ANALYTICAL STUDY OF AWARENESS REGARDING ANTENATAL CARE AMONG REPRODUCTIVE WOMEN IN BARAMATI

A

THESIS

SUBMITTED TO

SHRI JAGDISHPRASAD JHABARMAL TIBREWALA UNIVERSITY

FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

In

Statistics

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2023

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Date: 10-11-2023 Ms. Priti Manohar Mohite

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ABSTRACT

India has a good heritage of health care practice, health tradition and health care technology. All human life on the planet is originated from women. A woman is an important member of the family and she will take care of each family member.With women having an important role in family life and contributing to economic goals, India has a rich history in healthcare. Women's health and engagement in service delivery require special consideration. Antenatal care (ANC) refers to pregnancy related health care by a doctor or health worker in a medical facility or at home. Antenatal care (ANC) plays a pivotal role in ensuring the well-being of both mothers and infants during pregnancy and childbirth. In this thesis, an analytical research that was carried out in Baramati is presented. We require cutting-edge, evidence-based antenatal care methods if we are to realise the Every Woman Every Child vision and the Global Strategy for Women's Children's and Adolescents' Health.

Main objective of this study is to determine how well-informed reproductive women were about antenatal care and how that knowledge affected critical mother and newborn outcomes. According to revised guidelines of World Health Organisation (WHO) this study uses a multidimensional strategy to analyse relevant characteristics related to minimum eight ANC visits, infant weight at birth, and delivery method, including chi-square tests, logistic regression models, and decision tree models. A cross sectional study of reproductive women of sample size 430 in the Baramati region was conducted as the study's first step in order to gather information on their demographics, socioeconomic situation, educational background, and knowledge of antenatal care with the help of well structured questionnaire. The relationships between these characteristics and ANC attendance are investigated using the chi-square test, providing important insights into the variables influencing the use of ANC services. In a further study, logistic regression models were used to examine the determinants of ANC visits while taking into consideration the impact of various variables. The results contribute to the identification of vulnerable groups in need of focused interventions by offering a detailed knowledge of how individual and environmental variables impact the chance of obtaining appropriate prenatal care.

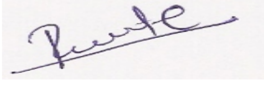
This thesis also examines how ANC affects the two extremely important outcomes, type of delivery and the baby's birth weight. Predictive models for these outcomes were developed using decision tree models, illuminating the intricate

relationship between maternal and neonatal health and awareness of ANC. This study reveals that mother's education, family income, husband's occupation, awareness about ANC, awareness about ASHA workers, distance from ANC centre to home, number of days iron supplement taken, knowledge about danger sign of pregnancy, mother's occupation are significant factors for minimum 8 ANC visits. Living area, gross monthly income, and mother's working status, mother's working type, mother's age at the time of marriage, awareness about ANC, attending ANC mother's weight before delivery, pregnancy period, child order, iron supplement taken are significant factors for new born baby's weight. Whereas mother's education, family type, living area, marriage month, type of earlier delivery, advise of nutrition, mother's weight before delivery, new born baby's weight, ANC service provider, month of first ANC visit, advice about nutritional intake, pregnancy period, mother's weight before delivery, new born Baby weight are significant factors on type of delivery. The study provides a useful tool for healthcare professionals to recognise high-risk pregnancies and customise therapies accordingly by utilising decision trees.

The study reveals a significant disparity in antenatal care (ANC) awareness between rural and urban communities. The majority of women in both urban and rural areas support ANC, suggesting better access to information. However, a higher percentage of women in rural areas believe less than the recommended number of ANC visits is sufficient. The study also highlights a gap in knowledge about Tetanus Toxoid (TT) injections, iron and folic acid supplementation, and the importance of early identification of potential complications during pregnancy. The study also highlights the need for targeted education and awareness campaigns to improve access to emergency services, family planning methods, and reproductive health. Addressing these disparities is crucial for improving maternal and child health outcomes in both urban and rural areas.

The decision tree method, which takes into account variables including number of pregnancies, marriage month, living area, and baby weight, has a 75.58% accuracy rate for detecting earlier delivery type, compared to the logistic regression model's 70.93% accuracy rate. Although the decision tree model performs more accurately than the logistic regression model, other important considerations include complexity, interpretability, resilience, and the nature of the problem. 83.72% of instances of a newborn weight more than 2.5 kg were correctly predicted by the logistic regression model, with significant variables. Tested on the validation dataset, the decision tree model's accuracy is around 79.07%. .We may use a logistic regression model to estimate the weight of a newborn baby since it is generally more reliable and less prone to over fitting.

Overall, the analytical study described in this thesis offers light on the maternal health care, newborn health, awareness about antenatal care among reproductive women in Baramati. In order to enhance ANC visits, maternal and newborn outcomes in the area, healthcare policymakers and practitioners can benefit from understanding the significant factors by including chi-square tests, logistic regression models, and decision tree models. In order to improve the health of both the mother and the foetus, early antenatal care (ANC) visits are essential for recognising risks and resolving difficulties. Women and families may learn about their relevance through door-to-door campaigns, local radio, and community awareness programmes. The study highlights the importance of understanding the duration of pregnant women's iron supplementation to assess compliance with maternal healthcare guidelines.



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NGO	Non-governmental organization
GDP	Gross domestic product
PHC	Primary Health Centre
NHM	National Health Mission
NHP	National Health Policy
MoHFW	Ministry of Health & Family Welfare
NFHS	National Family Health Survey
UT	Union territory
U5MR	Under-Five Mortality Rate
IMR	Infant mortality rate
NNMR	Neonatal Mortality Rate
HDI	Human Development Index
GNI	Gross National Income
UNDP	United Nations Development Programme’s
TFR	Total Fertility Rate
JSY	Janani Suraksha Yojana
IMNCI	Integrated Management of Neonatal and Childhood Illness
WHO	World Health Organization
UNICEF	United Nations Children's Fund
ANC	Antenatal Care
FWP	Family Welfare Programme
MRR	Maternal mortality ratio

SDG	Sustainable Development Goals
NRHM	National Rural Health Mission
S.D.	Standard Deviation
ASHA	Accredited Social Health Activists
CS	Caesarean Section
EDA	Exploratory Data Analysis
OR	Odds Ratio
ML	Machine learning
HB	Haemoglobin
NA	Not Applicable
TT	Tetanus Toxoid
LR	Logistic Regression
SD	Standard Deviation
ANOVA	Analysis of variance
Inf	Infinity
d.f	Degrees of freedom
l.o.s.	Level of Significance

CHAPTER-1
INTRODUCTION

1.1 The Context

In this chapter, both the introduction and the formulation of the research issue are provided. It provides an overview of the situation of maternal health and maternal mortality on a global and local scale. A child and mother's health condition in Maharashtra is also highlighted in this chapter. In addition to this, it examines the variables that influence prenatal health, such as the availability of therapy and the quality of care that is obtained. The topics of factors significantly affect the awareness of antenatal care, type of delivery and new born baby's weight of women's in Baramati are also covered. This chapter provides a historical overview of the development of health of mothers and children in India. Finally, it conceptualizes the study's justification, public health, and health rights.

1.2 Background

The human resource is an essential component in the process of economic growth taking place in a country. It is dependent on the health state of the human resource whether or not the quality of the human resource is high. One of the most important factors that determine the quality of an economy's output is its human capital. India is a country that has a significant population. In point of fact, more than half of our population is comprised of individuals who are part of the working age group; hence, we enjoy a demographic dividend. Without a doubt, the state of Maharashtra is not an exception to any of these emerging demographic trends.

Health care systems are a top priority for governments across the world, and they are always looking for methods to make them more efficient, successful equitable, and responsive. As of right now, there is no general agreement over the most effective structures, contents, or methods of service delivery in order for the benefit of public health. In recent years, however, there has been a growing recognition of the significant role that basic medical treatment plays in contributing to the accomplishment of these goals, which include delivering healthcare that is both affordable and accessible to the entire population. Everyone in a community has access to primary medical care if they take an active role in their own heath. It is provided at a cost that the community and the country are able in order to maintain, and it is provided in a sense of autonomy and self-sufficiency. It is based on techniques and technologies that are not only scientifically valid but also socially acceptable and widely applicable.

