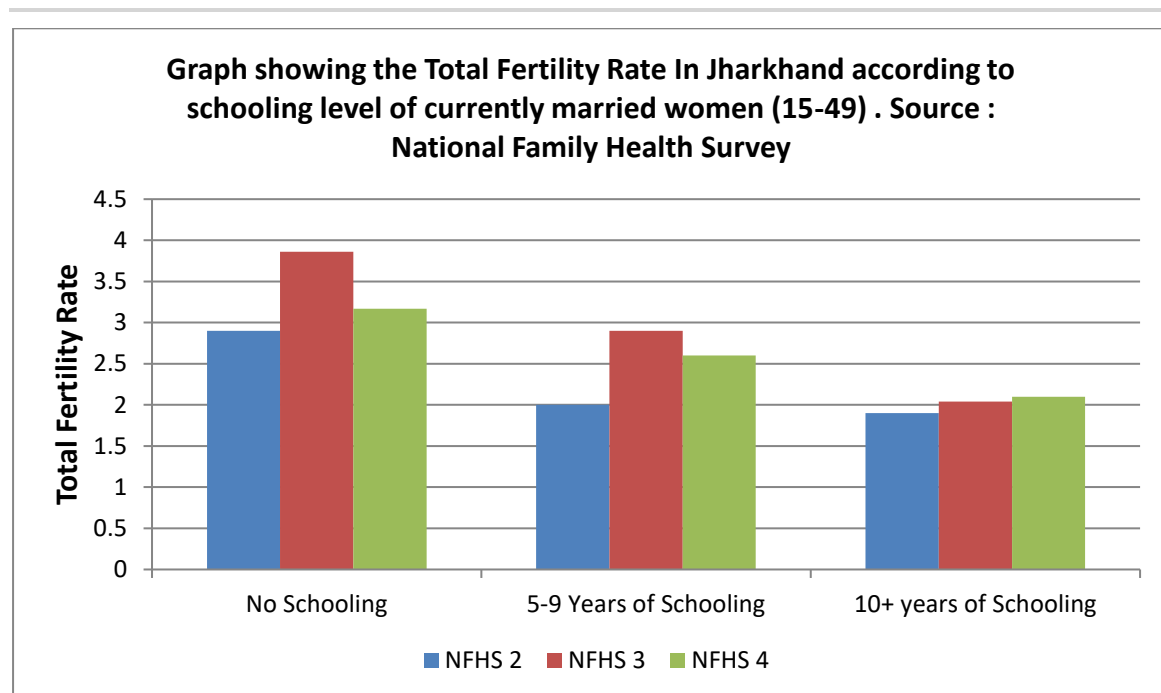
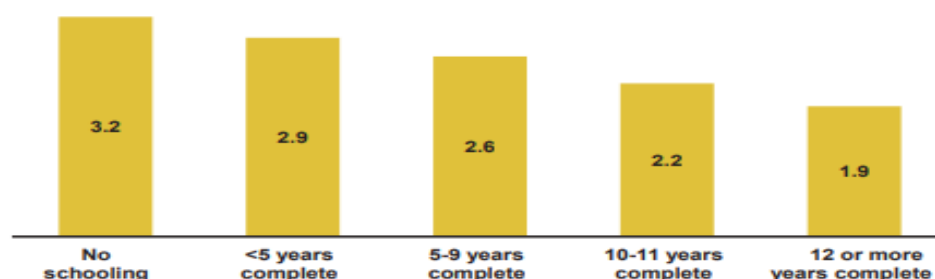


Fig 4- Total Fertility Rate in Jharkhand by the level of education

Figure – 4 indicates the fertility differentials by education in NFHS-2, 3 and 4. With respect to the education level, the fertility rate has showed a decline. In NFHS-2, fertility decreases from 2.9 (children per woman) without education to 1.9 (children per woman) with a total education of 10 or more years. Likewise in NFHS–3, the decrease in fertility ranges from 3.86 to 2.04 and in NFHS – 4, 3.17 to 2.1 children per woman.

How does fertility vary with schooling? Total fertility rate (children per woman)



Source – National Family Health Survey 4

The Fertility rate in Jharkhand differs considerably with education level, caste/tribe and religion to which women belongs. At present, women without any schooling (3.2)

experience tends to have 1.3 children more than women who had an experience of 12 or more years of schooling (1.9). Likewise, Muslim women (TFR – 2.9) will roughly have 0.4 more children on average than the Hindu women (TFR – 2.5) and women belonging to scheduled caste (TFR – 2.8) will have on average 0.7 children more than women who do not belong to the deprived section of the society.

Knowledge and Use of Contraceptives

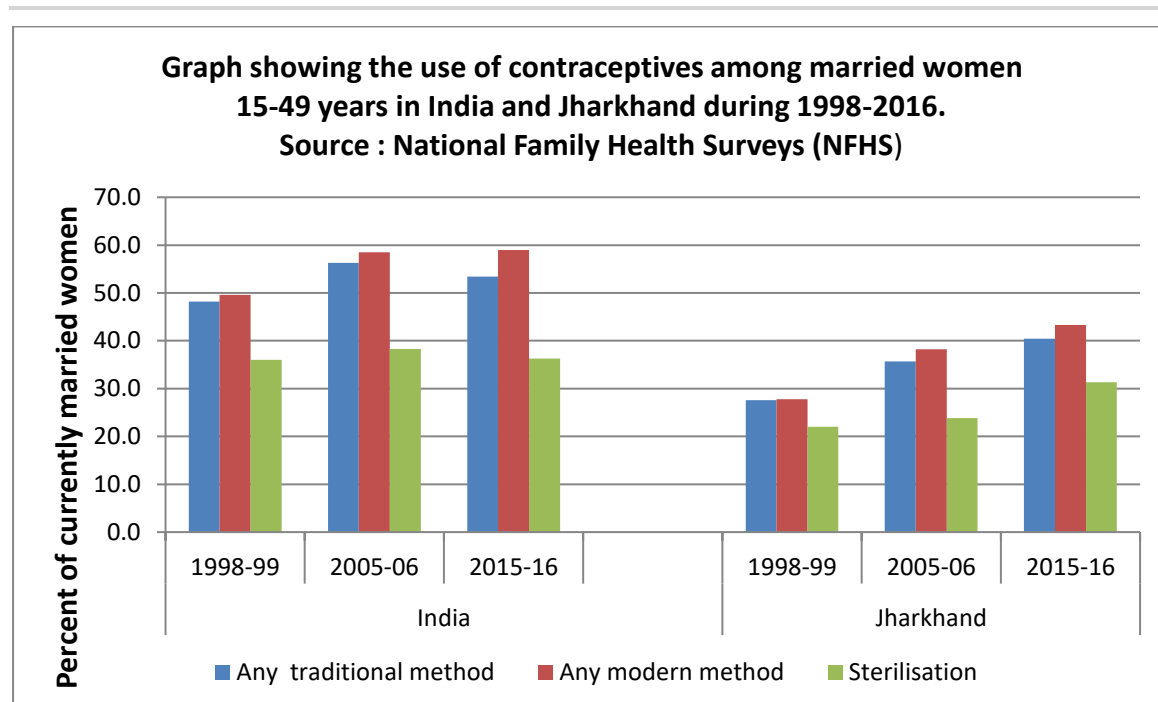


Fig 5 – Use of contraceptives among currently married women (15-49 years) in India and Jharkhand, 1998-2016.

Figure 5 indicates the use of Contraceptive among currently married women 15–49 years varies greatly between India and Jharkhand. Firstly, there seems to be a significant gap in the use of modern contraceptives among India (59%) and Jharkhand in 2015–16 (43.3%). Secondly, the level of sterilization also varies considerably. About 36.3% and 31.3% of couples in India and Jharkhand respectively have one of the partners sterilized. Thirdly, by 2015-2016, the use of conventional methods rises in Jharkhand from 27.6% to 40.4%.

Pills (3 percent) and Condoms (2 percent) are the popular modern spacing methods used in Jharkhand. Also, women of urban areas and those who are educated are typically more likely to use any modern method of contraception. In Jharkhand, 3% of women who have been married use any traditional method of contraception.

“The contraceptive prevalence rate (CPR) among currently married women age 15-49 is 40 percent, up from 36 percent in NFHS-3”. In NFHS-4, the use of modern methods has also increased by 38% compared to 31% in NFHS 3. The use of female sterilization has significantly increased from 66 percent at NFHS-3 to 77 percent in NFHS – 4.

NFHS-4 data shows a sharp increase in contraceptive use with age from 7% for women between 15-19 and 52-53% for women between 30-49 years. Contraceptive use in Jharkhand is more frequent in urban areas (47%) than in rural (38%). While the contraceptive prevalence continue to rise with the level of education, 16 % women having schooling of 12 or more years and about 37% of women who never went to school are to be sterilized which is just double. It was also observed that Hindu women (45%) are likely to be sterilized more than that of other religions.

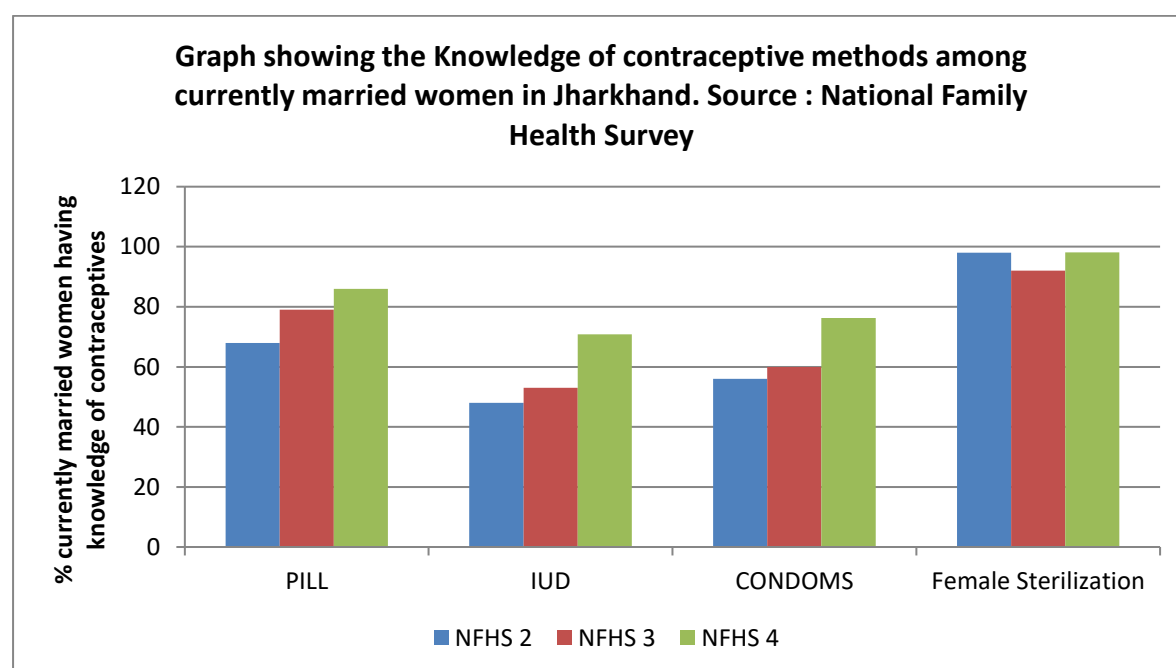


Fig 6 - Knowledge of contraceptive methods among currently married women in Jharkhand

The capability of women and men to make sound decision regarding reproductive health is integral to the knowledge of contraceptive methods. Figure – 6 indicates the knowledge of contraceptive methods. Trends from NFHS – 2, NFHS – 3 and NFHS – 4 showed that over the years, awareness about contraception has evolved. The knowledge of any form of contraception among married women was universal i.e. 95 percent. There is an increasing trend in the knowledge of modern spacing methods such as pills, IUDs and condoms among all age groups. In NFHS – 4, 86 percent of currently married women

have the awareness of pills as compared to that of 79 percent in NFHS – 3 and 69 percent in NFHS – 2. The knowledge of pill has shown 8 percent increase between NFHS – 3 and NFHS - 4. The knowledge of IUD has increased from 48% to 70.8% in NFHS-4. Knowledge of female sterilization among women has also increased from 92% in NFHS – 3 to 98.1% in NFHS – 4. There is a decline of 6 percent in the knowledge of female sterilization from NFHS – 2 to NFHS – 3 and then again rises by 6 percent from NFHS – 3 to NFHS - 4. This report shows that the modern spacing method is being popularise among the reproductive women.

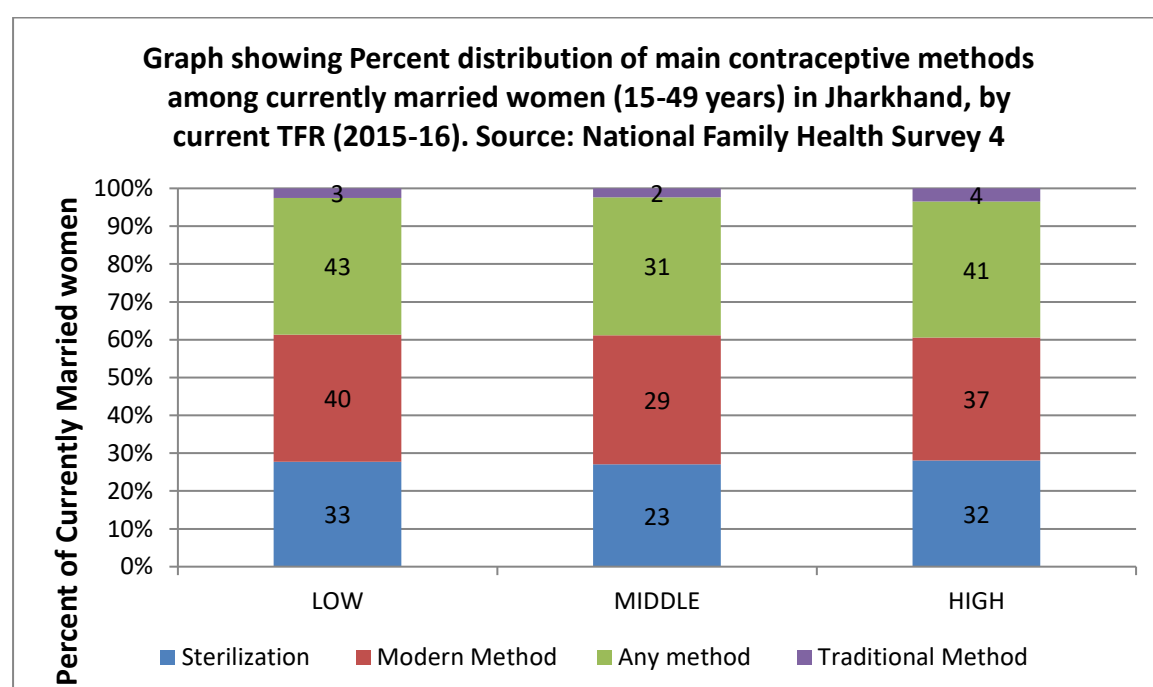


Fig 7 – Percentage distribution of contraceptive methods among currently married women (15 – 49) by TFR (2015 – 2016)