Governments all across the world are looking for methods to enhance the responsiveness, fairness, efficacy, and efficiency of their respective health care systems. At this time, there is no consensus about the most effective structures, content, and methods for providing services that are both cost-effective and efficient in order to produce health advantages for people of all ages. Going back a few years, however, there has been a growing recognition of the significant role that primary healthcare plays in contributing to the accomplishment of these goals, which include delivering healthcare that is both affordable and accessible to the entire population. Essential healthcare that is grounded on pragmatic, scientifically valid, and socially acceptable standards is known as basic medical therapy. With everyone's help, it's available to everyone in the community, and it's affordable for the nation and the community to keep up with as they grow, all while fostering autonomy and decision-making.

Research from around the world shows that a country's primary care system has a direct impact on the overall health of its population. This includes measures like total mortality, premature death overall, and cause-specific early mortality from serious respiratory and cardiovascular diseases. This relationship remains statistically significant even after accounting for the larger variables (GDP/capita, total physician-to-population ratio, percentage of the population over 65), micro-level variables (the mean ambulance visits, income per capita, cigarette and alcohol consumption), and so on that affect population health.

The International Institute for Population Sciences has been chosen by the Indian Ministry of Healthcare and the Welfare of Families. It is located in Mumbai, as the nodal organisation that will be responsible for carrying out the National Family Health Survey 5. In every succeeding cycle of the Family Wellness Survey of the major objective has been to offer reliable information on family welfare, wellbeing, as well as any new issues that may arise in these domains. Standards may be established and health sector progress can be evaluated with the use of data from the National Surveys on the Medical Care of Families. In addition to providing proof that the activities that are currently being carried out are successful, the findings of the By determining which populations are in the greatest need of basic services, this study may propose new programmes with a regional emphasis.

Both the federal government and individual state administrations are established under the Constitution's federal system. each have their own operating zones on their respective territories. The Union list, State list, and Concurrent list are three comprehensive lists of subjects that are described in the Constitution's Seventh Schedule. Some items, such as public health, hospitals, sanitation, and other similar topics, are included on the State list. However, the Concurrent list also includes items that have wider national implications, such as family welfare and control of population, health education, the prevention of food adulteration, quality control in drug manufacturing, and other similar categories. To ensure that a number of initiatives in the fields of health and family welfare, prevention and control of serious infectious diseases, and advancement of traditional and a native medical practices are carried out across the entirety of the nation, it is the responsibility of the Union Ministry of Health and Family Welfare to ensure that these initiatives are carried out. This ministry contributes significantly to the successful execution of these programmes. The Ministry also offers technical help to States so they can prevent and manage the spread of epidemics and outbreaks of seasonal diseases. The Ministry of Medical and Family Welfare incurs expenses directly via Central Funds or indirectly through aid payments to non-governmental organisations and other autonomous/statutory entities. In addition to projects funded by the Central Government, in collaboration with the state authorities, the Ministry is functioning to implement a number of international NGO financed projects.

India continues to have fertility, mortality, and morbidity rates that are unacceptable, both in comparison to other nations in the area and to countries with economic levels that are comparable to India's. Despite the fact that poverty and a lack of knowledge are the primary factors, bad management of the health system is also partly to blame. Primary Health Centres (PHCs) are the foundation of India's basic healthcare system. They serve as the foundation of rural health services and are the initial point of contact for patients seeking medical attention from a competent physician. The utilization of health services provided by the Government is a complex behavioural phenomenon. The use of medical facilities is frequently shown to be connected to social structure, health attitudes, and individual user qualities as well as to service availability, quality, and cost, according to empirical research of preventative and curative treatments.

This is the only way that we will be able to achieve the long-term development of the country, and it is only via the supply of comprehensive care for mother and her kid. Within the framework of the National Medical Plan, significant and planned expenditures have been made to promote maternal health. Mothers' health and survival are crucial for addressing significant larger economic, social, and developmental concerns in addition to being significant in and of themselves. Any nation's progress in terms of boosting fairness and lowering poverty depends on maternal health. When we talk about maternal health, we are referring to the state of health that women are in throughout pregnancy, delivery, and the postpartum period. Even though becoming a mother is frequently a happy and satisfying event, for far too many women, it is also a time of pain, sickness, and even death. There are a number of direct a number of factors that related to the morbidity and mortality, the most prominent of which are haemorrhage, infection, hypertension, unsafe abortion, and abnormal labour.

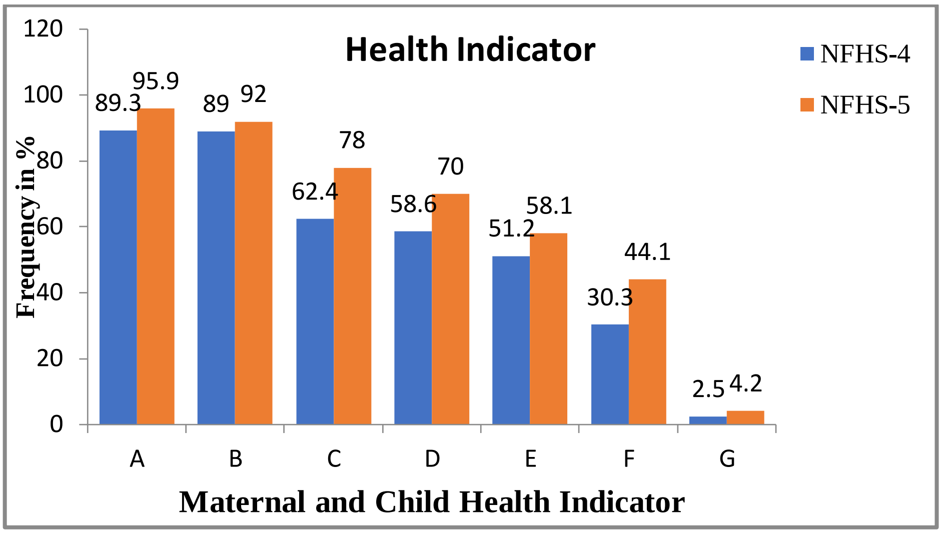
The 5th surveys study in the series of surveys conducted by the NFHS, the Survey 2019–21 (NFHS-5), supplies information on the people of India, wellness, and diet is provided, as well as information on each state and union territory (UT). In the same way that the NFHS-4 does, the NFHS-5 offers forecasts for a number of significant factors at the level of the district.

To facilitate comparisons over time, NFHS-5's material is comparable to NFHS-4's. On the other hand, the National Family Health Survey-5 (NFHS-5) includes a few new topics, such as preschool education, handicap and access to a restroom, death registration, menstrual hygiene practises, and techniques and grounds for abortion. Measurements of the waist and hip circumference have been added to the list of clinical, anthropometric, and biochemical testing (CAB) procedures. This expansion brought to the addition of these measurements. In addition, the age maturity range that may be tested for blood pressure and blood glucose has been broadened. The testing for HIV, on the other hand, has been suspended. For the purpose of providing estimates of a number of survey variables at the national, state, and district levels, the (NFHS-5) sample has been developed. The estimations of the indicators of sexual behaviour, history of the husband's financial situation and wife's employment, knowledge, attitudes, and behaviour related to HIV/AIDS, in addition to violence inside the home, are only accessible at the federal level and at the state/UT level. A decision to work with the International Institute for Population Sciences was made by the department of the Ministry of Family and Medical Welfare of the Government of India, which is located in Mumbai, as the nodal organisation that will be responsible for carrying out the National Family Health Survey 5. In every succeeding cycle of the NFHS, a primary goal or purpose has been to offer data of a high quality on family welfare, health, and newly emerging concerns in these areas. Setting standards and assessing the development of the health sector over time will benefit from the NFHS-5 data. In addition to providing proof that the activities that are currently being carried out are successful, the findings of the National Family Health Survey help to suggest the requirement of new programming that includes a focus on a particular region and the identification of populations who are in the greatest need of basic services.

In order to collect information on all of the regular members of the household, overnight guests, and the socioeconomic status of the household, as well as information on hygiene, water quality, and health insurance, disabilities, ownership of real estate, the number of deaths that occurred within the household in the three years prior to the survey, and the possession and use of mosquito nets, the Household Schedule was utilised. A wide range of topics were covered in the Woman's Schedule, such as the qualities of women, marriage, reproduction, methods of contraception, children's immunisations and medical care, dietary habits, fertility, sexual behaviour, HIV/AIDS, women's empowerment, and domestic violence. Each of these topics was covered in detail. In the Man's Schedule, information was provided about the man's qualities, including his marriage, the how many of children he had, his use of contraception, his preferences for reproductive therapies, his diet, his sexual behaviour, his health problems, his perspectives on gender roles, and his HIV/AIDS status. Measurements of children's height, weight, waist circumference, and hip circumference were included in the Biomarker Schedule. Additionally, haemoglobin levels were also taken into consideration. It also included measurements of women's and men's blood pressure as well as random blood glucose levels for those who were 15 years of age and older.

The results for the 17 states are shown in the tables and figures that follow. These findings pertain to indicators including population, health and nutrition, access to infrastructure, and gender.

Figure 1.1: Maternal and Child Health Indicator across NFHS-4 and NFHS-5



A: Registered pregnancies

B: Tetanus protection for newborns is provided by the last birth.

C: Received PNC from health Care (%)

D: During the first trimester, mothers attended ANC (percentage).

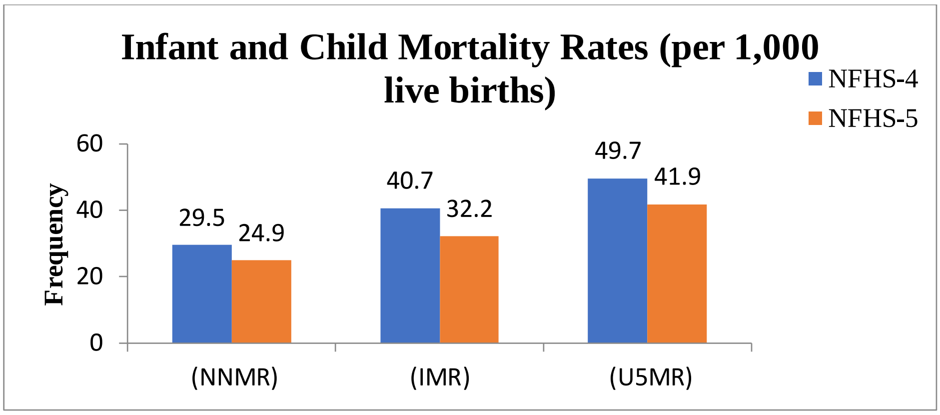
E: Mothers attended at least 4 ANC visits (%)

F: Administration of supplementation with folic acid and iron levels for duration of 100 days during pregnancy.

G: Infants delivered at home but sent to a healthcare centre within 24 hours after delivery.

Above figure indicates that registered number of India's pregnant occurrences in NFHS-4 (2015-16) was less than NFHS-5 (2019-21). The number of infants immunised against neonatal tetanus in India was lower in NFHS-4 (2015-16) compared to NFHS-5 (2019-21). Women’s received prenatal care from health Care (%) of India was increased in NFHS-5 (2019-21). The percentage of women who attended ANC in the first trimester was lower in NFHS-4 (2015-16) compared to NFHS-5 (2019-21), as was the percentage of mothers who attended at least 4 ANC appointments. Following the NFHS-5 (2019-21), it was noted that the dietary supplement that contains vital organic substances of 100 days during pregnancy had risen in comparison to NFHS-4 (2015-16). The number of infants delivered at home but subsequently taken to a healthcare institution within 24 hours of delivery has reduced in the NFHS-5 in comparison to the current NFHS-4.

Figure 1.2: Infant Child Mortality Rate (per 1000 Live Births)



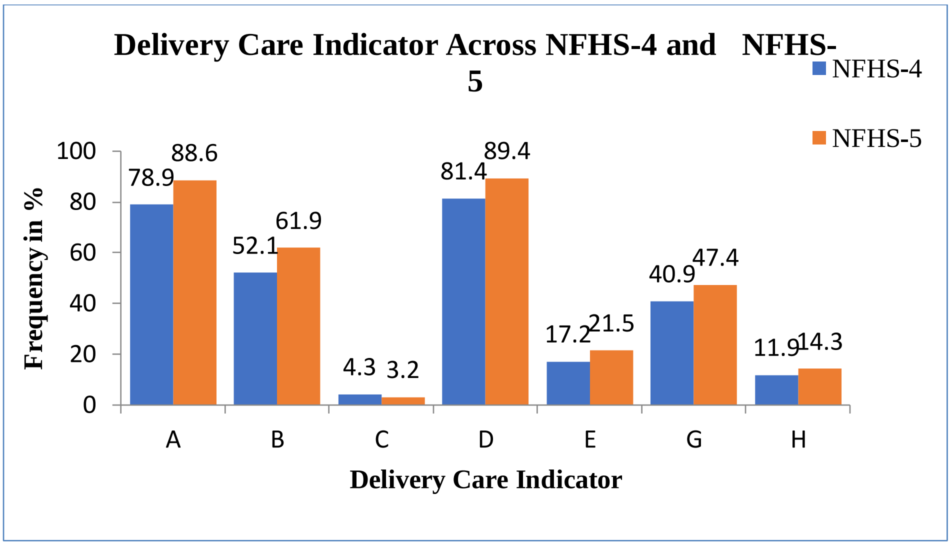
NNMR: Neonatal Mortality Rate

IMR: Infant mortality Rate

U5MR: Under-Five Mortality Rate

It can be observed that, Infant mortality rate (IMR), Neonatal Mortality Rate (NNMR), Under-Five Mortality Rate (U5MR) were decreased in NFHS-5 compared to NFHS-4.

Figure 1.3: Delivery Care Indicator across NFHS-4 and NFHS-5



A: Births that have place in hospitals (%)

B: Births that take place in public facilities and institutions (%)

C: Deliveries at home that were performed by professional health personnel.

D: Assisted deliveries by trained medical professionals.

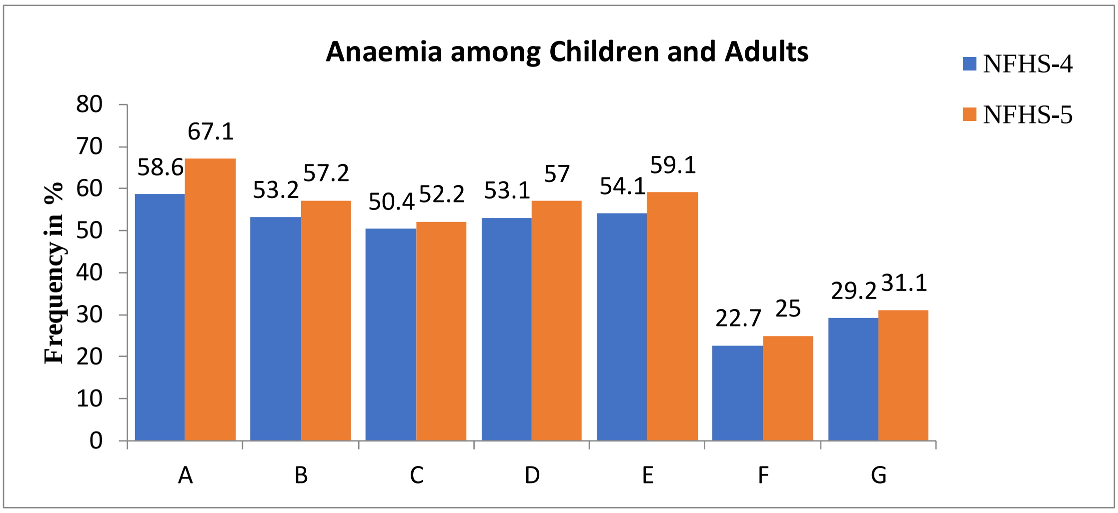
E: Caesarean section births (%)

F: Caesarean sections performed in a private hospital (%)

G: Delivery via caesarean section at a public health institution (%)

Proportion of births occurring in institutional settings, namely in public facilities, when comparing NFHS-4 with NFHS-5, it is evident that the former had a lower number of births attended by competent health workers, C-section deliveries, births in private health facilities, and births in public health facilities. The proportion of home births attended by qualified healthcare professionals rose in NFHS-4 compared to NFHS-5.

Figure 1.4: Anaemia among Children and Adults



A: Anaemic babies aged 6–59 months.

B: Non-pregnant women in reproductive age.

C: Anaemic pregnant ladies (15–49 years old).

D: The percentage of women suffering from anaemia between the ages of 15 and 49.

E: All women between ages 15-19 years who are anaemic (%)

F: Anaemic men between the ages of 15 and 49

G: Men age 15-19 years who are anaemic.

In the NFHS-5, there were significantly more males aged 15–49 than in the NFHS-4. Similarly, there were significantly fewer non–pregnant female, pregnant women in the reproductive age group, total females aged 15–49, females aged 15–19, and the percentage of children aged 6–59 months.