Districts within Jharkhand are clustered into 3 tiers – Low, Medium and high based on the fertility rate. The Range is - low: TFR $\leq$ 2.3, middle: TFR = 2.3–2.9 and high: TFR $\geq$ 3.0. In the three groups of districts, the combination of family planning methods is evident. The importance of using sterilization is decreasing gradually and the use of modern methods such as condoms is increasing over time. Majority of women also depend on traditional methods. In low and high fertility district groups, the share of sterilization was 33% and 32% respectively. Similarly, modern methods usage is 41% and 37% in low and high fertility districts respectively. Traditional methods of contraception attributed for 2 per cent of users in districts with low and medium fertility and 4 per cent in districts with high fertility in 2015–2016.

Fertility differentials within Jharkhand

In NFHS – 4, the fertility level in districts varied from 1.65 in west Singhbhum, 1.91 in Ranchi districts; highly urbanized region, in central Jharkhand to 3.55 in Sahibganj districts from northern part. Total fertility levels were 3.0 or more for 1/3rd of the 24 districts. In the north region of Jharkhand and its neighbouring districts, most of the districts with high TFR were accumulated. The southern region of Jharkhand consists of districts with low TFR. Various district features were related to higher total fertility rates, including higher proportion of women without education, urbanization, larger part of the Muslim population and greater poverty in the region.

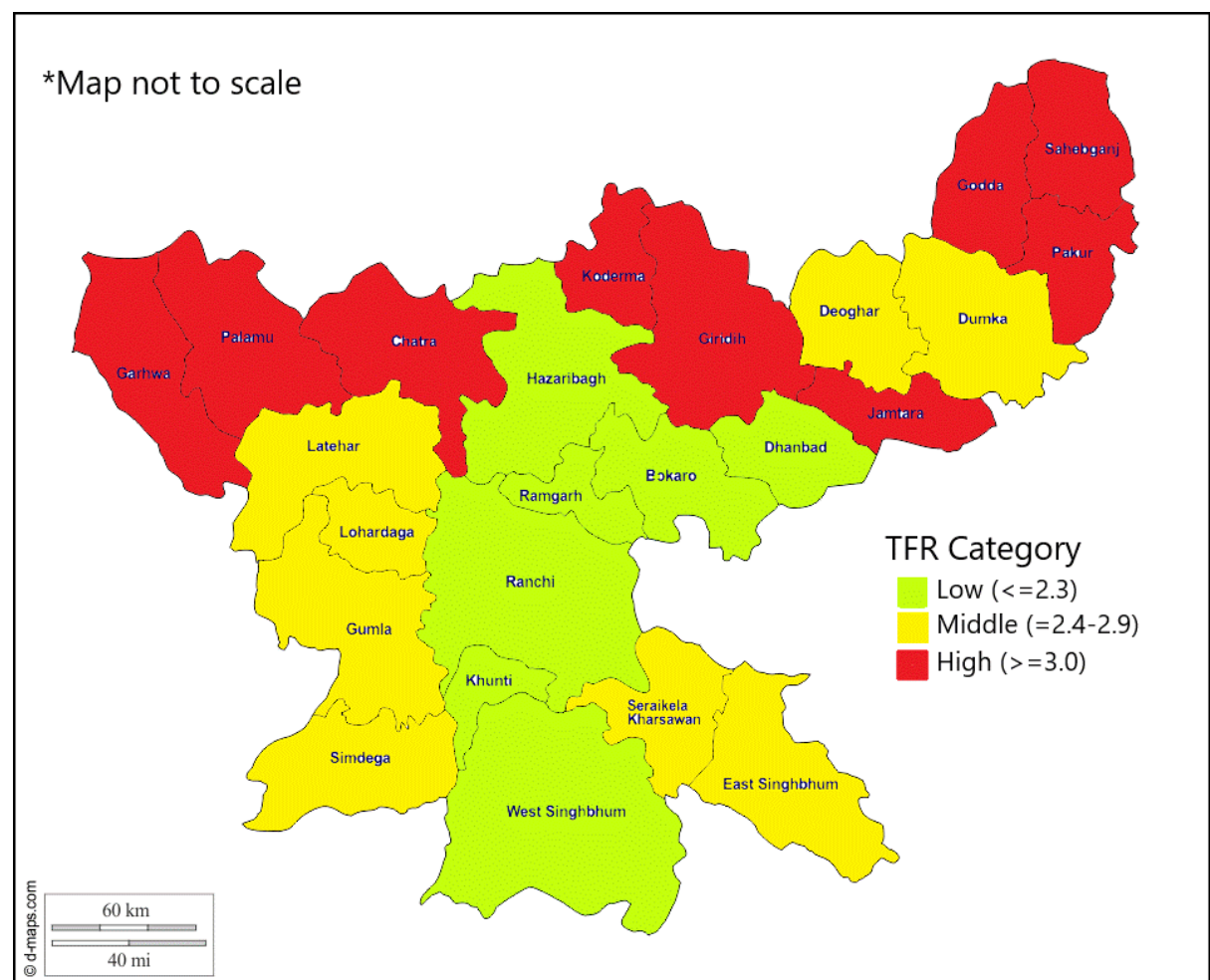


FIG 8: Total Fertility Rate by District, Jharkhand 2015 – 16. Source: NFHS

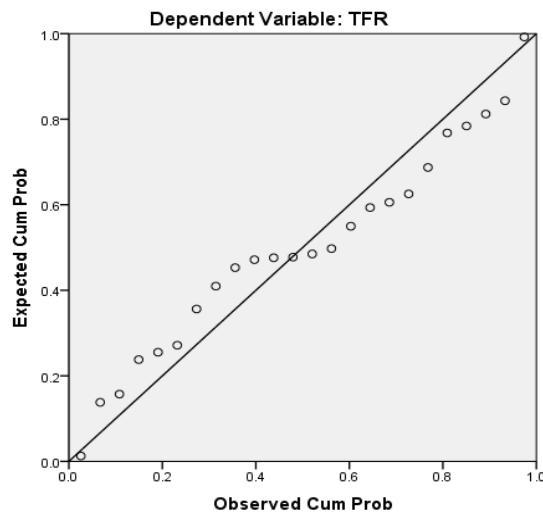


Fig 9: Normal P-P plot of regression standardized residual

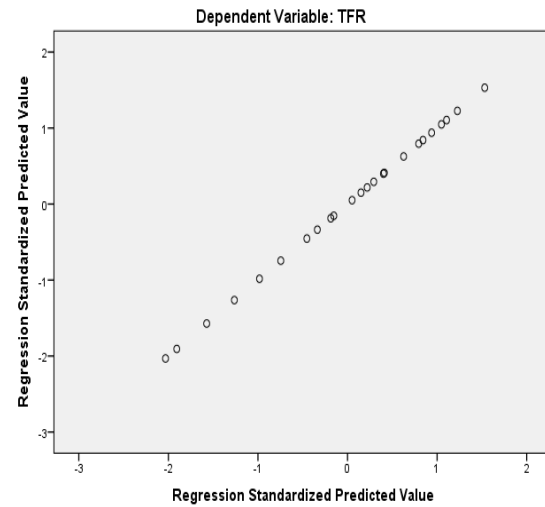


Fig 10: Scatterplot

Before applying regression analysis, we test its assumptions like normality, linearity, homoscedasticity, and multicollinearity etc. Figure 9 represents the normal P-P plot of regression standardized residual and dependent variable which tell us that the error terms follows the normal distribution. In Figure 10, scatter plot for regression standardized predicted values and dependent variable shows normal distribution of the dependent variable and absence of outliers. Based on coefficients output, the VIF values obtained are below 10. Therefore, it can be concluded that there are no multicollinearity symptoms, indicating that the assumptions are met.

Independent Variables	Dependent Variable (TFR)	
Currently married women with:	Bivariate model:	Multivariate model:
	β -coefficient (S. Error; p -value)	β -coefficient (S. Error; p -value)
No Schooling	0.000 (0.001; 0.000)	0.002 (0.001; 0.049)
Residence (Urban)	0.000 (0.000; 0.088)	-0.001 (0.000; 0.018)
Religion (Muslim)	0.000 (0.000; 0.924)	0.000 (0.001; 0.731)
Caste (Schedule caste)	-0.001 (0.001; 0.414)	0.000 (0.001; 0.652)
Wealth Index (Poor & Poorest)	-0.001 (0.001; 0.342)	-0.001 (0.001; 0.388)
R square		0.362

Table 1: Factors affecting the TFR

Note – “Model-fit (R^2) is statistically significant at $p < 0.05$. Therefore, this model is significantly good fit”

A variety of District characteristics have been related to higher fertility rates, including districts with higher numbers of women who never attended school, lower urbanization rate, higher Muslim population and higher district poverty levels, based on bivariate regression analysis (Table 1); but only level of schooling showed a significant effect. In the multivariate analysis only schooling levels and urban residence were significantly associated with TFR in 2015–16.

R square value of 0.362 means that 56.2% of the variation in TFR levels around the mean are explained by the independent variables (Urban, Muslim, Scheduled Caste, No schooling, poor wealth index). Therefore, 36.2% of the values fit the model.

Rates & Patterns of Demand and Unmet need for family planning

Unmet need for Family Planning is a significant predictor for accessing the future Family planning services. “Unmet need for family planning is described as the percentage of currently married women who either wish to space their next child birth or stop bearing child completely without using any contraception.”

Table : Levels and Trends in demand for family planning in Jharkhand 1998–2016			
YEAR	1998-99	2005-06	2015-16
Unmet need for family planning			
For Spacing	11.1	11.3	9
For Limiting	9.9	11.9	9.4
Total	21	23.1	18.4
Met need for family planning			
For Spacing	1.7	3.2	2.9
For Limiting	25.9	32.5	37.5
Total	27.6	35.7	40.4
Total demand for family planning			
For Spacing	12.8	14.5	11.9
For Limiting	35.8	44.4	46.8
Total	48.7	58.8	58.7

Table 2: Levels and Patterns in demand for family planning in Jharkhand 1998–2016

Table–2 shows the Approximately 48.7 per cent of all reproductive-age women in Jharkhand required family planning in 1998 –99. However, in 2005-06 it increased by 10

percent to reach 58.8 percent, and stagnated in 2015-16. The overall demand of family planning (for limiting) showed an 11 percent increase from NFHS 2 (36%) to NFHS 4 (47%). The level of unmet need among reproductive women (15-49 years) in Jharkhand was approx. 21 percent, which showed an increase of 23 percent in 2005-06. Henceforth, the level of unmet need among women has subsequently dropped in 2015-16 to 18.4%. Considering the unmet need for spacing and limiting separately, it has been rising steadily over the period till 2006 and then a sudden decrease in a period of 10 years. The percentage of unmet family planning needs in Jharkhand is well above national level (12.9%). Including the met and unmet needs for family planning, 59% of Jharkhand's currently married women have demand out of which 68.7 percent are convinced.

Rates & Patterns in Contraceptive use and method mix

One of the key determinants of fertility is the current extent of contraceptive usage or contraceptive prevalence rate (CPR). It is defined as “percent of woman of reproductive age 15 – 49 years who are currently using a contraceptive method, mainly reported for married women”. This further highlights the effectiveness of family planning programmes.

Table : Current use of contraceptive methods among currently married women 15-49 years by residence in Jharkhand.									
Source : National Family Health Survey									
Contraceptive Method	NFHS 2			NFHS 3			NFHS 4		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Any Method	40.2	25	27.6	60	28.2	35.7	46.7	38.3	40.4
Any modern method	37.5	22.2	24.9	49.3	25.2	31.1	42.5	35.6	31.1
Pill	4	0.9	1.5	4.9	3.4	3.8	3.3	2.4	2.6
IUD	0.8	0.2	0.3	1.4	0.4	0.6	1.3	0.9	1
Condom	4.6	0.4	1.1	7.9	1.1	2.7	4.5	1.4	2.2
Female Sterilization	27.3	19.8	21.1	36	19.8	23.4	32.7	30.5	31.1
Male Sterilization	0.8	0.9	0.9	0.5	0.3	0.4	0.2	0.2	0.2
Any traditional method	2.4	0.9	1.1	10.1	2.9	4.7	4.1	2.5	2.9
Rhythm/Safe method	0.8	0.4	0.5	4.1	1.4	2.1	3	1.7	2
Withdrawal	1.6	0.5	0.7	5.1	0.9	2	1.1	0.8	0.9

Table 3: Current use of contraceptive methods among currently married women 15 – 49 years, according to residence, Jharkhand 1998 – 99 to 2015 – 16

Table 3 indicates the contraceptive prevalence rate in Jharkhand among reproductive women grew 40.4% compared to 35.7% in NFHS – 3 and 27.6% in NFHS - 2. The rate of contraceptive use in Jharkhand is considerably lower than the country as a whole (56%) and also few states such as Meghalaya, Nagaland and Bihar. Traditional method has shown a declining trend from 2005-06 to 2015-16. Female sterilization and any modern method are the most popular modern method of contraception. Female sterilization is 31.1 percent compared to 23.4% and 21.1% in NFHS – 3 and NFHS – 2 respectively. The male sterilization has further decline from 0.9 percent to 0.2 percent in NFHS – 4. The three modern methods such as pills, IUDs and condoms have shown a remarkable trend. Use of pill and condom has decreased and the use of IUD has increased in NFHS – 4. Among three the most widely used method is pill (2.6 percent). Still about 60 percent women according to NFHS-4 are not using any contraception method. Rural areas has shown a steadily increase in the level of contraception while there is a decrease in the level of contraception in urban areas. Between the periods the contraception of modern method has increased by 13% in urban region compared to 60% in rural region. For urban areas, women's sterilization falls to 32.7% in NFHS – 4 from 36% in NFHS-3. Yet women's sterilization increases to 30.5% in NFHS – 4 in rural areas from 19.8% in NFHS-2.