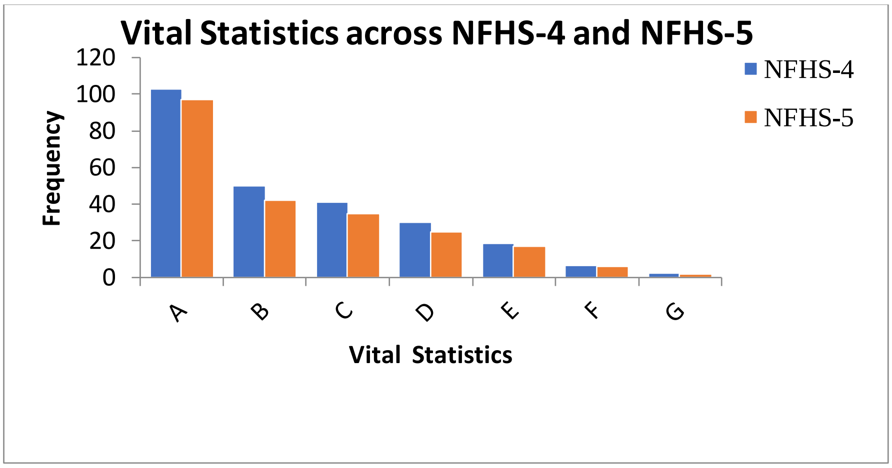
1.3 Status of Health in India

The Human Development Index (HDI) is a measurement of a nation's average level of success in accordance with three important aspects of prosperity, education, and a healthy and long life span for all people. These are the three fundamental aspects of human development, the total income of the nation per capita, mean years of schooling, predicted years of schooling, and life expectancy at birth are the four indicators used to create the Human Development Index. Out of the 191 nations that make up the globe, India's rating has dropped from 130 in 2020 to 132 in 2022, as previously stated in the Global Human Growth and Development Report 2021–2022, which was published by the development initiative of the United Nations. The status of health indicators in India is shown in following table:

Table No.1.1: Vital statistics across NFHS-4 and NFHS-5

Sr. No	Indicator	NFHS-4 (2015-16)	NFHS-5 (2019-21)
1	Maternal Mortality Rate (per 1,00,000 live births)	103	97
2	Childhood Death Rate (per 1000 live births)	50	42
3	Rate of Infant Death (per 1000 live births)	41	35
4	Rate of Neonatal Death (per 1000 live births)	30	25
5	Raw Birth Rate (per 1000)	18.8	17.1
6	Rate of Crude Death (per 1000)	**6.4**	**6**
7	The Rate of Total Fertility	**2.2**	**2**

Figure 1.5: Vital Statistics across NFHS-4 and NFHS-5



A: Maternal Mortality Rate (per 1,00,000 live births)

B: Under age 5 Mortality Rate (per 1000 live births)

C: Infant Mortality Rate (per 1000 live births)

D: Neonatal Mortality Rate (per 1000 live births)

E: Crude Birth Rate

F: Crude Death Rate

G: Total Fertility Rate (TFR)

Maternal Mortality Rate of India (per 1,00,000 live births) in NFHS-4 (2015-16) was higher than NFHS-5 (2019-21). Under-five Mortality Rate (per 1000 live births), Infant Mortality Rate (per 1000 live births), Neonatal Mortality Rate (per 1000 live births), Crude Birth Rate (per 1000), Crude Death Rate (per 1000) and Total Fertility Rate (TFR) of India in NFHS-4 (2015-16) were higher than NFHS-5 (2019-21).

1.4 Need for good health care infrastructure in INDIA

Many primary healthcare clinics (PHCs) lack the most basic infrastructure, including clean labour rooms for childbirth, regular power, beds, rooms, toilets, and drinking water amenities. There are a total of 3966 PHCs in the tribal area and 5439 PHCs in urban regions, according to the Rural Health Statistics from MoHFW 2021.

Economic growth and population well-being are both significantly influenced by people's health, which is also one of these factors. Since the beginning of the twenty-first century, there has been a significant amount of attention paid to the efficiency of the public healthcare system in the country, as well as the relevance of health as a means of increasing the economic growth and development of a nation. The majority of developing nations have made improving population health a top priority for a very long time (WHO, 2000). Health is now recognised as a crucial factor in a country's development, rather than as the process' final result. The connections between development, a healthy workforce, and the elimination of poverty are widely known.

Comprehending a nation's welfare system and health care strategy begins with comprehending its health infrastructure. It denotes the importance of investment in the development of healthcare facilities. When paired with the widespread poverty that exists in the country, India is confronted with significant challenges. One of the world's most populous countries is India. The tropical environment of the country, which is both a blessing and a curse because it supports agriculture but also creates a breeding ground for illnesses, is to blame for the country's topographical difficulties. When we discuss health infrastructure, the emphasis is on developing material capacity in the area of public health delivery mechanisms rather than just discussing the results of a country's health policy.

The majority of hospitals lack good personnel planning, which underutilizes resources. The hospital's administrators must make sure that the existing personnel in the various departments have been assigned in a way that takes into account their workload and complies with established standards. To manage hospitals efficiently, managers need to conduct regular analyses of how they operate.

Despite having several governmental and private hospitals, clinics, dispensaries, and health centres as well as NGOs and philanthropic organizations. The demands of India's 1.4 billion people have been unmet by the country's healthcare system. Due to changes in the population and epidemiology, environmental degradation, newly developing infectious illnesses, and antimicrobial resistance, new public health issues arise in India every year. Despite this, India's health care infrastructure is unable to meet these new difficulties. This is due to the fact that the delivery system is not functioning at its full capacity and is not based on the requirements of the population at the present time.

The current health care situation offers numerous opportunities, but if handled improperly, it may cause a lot of issues. Data are now used more and more in healthcare. The difficulty comes from handling this enormous data sea. According to a paper in Frontiers in ICT, providers and health care systems were already producing about 80MB of data per patient year before the epidemic. In addition to information stored in electronic health records (EHRs), this data also consists of administrative information such addresses, demographics, information about insurance policies and claims, payment history, and appointment scheduling?

India's healthcare institutions struggle with several operational issues. These include a lack of funding for drug supplies, diagnostic tools, lab equipment, urinals, latrines, bathrooms, ambulances, phones, fax machines, etc., and they are all in very bad shape, which is a very sad reflection on how well health centres function and a general deterioration of physical infrastructure. Another issue is the lack of sufficient hospitals and medical professionals. According to HDR 2020, there are only 8.6 doctors and 5 beds for per 10,000 people in India. This amply illustrates how inadequate India's health infrastructure.

1.5 Women's Health

Women's health is a universal issue that cuts beyond national borders and includes a woman's physical, mental, and social wellbeing. Women's health is becoming more widely acknowledged as being important to both public health and sustainable development in recent years. Understanding the situation of women's health globally depends on a number of global issues.

India has a good heritage of health care practice, health tradition and health care technology. All human life on the planet is originated from women. As one of the nations with the greatest population, India has special advantages and disadvantages when it comes to the well-being of its female citizens. The lady is an essential component of the family, and she is the one who will look after all of the other members of the family. The women's health and her participation in the delivery of services have a direct bearing in achieving the economic target set by the various countries. So there is special attention is required to take care of women's health.

In particular throughout the reproductive years, maternal health is a crucial component of women's health. With differences in access to prenatal care, competent delivery attendance, and postnatal care, maternal mortality is still a problem on a global scale. Targets have been set for lowering maternal death rates and enhancing maternal health outcomes by organizations like the World Health Organization (WHO). Women have obstacles while trying to receive healthcare services, particularly prenatal care, in many regions of the world because of things like geographic isolation, socioeconomic position, and cultural conventions. This makes it more difficult to identify and treat pregnancy-related issues early on.

A nation with a large female population has special possibilities and problems when it comes to maternal health care. The lady is an essential component of the family, and she is the one who will look after all of the other members of the family. Because of these trends, the worldwide nutrition aim of halving the prevalence of anaemia in women of reproductive age by the year 2025 or 2030 (indicator 2.2.3 of the Sustainable Development Goals) is expected to be met by a lower number of nations. Additionally, there is a need for additional efforts to be made in order to decrease anaemia on a worldwide scale. From 2016 to 2022, the amount of reproductive-age women who would have their family planning needs met by modern methods of birth control improved from 76.8% to an expected 77.6%. This represents a significant increase. Inequity in access to reproductive and maternal health services is evident on a national and international scale, since low-income and other discriminated women are much less likely to get these services than their more privileged peers. For instance, the majority (97%) of unsafe abortions take place in underdeveloped nations, with Africa having the greatest death rates and the proportion of least safe abortions. Gender equality is indicated by the maternal mortality rate. Deaths and injuries that women and girls eventually suffer during pregnancy and delivery are often attributed to the "three delays": the time it takes to seek proper medical attention, the time it takes to get to an acceptable good health institution, and the time it takes to obtain adequate care while at a facility. These delays are caused by a variety of human rights issues, and discriminatory actions feed the underlying issues that hinder women from getting the resources they need.