Attitude towards family planning

Women's attitude: Attitude is acquired and developed through various experiences. It is not present since birth. It was observed that the desired number of children tends to decrease when the level of education increases. Women who were aware of the contraceptive methods and side effects related to it were able to make better decision than the others. However, it was observed that more than half of the women were not using any method of contraceptives indicating that attitude is yet to be turned into behaviour. Moreover, Socio-economic factors played an important role in developing a positive attitude.

Men's attitudes: 56% of men believed that contraceptive is women's business and men should not be concerned about it. 51% of men were aware that use of condom can often prevent pregnancies.

DISCUSSION

Jharkhand has played a major role in India's decline in fertility, particularly since 2005, when Jharkhand experienced a stronger decline in fertility than the whole nation. However, the overall fertility of Jharkhand remains 2.55 which is 16.9% above the national average. India's attempt to achieve its substitution fertility level target depends on the decline in fertility level of states. Increased contraceptive methods among married women in the age group 15-49 led to a decrease in fertility level in Jharkhand. There are however significant differences in overall contraceptive use patterns within India. NFHS – 4 data shows that female sterilization and modern method are most prevalent method in Jharkhand. The proportion of women sterilized in Jharkhand is 77 percent. The contraceptive prevalence rate (CPR) in Jharkhand is 40% while it is 54% in India. The second most common method was the use of pills and condoms. Traditional family planning approaches have declined, especially periodic abstinence, in NFHS – 4. Only 2.9% women used any traditional method in Jharkhand while in India it is 5.8% which is twice as prevalent as in Jharkhand.

About 74% of women who had their sterilization visited Public Sector health facilities for it. Similarly, 72% of women got their IUD OR PPIUD implantation from a public health facility. But, most users visited private health sector for pills, condoms, etc. In addition, the public health facility stocks 20 per cent of pills and 9 per cent of condom / Nirodhs.

Knowledge of any form of family planning and of any modern practice in Jharkhand is universal. The use of family planning method is greater in urban area than in rural area. In contrast with rural areas, three forms of spacing and female sterilization are higher in urban areas. More than two-thirds of the women opt for sterilization in Jharkhand and its neighbouring states like Bihar, Chhattisgarh, and Orissa and UP. It means that the basket of contraceptive methods must be expanded to include injectable diaphragms and the Standard Days Process. Such strategies can already be applied to the existing national basket of the private sector. Male sterilization is very low. This suggests that permanent methods services are not available and non-accessible. Also, it shows the lack of awareness among men regarding benefits and safety of male sterilization. High unmet need among the reproductive women elicits large number of unwanted pregnancies, unsafe abortions and poor maternal and child health outcomes. Socio-economic

differentials in unmet need suggest that there are many subgroups such as young, elderly, poor wealth quintile, illiterate, schedule caste where the unmet need has risen over the span of study. Govt. should not only concentrate on spacing methods but should also attempt to target groups to promote contraceptive use among them.

Jharkhand has significantly lower coverage of family planning with modern methods compared to India among currently married women, suggesting that significant improvements are required in access to family planning methods (NFHS-4). Jharkhand's family planning program needs to be strengthened. Jharkhand, one of NRHM's (National Rural Health Mission) EAG states, has a bleak picture in terms of contraceptive use and offers scope to strengthen it further. There is a requirement of further training and orientation of health workers which will thus help to generate awareness in the community. Moreover, Implants and injectable contraception also have potential for adoption owing to some of the advantages. Similarly, the issues associated with bleeding disorders may be addressed and trained to the beneficiaries.

There is significant variability in fertility within districts of Jharkhand, ranging from 1.65 to 3.5 in 2015–16, including one-third of districts with fertility rates of 3.0 or above. In the north region of Jharkhand and its neighbouring districts, most of the districts with high TFR were accumulated. The southern region of Jharkhand consists of districts with low TFR. The reason behind low fertility is better education facility and high level of urbanization.

Regardless of the economic or sociocultural characteristics, districts with the greatest success in reducing illiteracy have seen the highest decline in fertility. The patterns in family planning and methods mix coverage depends on the fertility rates of the districts, but still there are coverage gaps and disparity in the use of sterilization persists. In low, medium and high fertility district groups (NFHS-4) the demand satisfied increases and significant increase in the share of modern methods and condoms among married women were observed.

Traditional methods, mainly the withdrawal method, are experiencing a significant decrease. The fact that some modern methods such as condoms, pills and sterilization are among the most common methods used by couples as contraceptives in Jharkhand and the

demand for family planning met by either method in all three clusters is very strong, particularly in the low fertility districts, suggesting that couples may practice them properly and could have contributed to the reduction of fertility. In addition, according to NFHS-4, there was a marked difference in condom use between the rural and the urban populations of Jharkhand, which remains high among the urban population with nearly 4.5% of people who use condom as compared to the rural population of 1.4%. Ironically, all three classes of districts met with equal demand rates in the early nineties when fertility was high. The new family planning survey reveals that modern methods are the most preferred choice. Therefore, without further study we cannot deny the effectiveness of modern methods and female sterilization in preventing unwanted pregnancies in Jharkhand.

LIMITATIONS OF THE STUDY

There are several limitations to this study. No analysis has been made of the role of sex preference in fertility differentials. The major factor that influences the desire for more children is the “son preference”. In 2015–16, the actual national use of contraception by married women with two daughters was significantly lower (53 percent) relative to those with one or two sons (68–71 percent). In Jharkhand, 83 per cent of currently married women with two boys and no girls, 79.8 per cent of those with one boy and one girl and 37.5 per cent of those with two daughters wanted no more children. Further research is required to assess the impact of “son preference” which will explain the difference between districts in fertility use and family planning. This research will shed further light on this matter.

Other fertility determinants, such as age at marriage or the rate of abortion were not discussed in this study. Men marry five years later than women on average. 38% of women 20-24 years of age married before a minimum legal age of 18 years, decreased from 63% in NFHS-3. 31% of women 25-29 years of age married before a minimum legal age of 21 years, decreased from 47% in NFHS-3. Changes in marriage are unlikely to play an important role in reducing fertility, as median marriage age is still very low. One potential reason for regulating fertility is the dramatic rise in induced abortions, in particular the self-administration of prescription abortion drugs.

There were inadequate data concerning the provision of family planning services to help us understand why modern methods of family planning are so popular and why Jharkhand has such in adapted traditional methods. This analysis finally did not go beyond the districts level. Sub-district (blocks) research may help gain insight into the best possible approach to action.

CONCLUSIONS

This research gives important insights into Jharkhand's fertility and family planning. There have been substantial decrease in fertility but a lot needs to be done to meet fertility targets, minimize disparity between areas and make family planning for the couple universal. Activities must be appropriately organized both geographically and culturally so that state changes in family planning services and fertility results can be achieved.

Family planning helps women avoid unwanted pregnancy, delay early child birth, and space births at least 2 years apart. In short, addressing the unmet need for family planning decreases fertility rates that contribute to improved health for women and children. Under both cases, the population of Jharkhand would likely rise slowly. State policymakers must also gradually expand access to family planning programs and fulfil the unmet family planning requirement.

The State needs to reflect more on:

- Enhancing access to a broad range of high quality contraceptive products and services.
- Emphasising on spacing methods and promoting spacing between children.
- Assuring greater participation of men in family planning.
- Expanding the health facilities and human capital to focus on the unmet need for family planning.

- Speeding up efforts to tackle socio-economic factors impacting fertility. It includes: raising girl's age of marriage, encouraging more girls to go to schools and generating more job opportunities for women.

There must be concerted efforts to address the unmet need for contraception by supporting existing contraception methods and introducing newer methods and by ensuring that eligible couples have wider access to contraception methods. In addition the favourable implementation of women's empowerment programme, higher rate of participation of women in labour market and dispersed development programmes is considered conducive for the decline in fertility and unmet need for family planning in Jharkhand.

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ANNEXURE

TABLE 4: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.602 ^a	.362	.185	.44726

a. Predictors: (Constant), WEALTH, SC, MUSLIM, URBAN, SCHOOLING

b. Dependent Variable: TFR

TABLE 5: ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	2.043	5	.409	2.043	.121 ^b
Residual	3.601	18	.200		
Total	5.644	23			

a. Dependent Variable: TFR

b. Predictors: (Constant), WEALTH, SC, MUSLIM, URBAN, SCHOOLING

TABLE 6: Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	2.409	.622		3.871	.001		
Urban	-.001	.000	-.765	-2.614	.018	.414	2.414
No schooling	.002	.001	.627	2.112	.049	.403	2.484
Muslim	.000	.001	.091	.349	.731	.525	1.903
SC	.000	.001	.105	.459	.652	.679	1.472
Wealth index	-.001	.001	-.202	-.885	.388	.679	1.473

a. Dependent Variable: TFR

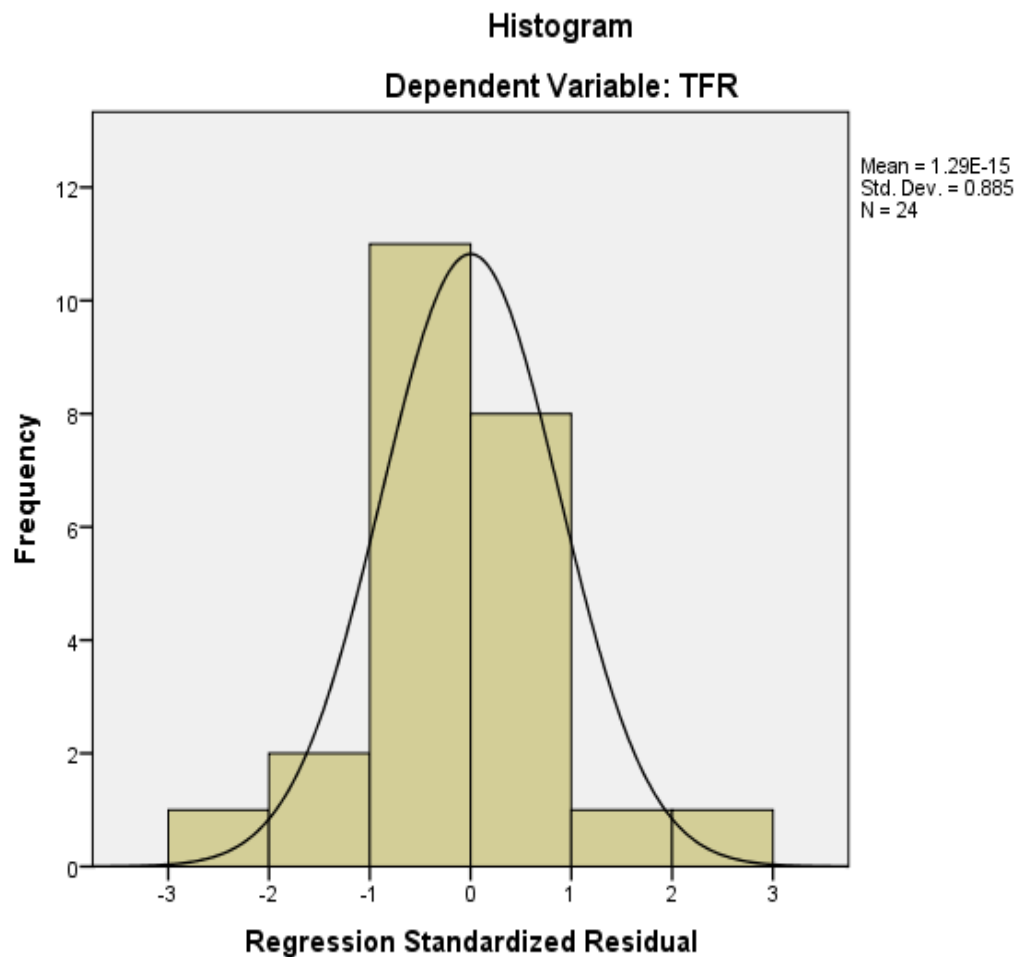


Fig 11: Normal Distribution Curve of Dependent variable

Part II: Online Course on “Data Analytics for Lean Six Sigma”

Course Description:

This course concentrates on techniques for data analysis that are often useful in the development of Lean Six Sigma projects. It describes how the data collected in such a project can be analysed and interpreted. The use of MINITAB as a statistical software is focussed. It illustrates the use and understanding of data analysis tools and interpretation of results. Many examples of the Lean Six Sigma projects are discussed in order to explain all methods.

Objectives of the Course:

The basic objective is to implement a measurement strategy that focuses on improving processes and reducing variations. Lean Six Sigma aims to maximize performance by recognizing and deleting the source of errors by using quality control and statistical instruments. It also minimizes variability.

Course Contents:

Module 1 – Data and Lean Six Sigma

Module 2 – Understanding and visualizing data

Module 3 – Using probability distributions

Module 4 – Introduction to Testing

Module 5 – Testing Numerical Y and Categorical X

Module 6 – Testing Numerical Y and Numerical X

Module 7 – Testing: Categorical Y

Learning Methodology:

Mooc platform – Coursera (Videos)

Key Learnings:

Lean Six Sigma - It is a stepwise method for running a Process improvement project.