The time immediately after the baby's birth and lasting for up to six weeks (42 days) is referred to as the postnatal period in this context. This period is an important for female, new moms, husbands, parents, carers, and families throughout this period. Yet, over this time, chances to improve maternal well-being and promote nourishing infant care have not been fully taken advantage of, and the continuing high rates of maternal and newborn morbidity and death are unacceptable. The entire range of care for mothers, newborns, and children must include afterbirth services. These services are important in order to accomplish the Sustainable Development objectives (SDGs) pertaining to reproductive, maternity, and child health. These objectives include the decline in the rates of maternal death and the elimination of baby deaths that are not necessary. With the ultimate objective of enhancing mother and the welfare of infants, WHO developed international recommendations to enhance the quality of necessary, regular after delivery care for women and babies? Ensuring women's reproductive rights, including the right to make informed choices about family planning, contraception, and safe abortion services, is crucial for their health and well-being.

Detailed guidelines for treatment after childbirth are included in the World Health Organization's guidelines. These recommendations focus on the fundamentals that all new mothers and newborns should get, while also paying proper attention to the standard of care, which includes the delivery of care and the experience of receiving care. Implementation tools are being developed by the World Health Organisation (WHO) to provide assistance to countries in the process of following the recommendations and in analysing the services that are already available in order to discover ways to enhance support for expectant moms and their infants. The WHO is the host organization for the Partnership for Maternal Newborn & Child Health (PMNCH), an alliance with more than 1300 member organizations spread across 192 nations. The Women's, Children's, and Adolescent Health Accountability Working Group offer suggestions to improve integrated accountability initiatives. The PMNCH collaborates with organizations like WHO, UNICEF, and Countdown to 2030 to standardise the worldwide reporting of maternal, paediatric, and adolescent health. PMNCH also oversaw the creation of the Protect the Promise 2022 progress report, which was unveiled at the World Health Summit 2022 in Berlin. The Every Woman Every Child Global Advocate also uses the report to submit reports to the UN Secretary-General.

According to the NFHS study from 2015–16, there were 991 females for every 1000 males. However, there will be 937 female births for every 1000 male births in 2020–21.In India, rates of maternal mortality and morbidity have decreased over time, yet there are significant differences between states and regions. To enhance maternal and child health outcomes, the government has started programmes like the National Health Mission (NHM). Regional variations in India's healthcare infrastructure result in uneven access to high-quality medical treatment. The accessibility of healthcare facilities, especially prenatal care services, is a problem that typically affects rural communities. In India, women's health is significantly influenced by socioeconomic position. Women's access to healthcare and prenatal care services may be hampered by poverty, illiteracy, and a lack of knowledge. Women's choices about antenatal care and family planning might be influenced by cultural norms, traditional beliefs, and social practices. These elements may help or restrict women's access to critical medical treatments. The Indian government has put in place a number of programmes and policies, such as prenatal care awareness, to address concerns related to women's health.

1.5.1 Pregnancy

A pregnancy is a unique and life-changing experience that is marked by the growth and care of a new life inside her body. This 40-week-long natural process, which includes a number of physiological and emotional changes, results in the birth of a child. Here, we'll go into great detail on pregnancy, prenatal care, and the significance of this profoundly transformative event. Even though they are times of increased vulnerability for both mothers and their unborn children, pregnancy and delivery are crucial life events for women and their families across the world. [2]

There are over 800 women who lose their lives every single day due to avoidable causes that are related with pregnancy and delivery. Countries with low or lower middle incomes account for 99 percent of these maternal fatalities. Despite the fact that tragically high rates of deaths among mothers persist in sub-Saharan Africa, they have fallen by more than 40% from 1990 levels by 2015[Okedo-Alex et. Al 2019]. Due to the many changes that occur while pregnant, which are driven by a variety of hormones and their numerous interactions and affects on bodily tissues, pregnancy is a highly intriguing condition from a medical perspective. An important demographic group with elevated nutritional needs is pregnant women. There is a significant influence that pregnancy, which is one of the most significant stages of a woman's life cycle, has on the physiological and social repercussions that the infant will experience. The socioeconomic and nutritional condition of pregnant women significantly influences the pregnancy outcome in various areas.

1.5.2 Stages of Pregnancy

First Trimester (Weeks 1-12):

Important developments during the first trimester of pregnancy include embryo development, placenta development, and early organ system and body system stages, causing symptoms like exhaustion and breast soreness.

Second Trimester (Weeks 13-27):

The relief phase of pregnancy, or the second trimester, lasts from weeks 13 to 27 and relieves certain first-trimester symptoms. The fetus's motions are becoming apparent as it continues to develop quickly. Many women report feeling more energised and having a noticeable baby bump.

Third Trimester (Weeks 28-40):

The fetus experiences tremendous growth and development in the third trimester. The growing baby's size may cause additional discomfort for the mother. Heartburn, backaches, and frequent urination are typical symptoms. With regular prenatal checkups, it's a period of pregnancy preparation. Numerous physical transformations occur throughout pregnancy as the body adjusts to accommodate the developing foetus.

1.5.3 Factors Affecting on the Results of Pregnancies

Numerous variables, such as biological, medical, lifestyle, and social determinants, might affect how a pregnancy turns out. These factors have the potential to influence pregnancy in both positive and negative ways, so influencing a mother's health as well as the health of the kid that is still in the womb. For the purpose of encouraging healthy pregnancies and enhancing mother and newborn outcomes, it is crucial to comprehend these aspects. Maternal Age, Maternal Health Status, Nutrition and Diet, Prenatal Care, Lifestyle Factors, Environmental Factors, infections and diseases, Multiple pregnancies, social Determinants, Healthcare Quality and Access, maternal behaviour, psychological Factors etc, these factors significantly affect on pregnancy output. It's crucial to understand that many of these elements are interconnected, and that treating one of them may benefit the others. To get the best results for mother and baby health throughout pregnancy, healthcare professionals are essential in identifying and controlling these issues. Public health programmes and policies can also improve prenatal care generally and lessen negative pregnancy outcomes on a larger scale.

Among the factors that the committee on maternal nutrition has identified as being significant in the number of children that were born with a birth weight that was low and the associated neonatal mortality, history of failed pregnancies, financial circumstances, biological immaturity, high equality, small stature, low pregnancy weight for height, low growth in weight throughout pregnancy, poor nutritional status, smoking, some infectious agents, chronic illnesses, difficulties of pregnancy, and a history of previous pregnancies are all factors that may contribute to premature birth are among the factors that have been cited.

1.5.4 Maternal Health

When we talk about maternal health, we are referring to the state of health that women are in beginning with pregnancy and continuing through birth and after delivery period. The health of mothers is an essential component for the growth and development of any nation, particularly with regard to the reduction of poverty and the promotion of fairness. The survival and well-being of women are not only vital in their own right, but they are also crucial to the solution of bigger difficulties in the areas of economics, society, and development. In order to ensure the health and well-being of women and their children, maternal health care services are very necessary. These services also have an impact on the total population, as well as the health and nutritional condition of the population. In this part, we will discuss the utilisation of care throughout pregnancy, care during birth, and care post delivery by women who reported having their youngest child born during the last five or so years before to the survey. It also demonstrates the degree to which males are involved in the care of mothers and their children.

For the purpose of ensuring that both the mother and the unborn child accomplish their best potential in terms of their health and well-being, it is essential that each stage be considered joyful. In spite of significant advancement over the past 20 years, 287 000 women will die during or shortly after giving birth in 2020. Simply said, this amount would be excessive. Excessive bleeding, an infection, high blood pressure, botched abortions, and obstructed delivery are the most frequent direct causes of maternal injury and death. Other direct causes include abortions that are unsuccessful. In addition to indirect variables such as anaemia, malaria, and heart disease, these are the most common direct causes. With prompt intervention by a qualified health practitioner serving in a supportive environment, the majority of maternal fatalities may be avoided. To increase equity and decreasing poverty, maternal health is a crucial component of every nation's growth. Mothers' survival and well-being are crucial for addressing larger economic, social, and developmental issues in addition to being significant in and of themselves. Health and well-being of mothers and their children, as well as the general population's health and nutritional condition, depend on maternal health care services. This section details the prenatal, delivery, and postnatal care that was used by females who said that they had their most recent child during the five years prior to the study.This indicates the extent to which males are involved in meeting the requirements of women throughout their pregnancy. The eradication of maternal fatalities that are not considered to be required must continue to be a top goal for the whole globe. On the other hand, just surviving pregnancy and birth is not sufficient to serve as a standard for determining whether or not maternal health care is beneficial. It is vital to expand the number of interventions that are focused at avoiding maternal damage and impairment so as to make improvements to health and people's overall well-being.

It is impossible to generalise about pregnancy and delivery. It is vital to address imbalances that have an influence on health outcomes, especially those linked to sexual and reproductive health and rights and gender, in order to ensure that all women have access to maternity care that is both respectful and of the highest quality.

To elevate the standing of women in society, improved maternal health is a crucial precondition. However, a major issue is the poor utilisation of and access to maternal healthcare services, especially among women living in rural areas, making them vulnerable and neglected. Fortunately, there has been a noticeable improvement in mothers' wellbeing during the previous ten years. This advancement can be attributed to a multifaceted strategy that improves maternal and child care practises, encourages better nutrition during pregnancy, and ensures greater accessibility to high-impact, low-cost public health interventions like treatment using oral rehydration and vaccines designed for both mothers and children. These developments highlight the significance of ongoing efforts to bridge the gender gap and indicate a potential trajectory towards protecting the health and empowerment of women**.** According to the International Health Organisation specific interventions, such as malaria prophylaxis measures such as insecticide-treated nets (ITNs), the implementation of dietary supplementation for pregnant or lactating mothers, iron or folic dietary supplementation. for pregnant and postpartum women, vitamin A supplementation for children and after childbirth women, intermittent preventive treatment during pregnancy, and dietary supplementation for women who are pregnant or have recently given birth have all contributed to improvements in baby and maternal health services. [Gladys BuruwaaNuamah et.al. 2019].

1.5.5 Maternal and Child Health in India

A research that was conducted by the globe Health Organisation (WHO), the United Nations Children's Fund (UNICEF), and the United Nations Population Fund (UNFPA) and released earlier this year under the title "Improving maternal and newborn health and survival and reducing stillbirth progress report 2023" found that India was responsible for around 17% of all fatalities among mothers and newborns, as well as stillborn babies that occurred throughout the globe. Among that 24 thousand deaths are maternal death, 2 lakh 97 thousand are stillbirth and 4 lakh 68 thousand are neonatal death. Indian women's maternal health status was found to be worse than that of women in other affluent nations. Within the framework of the Plan for the Welfare of Families implemented by the India's Central Government, one of the most essential aspects has been the promotion of the health of mothers and babies from the beginning of this initiative. The country has to enhance MCH Care in order to experience sustained growth and development. To lower child and maternal death rates and to meet the millennium development objectives, safe motherhood via high-quality prenatal care (ANC) is crucial. [Patel, B. B et al. 2016]**.**

'Improving Maternal and Newborn Health and Survival and Reducing Stillbirth Progress Report 2023,' which was recently issued by the World Health

Organisation (WHO), the United Nations Children's Fund (UNICEF), and the United Nations Population Fund (UNFPA), has put light on the continued issues that are faced by the healthcare system in India for both mothers and newborns. According to the report, India's share of the total fatalities among mothers and newborns, as well as dead babies stands at a significant 17%. In India, there will be 788,000 deaths overall in 2020. Of them, 24,000 will be related to maternal mortality, 297,000 will be stillbirths, and a tragic 468,000 will be neonatal deaths. These findings demonstrate the critical need for continuous, reinforced programmes to enhance maternal and newborn healthcare in India. The study serves as a potent wake-up call for decision-makers, healthcare professionals, and other stakeholders to prioritise comprehensive policies and initiatives aimed at bringing down these worrisome figures and, ultimately, safeguarding the health and wellbeing of Indian mothers and their newborns.

More initiatives have been launched globally to improve national medical care frameworks. Expanding coverage is possible via programmes that aim to enhance care for mothers and lower obstacles to using various efforts by integrating work across the six components of the health systems. Therefore, enhancing service delivery is crucial to reducing maternal mortality, which is still a pressing issue that has to be addressed by health systems worldwide in poor nations. 99% of the daily fatalities of 800 women take place in underdeveloped nations.[Wairia, S. K.et al. 2016]. Maternal health is important for women's empowerment and social standing, yet women are vulnerable due to limited access to healthcare services, particularly in rural regions. There have been a variety of variables that have contributed to the improvement of mother health outcomes during the last 10 years. These factors include improved methods of child raising, enhanced prenatal nutrition, and public health efforts that are more easily accessible and more reasonably priced. However, a 2008 research in Zaria, Kaduna State, Nigeria, found that those of the reproductive years, including women and men had little understanding of and awareness of maternal health. The optimal usage of maternal health care is shown to be constrained by socioeconomic factors, low levels of education, and community perceptions of treatment quality. Raising female health care knowledge and enhancing the standard of care at nearby institutions are necessary to promote reproductive health in rural regions [Butawa, N. N.et al. 2010]. The Family Welfare Programme (FWP) in India encompasses a broad range of services, including those pertaining to concerns pertaining to the health of mothers and her baby, in addition to those pertaining to sterilisation. This programme, now in its fifth decade, was created to offer men and women combined preventive, promotional, and curative treatments. Within the framework of the Family Welfare Programme (FWP), the majority of medical attention for mothers and kids is delivered in places that are rural in India via primary health facilities and sub centres that are operated by the government. ANMs (auxiliary nurse midwives), who are female health professionals, offer maternity and child health care in the communities. In reality, a sub centre is frequently an addition to the ANM's home. The ANM is responsible for evaluating pregnant women's health at any point throughout their pregnancy, whether in their homes or at a prenatal clinic. The ANM must send pregnant women to the main health facility if the difficulties they experience are beyond the scope of the health worker's expertise or available resources. However, those facilities only have a limited amount of resources, including the ability to provide prenatal and postnatal care. [By Zoe Matthews et. Al.2001]**.** Antenatal care (ANC) opens the door to the possibility of fostering a joyful pregnancy experience and enhancing the chances of survival for both the mother and the child. Given that it falls inside the crucial "1000 days" window, prenatal care is equally crucial to the child's long-term growth and development. By acting as a bridge between the individual, her family, and the medical system are all individuals involved, it has the potential to facilitate a better utilisation of essential services such as postpartum family planning, child immunisation, nutritional counselling, and breastfeeding advice. [Gunman Kumar et. Al.2019].

1.5.6 Maternal Health in Maharashtra

According to national family health survey (NFHS-5)(2019-21) throughout the course of the five years prior to the study, 90% of last pregnancies in Maharashtra ended in a live birth, with miscarriage being the most common type. Abortion accounts for 4% of all pregnancies, with unplanned pregnancy (43%) and complications (17%) being the main reasons for seeking abortions. Medications account for 57% of all abortions procedures, while manual vacuum aspiration accounts for 11%, and other surgical procedures account for 26% of all abortions. It is estimated that the private health sector was responsible for the vast majority of abortions, whereas the public health system was responsible for just sixteen percent of abortions.

In Maharashtra, 90% of abortions are carried out by medical professionals. Among young ladies between their teenage years of 15 and 19, 8% have already begun childbearing, which is almost the same as in NFHS-4. If all women in Maharashtra had just the quantity of children they desired, the overall fertility rate would have been 1.4 children per woman, which is much lower than the present level of 1.7 children per woman. Unplanned pregnancies are very prevalent in the state of Maharashtra.

During the first period of pregnancy, more than seventy-one percent of women got prenatal care, and seventy percent of those women had four or more visits to antenatal care. Those who lived in urban areas were more likely to receive four or more prenatal care visits than those who lived in rural areas. Since the National Family Health Survey (NFHS)-4, there has been a minor decrease in the proportion of women who had at least four prenatal care visits, but there has been an increase in the percentage of mothers who had a prenatal check during the initial stage of their pregnancy.

There are ninety-five percent of births that take place in a health facility. Women who have undergone a prenatal check, women who have completed ten years of education or more, women who are having their first birth, and women who live in metropolitan areas are more likely to give birth in an institution.