A process improvement is required to:

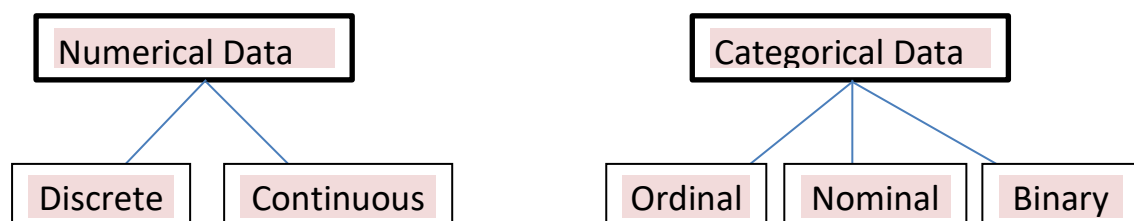
- Find biggest problems
- Diagnose current process
- Investigate effect of improvements

DATA & DMAIC - Lean Six Sigma offers a roadmap known as DMAIC. These five phases proscribe a step wise procedure for process improvement based on measurements and evidence based improvement actions.

Define	Select project and establish objectives
Measure	Make the problem quantifiable and measurable
Analyze	Analyze the current situation and make a diagnosis
Improve	Develop and implement improvement actions
Control	Control the improved process performance and close the project.

MINITAB - It is a statistical software package. It is used by in many organizations by belts executing Lean Six Sigma Projects. It provides an easy, efficient way for statistical information to be entered, manipulated, trends and patterns found and answers to the current problems to be extrapolated. Minitab offers a simple and efficient approach for analysis in most Six Sigma projects.

NUMERICAL AND CATEGORICAL DATA



Numerical (quantitative) data:

Real-valued or whole numbers: 85.3 °C (temperature), 2.12 mm (dimension), 14 people (counts)

- *Discrete*: Variables that can only take integer values, such as counts (number of people, number of mistakes). Variables can also be discrete because of rounding.
- *Continuous*: Values not limited to integers, such as a distance or temperature.

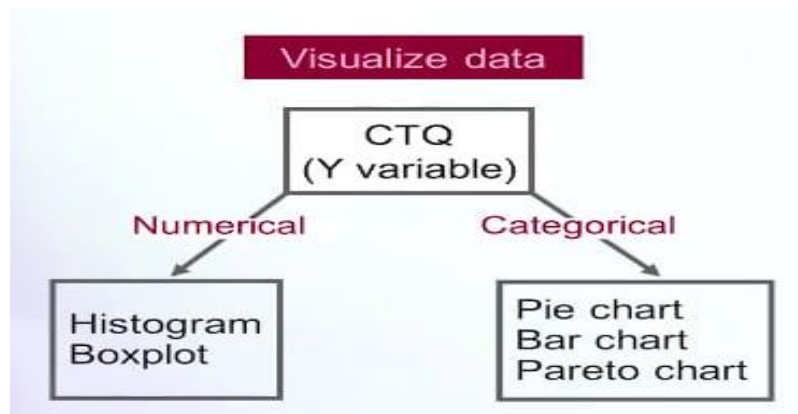
Categorical (qualitative) data:

Subtraction and addition have no meaning

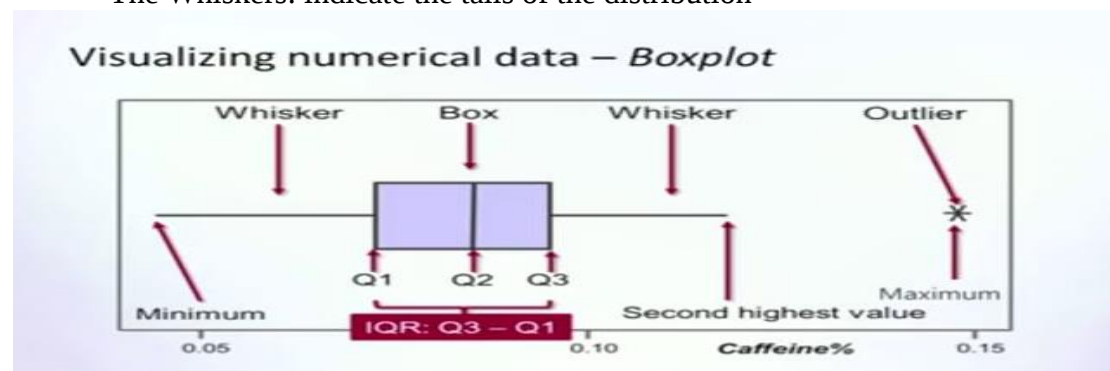
- *Ordinal data (order)*: there is a well-defined order among categories. Example: good, acceptable, critical, reject.
- *Nominal data (nomen = name)*: unordered categories; merely labels. Example: type XO, MM, SW, LS.
- *Binary data (bi = 2)*. Example: pass/fail, positive/negative, ok/nok.

Why make the distinctions between Numerical and Categorical data?

- **Information Density**. Numerical Data contains more information than categorical data. For Categorical data, more observations are required than numerical data.
- It determines which tool one should use.

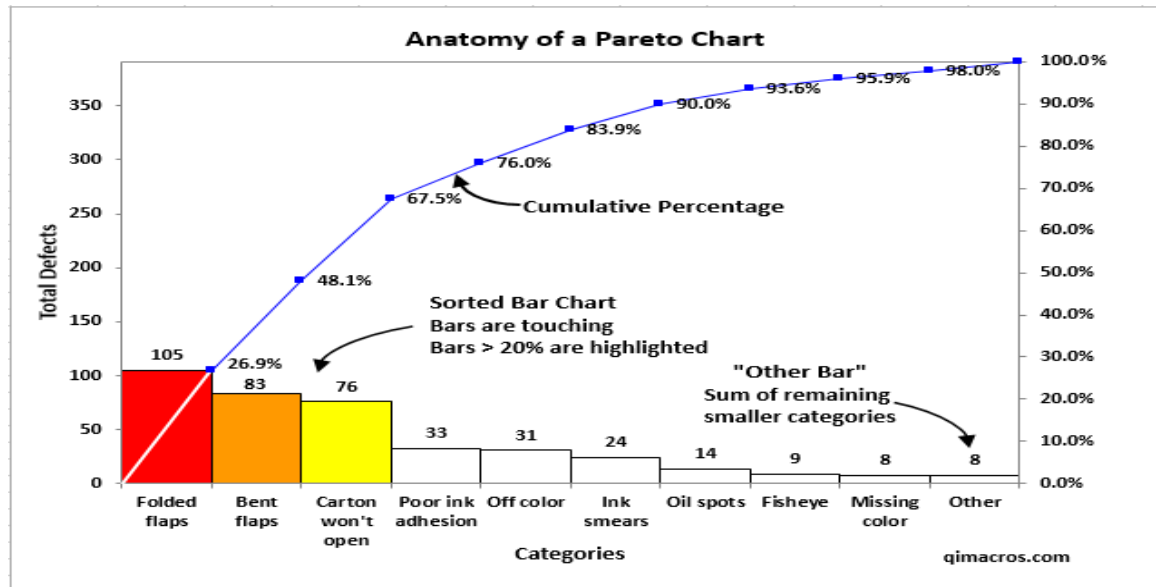
**BOXPLOT –**

- The bulk of the data. Ranges from Q1 to Q3
- The Whiskers: indicate the tails of the distribution