1.6 Maternal Mortality

Maternal mortality was still a terrible reality in 2020, with approximately 800 women dying every day from conditions connected to pregnancy and delivery that could have been avoided. Nearly two-thirds of all maternal fatalities are caused by serious complications, which include severe bleeding (typically after childbirth), infections, high blood pressure throughout pregnancy (pre- and eclampsia), problems after delivery, and botched abortions. This devastating toll meant that a mother died every two minutes or so, highlighting how urgent it is to address maternal health on a worldwide level. Fortunately, the global maternal mortality ratio (MMR) decreased significantly between 2000 and 2020, by around 34%, indicating significant advancements in protecting expecting women' lives. However, it is also crucial to understand that the large majority of fatalities among mothers —nearly 95% of them—remain concentrated in low- and lower-middle-income nations, underscoring the demand for focused interventions and expanded access to healthcare. The information strongly supports the need for excellent medical treatment before, during, and after childbirth since their knowledge has the ability to save both women's and babies' valuable lives. A crucial global health priority continues to be addressing maternal health inequities and advancing easily accessible, high-quality care.

Globally, there has been significant improvement in lowering maternal death rates in the years before to 2021. This development was primarily attributed to better prenatal care, more access to professional maternal healthcare, and increasing knowledge of maternal health problems. As one of the Sustainable Development Goals (SDGs), the international community established high standards for lowering maternal mortality. By 2030, SDG 3.1 sought to bring the worldwide rate of reduce the rate of female mortality to fewer than 70 per 100,000 live births. More than half of maternal fatalities globally between 2003 and 2009 were caused by haemorrhage, hypertensive disorders, and sepsis.

By location and nation, maternal mortality rates differed greatly. MMRs were often greater in low-income and developing regions compared to high-income nations. Greater maternal death rates were seen, particularly in South Asia and Sub-Saharan Africa. Regions and sub regions of the Sustainable Development Goals (SDG) are utilized here. It is estimated that about 87% (253 000) of the worldwide maternal deaths that are expected to occur in the year 2020 happened in Southern Asia and Sub-Saharan Africa. When compared to maternal mortality in Southern Asia, which accounted for around 16% (47 000), only maternal deaths in Sub-Saharan Africa was responsible for more than 70% (202 000).

The maternal mortality ratio (MMR) decreased the most between the years 2000 and 2020 in Southern Asia as well as Eastern Europe, by 70% (from an MMR of 38 to 11) and 67% (from an MMR of 408 to 134), respectively. Sub-Saharan Africa also managed to accomplish a significant drop in MMR of 33% between 2000 and 2020, while having a relatively high MMR in 2020. Over the span of this time period, the MMRs of our sustainable development objective sub-regions in Eastern Africa, Central Asian Eastern Asia, North Africa, and the west of Europe all noticed a decrease of around one third. The maternal mortality ratios (MMR) in the least developed countries typically fell by a little amount, about fifty percent. Among emerging countries that are landlocked, the MMR dropped by fifty percent, from 729 to 368. The MMR fell by 19% in poor countries with tiny islands, going from 254 to 206 from the previous year.

The lack of access to high-quality maternal healthcare services and problems during pregnancy and delivery were frequently blamed for maternal death. Some of the main causes of maternal fatalities included haemorrhage, infections, excessive blood pressure, and unsafe abortions. In order to decrease needless maternal and neonatal morbidity and death, the World Health Organisation (WHO) recommends that every pregnant woman and newborn get professional care throughout delivery. This care should be provided in an atmosphere that is caring, respectful, and supportive by employing methods that are supported by evidence. As a result of efficient prevention and care of conditions throughout late pregnancy, delivery, and the early newborn period, it is anticipated that the number of maternal fatalities, prior to delivery and intrapartum-related stillbirths, and early neonatal mortality would significantly decrease. As a result, elevating the quality of curative and preventive care throughout this vital period of time may have the greatest impact on the likelihood of survival for the mother, the foetus, and the newborn.

1.6.1 Factors Influencing Maternal Mortality:

Access to Healthcare: It's still difficult to get to healthcare facilities, especially in rural and isolated locations. Many women in low-resource environments lacked access to emergency obstetric care or competent delivery attendants.

Socioeconomic Factors: Maternal mortality was significantly influenced by socioeconomic inequalities. Risks associated with pregnancy and delivery was frequently greater for women with lower incomes and educational levels.

Healthcare Quality: There are significant regional and national differences in the quality of healthcare services, including the availability of trained medical personnel and modern facilities.

1.6.2 Maternal Mortality Reduction Initiatives:

To provide better maternity care, several nations and organisations sought to develop healthcare systems, upgrade infrastructure, and train healthcare professionals. Promoting access to family planning services was a crucial method for preventing unwanted pregnancies and reducing unsafe abortions. Utilizing midwives and community health professionals to deliver care and instruction to the local population. Education and information: Increasing the general public's awareness of the significance of prenatal and postpartum care, as well as maternal health and family planning.

Maternal mortality is influenced by prenatal illness. Particularly when compared to other women, young adolescents have a greater risk of complications and mortality from pregnancy. Complications during pregnancy, labour, and delivery are referred to as maternal morbidity. According to NFHS-3, six percent of women reported vision problems, nine percent experienced night blindness, ten percent experienced convulsions, twenty-five percent experienced swelling in their legs, bodies, or faces, forty-eight percent experienced excessive fatigues, and four percent experienced vaginal bleeding during pregnancy. Around 12% of women experienced heavy vaginal bleeding and 14% experienced extremely high fever as postpartum symptoms.

The government of India has made it a top priority to work towards improving the indicators measured for maternal health. Significant advancements have been achieved in the prevention of maternal fatalities that are not essential over the course of the previous two decades: The quantity of females who lose away every single year as a result of problems during pregnancy and delivery has drastically dropped around the world. This figure has fallen from 451,000 in the year 2000 to 295,000 in the year 2017, representing a 38% reduction.

Nevertheless, the incidence of life-saving medical therapies and procedures is still very low. This is mostly due to a lack of knowledge, policies, and resources now available. Both the urban-rural divide and the division between the affluent and the poor may be found in a number of different locations. A mother's and her family's financial position, in addition to their place of residence, is sometimes a determining factor in whether or not they have access to hospital facilities.

1.6.3 National Health Mission

Both the National Rural Health Mission (NRHM) and the National Urban Health Mission (NUHM) are considered to be sub-missions of the National Health Mission (NHM), which is the more comprehensive of the two. The primary programming components consist of the building of health systems in both rural and urban regions, the promotion of reproductive, newborn, parental, and child and adolescent health (RMNCH+A), as well as the prevention of infectious and noncommunicable diseases simultaneously. The National Health Service (NHS) envisions a world in which everyone has access to healthcare services that are not only inexpensive and of high quality, but along with being responsible and responsive to the requirements of individuals. The mission (NRHM) is to offer high-quality medical treatment to the rural population, with a particular focus on populations who are particularly vulnerable. The Empowered Action Group (EAG) States, North Eastern States, Jammu and Kashmir, and Himachal Pradesh are prioritised by the National Rural Health Mission. Mission emphasis is on creating a fully functioning, owned by the community, decentralised health delivery system with inter-sectoral convergence at all levels. Taking this step is done in order to guarantee that simultaneous action is made on a broad variety of health factors, such as water quality, hygiene, education, nutrition, social justice, and gender equality. National Urban Health Mission (NUHM): The objective of the NUHM is to enhance the health status of the urban population, especially the urban poor and other vulnerable groups, by enabling their access to primary healthcare that is of high quality. In a phased approach, the National Urban Health Mission (NUHM) encompasses all state capitals, district headquarters, and other cities and towns with a population of 50,000 or more (according to the census of 2011). NRHM will continue to provide coverage for municipalities and towns with populations of less than 50,000 people.

1.6.4 National Urban Health Mission:

Through a redesigned health care system, partnerships, and community-based mechanisms, with the active involvement of urban local bodies, the goal of the National Urban Health Mission would be to enhance the health condition of people living in cities as a whole, but in particular of the poor and other disadvantaged parts of the population. The NUHM work to establish an urban health care system that is sustainable to address the concerns around health of the people living in city area.