PARETO – ANALYSIS

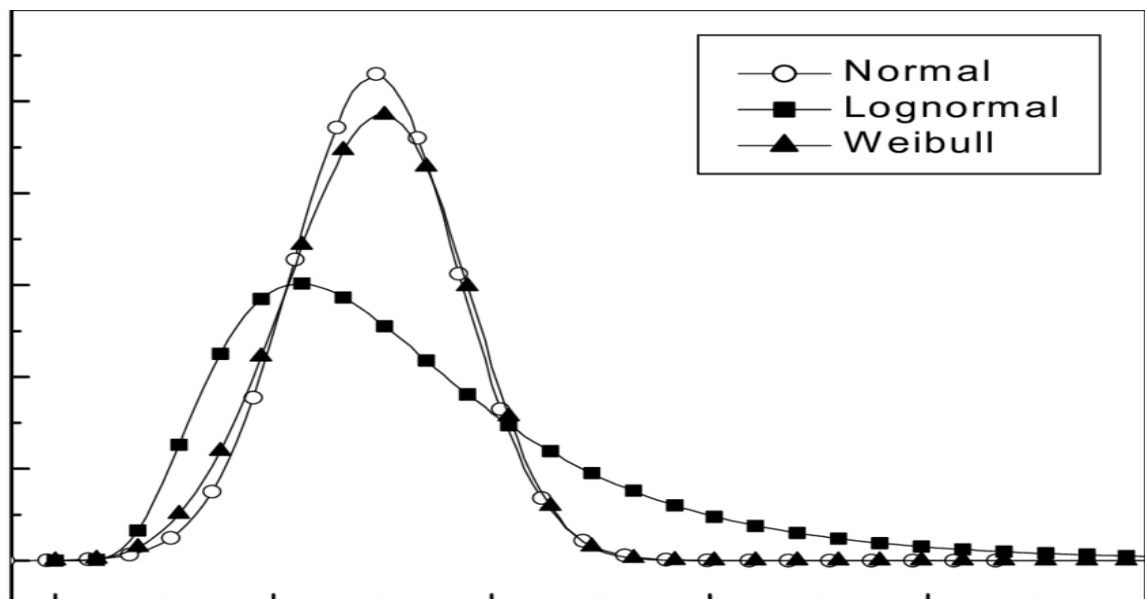
The 80/20 principle, also known as the Pareto Principle. A Pareto chart can help to single out the few vital issues, from the trivial many.



PROBABILITY DISTRIBUTION GRAPHS

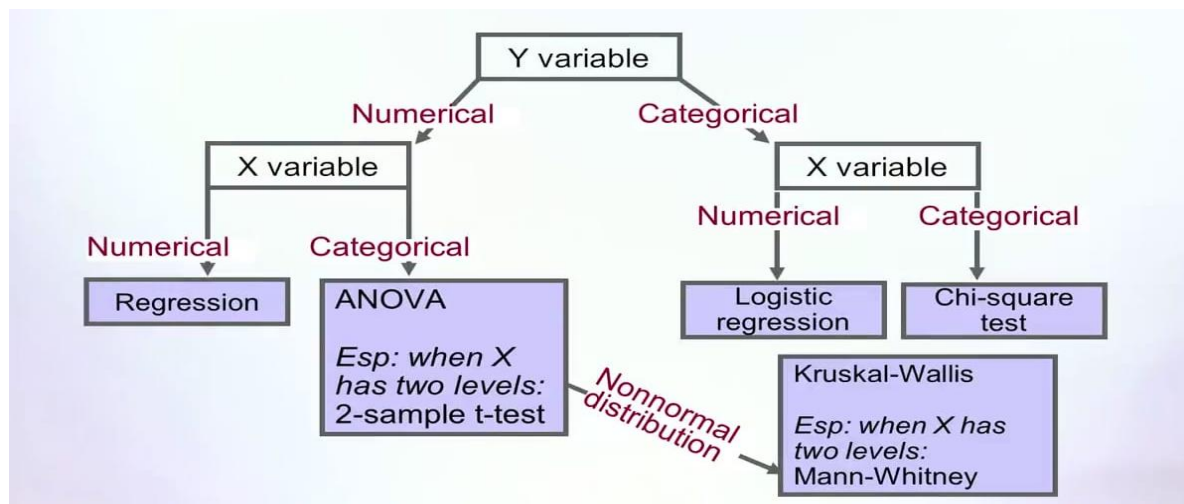
3 Types of Probability Distribution Graphs

- Normal Distribution
- Weibull Distribution
- Log-Normal Distribution



DATA ANALYSIS

Data-based testing of ideas and improvements is one of the principles of Lean Six Sigma. This Principle is sometimes referred to as Evidence-based improvement actions. There are many methods to analyze data. These are ANOVA, Regression, Logistic regression and Chi-square test. These methods depend on the type of data one has. First, we have to determine the influence factor (X) and CTQ(Y). It depends if CTQ and Influence factor are categorical or numerical variables.



Testing: Numerical Y and Categorical X – ANOVA

ANOVA – It is the appropriate statistical technique when the Y variable is Numerical and X variable is Categorical. ANOVA is performed in 3 basic steps. These are:-

1. Organize Data - Organize the data such that the Y and X variables are in the columns

2. ANOVA - Are the groups means identical for each of the levels of the X variable?

3. Residuals - Is the random scatter normal?
Are there outliers or irregularities?

ANOVA Residuals – Residuals are calculated by subtracting the mean of the relevant machine from each observation. (Residual = Measurement – group mean)

KRUSKAL-WALLIS Test

It is a non-parametric test. This means that there is no specific distribution assumed on the residuals. ANOVA is based on assumptions that residuals are normally distributed, and that the residuals contain no irregularities such as outliers. Kruskal-Wallis Test is less powerful than ANOVA as we let go of the assumptions.

Two- Sample t-test

Also known as the student's t-test. It is a method used to compare means of two groups. The p-value can be used to calculate whether the differences of the two mean is coincidental, or truly significant. It is a very old test and forms the building block of many other tests that have been developed since.

TEST FOR EQUAL VARIANCES

Increasing variability always degrades the performance of the production system. This is the law of variability. Compare variances across groups with the test for equal variances. It can also be used for the ANOVA analysis to determine if the 'assume equal variances' mode can be used (p-value will be more precise).

Testing Numerical X and Numerical Y

Correlation: It is an index that expresses how strong a relationship between two numerical variables is. This index is always between minus 1 and plus 1. A correlation of 0 means that there is no linear relationship.

Regression: Regression analysis is about finding the best fitting linear line. A line can be described mathematically by the formula $y = a + bx$. Regression analysis means finding the a and b that gives the best fitting line. Regression analysis consists of four steps.

1. Fitted Line Plot	• Fit a line $Y = a + bX$ that describes the relationship
2. Regression	• Is the evidence for the relationship significant? • Is the relationship strong?
3. Residuals	• Are the residuals normal? • Are there outliers or irregularities?
4. Prediction interval (optional)	• Bounds for 95% of the data points

Testing Categorical Y

Chi-square analysis – It is a suitable method if you have a categorical Y and a categorical X. The first step is to make a cross-tabulation. The second step is to look at the p-value and check if the results are significant.

Logistic Regression – It is used to study the relation between categorical Y and numerical X variables.

It is done in 3 steps:-

First	• Enter data in event/trail format
Second	• Make fitted line plot
Third	• P- Value