Output of NHUM:

- Increase in OPD attendance.
- Increase in BPL referrals from U-PHCs/ referral availed.
- Increase in institutional deliveries as percentage of total deliveries.
- Increase in complete immunization among children < 12 months.
- Increase in case detection for malaria through blood examination.
- Increase in case detection of TB through identification of chest symptomatic.
- Increase in referral for sputum microscopy examination for TB.
- Increase in number of cases screened and treated for dental ailments.
- Increase in ANC check-up of pregnant women Increased Tetanus toxoid (2nd dose) the coverage among women who are pregnant

1.6.5 National Rural Health Mission:

This mission was founded with the intention of considerably enhancing the the public healthcare sector of the country also the health of its residents, in particular those who reside in more remote areas of the nation. The Mission is to reduce child and maternal fatalities, stabilise population, achieve gender and demographic balance, and offer universal access to just, accessible, and excellent medical care that is responsible and sensitive to people's needs. During this phase, the Mission would be contributing to the accomplishment of the Millennium Development objectives in addition to that the objectives of the National Strategy for Health. NRHM aims to give the rural populace, especially the most disadvantaged populations, access to high-quality healthcare. It is the mission of this organisation to establish a fully operational, community-owned, decentralised health delivery system with inter-sectoral convergence at all levels. This will allow for simultaneous action to be taken on a wide range of health factors.

1.7 Major Initiatives under NRHM/NUHM

ASHA: ASHAs are community health workers who are essential in raising public awareness of healthcare issues, organizing neighbourhoods, and easing access to medical treatment in rural regions. In real time all throughout the nation, more than 9.15 lakh Accredited Social Health Activists (ASHAs) perform the roles of facilitators, mobilizes, and offer care at the community level. For those in the community who are marginalized, particularly women and children, ASHA is their first port of call. ASHAs are now being chosen in urban areas as well since 2013, when the National Urban Health Mission was established. According to a number of evaluations and subsequent Common Review Missions, the ASHA has been a significant contributor to the achievement of favourable outcomes, including the increase in the number of hospital deliveries, the administration of vaccinations, the active participation in disease control programmes (particularly those aimed at preventing malaria, kala-azar, and lymphatic filariasis), and the improvement of breastfeeding and nutrition practices. For the ASHA to guarantee ongoing training, on-site field mentorship, and performance monitoring, the majority of States have put in place an active training and support structure.

Janani SurakshaYojana (JSY)

This Yojana aims to motivate pregnant female to deliver birth in government run medical facilities, with the goal of lowering the rate of maternal mortality among expectant women. As part of the programme, pregnant women who meet the requirements are entitled to receive financial support in order to give birth at a government-run medical institution. As a result, it encourages safer delivery practises and reduces the number of deaths that occur among mothers and newborns. 8.55 crore women have benefitted from the National Rural Health Mission (NRHM) since it was first established.

Rogi Kalyan Samiti/Hospital Management Society:

The National Rural Health Mission (NRHM) created Rogi Kalyan Samities (RKSs) / Hospital Management Committees in 2005 as a platform to improve the operation and service delivery in entities that provide public health, boost participation, and strengthen accountability. By including local populations in the administration and development of healthcare facilities, these committees increase accountability and openness. With the active participation of Panchayati Raj Institutions (PRIs) and Urban Local Bodies (ULBs), the National Health Mission (NHM) emphasises the necessity of strengthening RKS in order to oversee governance and serve as an efficient grievance redressal mechanism at the facility level. This is in recognition of the challenges that are involved in making RKS effective.

It has a simple management structure that is nonetheless efficient. This committee is a registered society 2 Chapter Annual Report 2015-16 12 whose members serve as trustees to administer the operations of the hospital. It is also responsible for the maintenance of the facilities and ensuring that patients in the hospital have access to improved amenities during their stay. Untied funds are used to give these committees with financial help so that they may carry out activities that are beneficial to the welfare of patients. Up till this point, 31,763 Rogi Kalyan Samitis (RKS) have been established at practically all District Hospitals (DHs), Sub-District Hospitals (SDHs), Community Health Centres (CHCs), and Primary Health Centres (PHCs). These RKS have been established with the participation of community people involved.

The Untied Grants to Sub-Centres (SCs)

The ANMs that we have out in the field now have a revitalised feeling of self-assurance. To monitor blood pressure, haemoglobin (Hb), a stethoscope, a weighing machine, and other vital signs, the SCs have been outfitted with more sophisticated equipment in the most recent days. Offering of products of superior quality prenatal care and other medical services has become less difficult as a result of this.

The Village Health Sanitation and Nutrition Committee (VHSNC)

To address concerns of environmental and socioeconomic factors, this committee is a crucial tool for grassroots community empowerment and engagement. Panchayati Raj representatives, ASHA and other frontline workers, as well as representatives from marginalised groups, are all members of the VHSNC. Each VHSNC receives an annual grant of Rs. 10,000 without any strings attached. 5.01 lakh VHSNCs have been established nationwide as of this writing. States are starting to improve the capacity of the VHSNC members with regard to their tasks, which include the monitoring and management of public services.

1.8 Healthcare service

Delivering of healthcare services necessitates significant human resource investment. Nearly 1.88 lakh extra health professionals, including 7,263 GDMOs, 3,355 specialists, 73,154 ANMs, and 40,847 staff nurses, have been provided to States by NHM as part of an effort to close the human resource deficit. Additionally, the National Health Service (NHS) has placed a significant emphasis on the multi-skilling of medical professionals in facilities that have been strategically positioned and selected by the states. For instance, MBBS physicians who have received training in life-saving anaesthesia skills (LSAS), medical emergencies, and laparoscopic surgery are of specialists who have received this training. The development of the skills of the ancillary workers and members of the nursing staff like ANMs is also given the proper attention. Additionally, NRHM encourages the co-location of AYUSH services in healthcare settings including PHCs, CHCs, and DHs. With NRHM, a total of 24,890 AYUSH physicians have been stationed in the United States.

Janani Shishu Suraksha Karyakram (JSSK):

JSSK was established on June 1, 2011, and it provides all female that are pregnant who give birth in public health facilities with the right to a delivery that is completely free of charge and does not incur any costs, include a caesarean birth for delivery. This represents a change towards an approach that is based on entitlement. Free diagnostics, free medicines and consumables, free food during stays in health organisations, free supply of blood, free travel from residence to health institutions, free transportation between health institutions in the event of referrals and free transportation back home are all included in the comprehensive list of free entitlements. Additionally, the free entitlements include exemption from all types of user fees. Each and every ill newborn (up to one year of age) who visits a public health facility is eligible for the same rights. Each and every one of the states and union territories is putting this plan into action. 89 percent of pregnant women were able to obtain free medications, 82 percent got free diagnostics, 75 percent received free meals, 49 percent received free transportation from their homes to the facility, and 56.03 percent received free transportation back to their homes. When it came to ill newborns, 73% of sick infants received free medications, 40% received free diagnostics, 10% received free transportation from their homes to the institution, and 28% received free drop-offs at their homes.

LaQshya Initiative:

This programme, which was started in 2017, intends to raise the standard of care provided in maternal operating rooms and labour rooms in public health institutions through initiatives. It has become more important to provide pregnant women with a positive experience during delivery, as is the case with programmes such as Surakshit Matritva Anushasan (SUMAN) and Labour Room & Quality Improvement Initiative (LaQshya). The goal of SUMAN is to provide all women and newborns who are visiting a public health facility with the provision of healthcare services that are free of charge, delivered in a manner that is respectful, respectable, and confident, and with no tolerance for treatment refusal. This is done with the intention of preventing all preventable deaths and morbidities that occur in the pregnant and newborn populations. To build this suggested project, the success of prior efforts, such as the Janani Shishu Suraksha Karyakram (JSSK) and the Janani Suraksha Yojana (JSY), served as the basis for the development of this proposed project.

Sub-Centers and Primary Health Centres (PHCs):

NRHM focuses on empowering PHCs and sub-centres to offer critical services connected with healthcare, including sterilisation activities, immunisation, and maternity and child healthcare.

Facility Based Newborn Care:

As a consequence of this the introduction of home-based and care provided to newborns at an institution, a continuum of newborn care has been formed. This ensures that every infant gets the necessary care from the moment of delivery and for the first 48 hours at the medical care, and then at home throughout the initial 42 days of their lives. Newborn Care Corners (NBCCs) are built at delivery locations in order to offer vital newborn care at the time of birth. Special Newborn treatment Units (SNCUs) at District Hospital/Medical College and Newborn Stabilisation Units (NBSUs) at Family Resource Units (FRUs) are responsible for providing treatment for unwell babies. There are a total of 14,441 NBCCs, 2,020 NBSUs, and 575 SNCUs that have been rendered operational throughout the nation as of the month of June in the year 2015.

National Mobile Medical Units (NMMUs):

A total of 1107 Mobile Medical Units (MMUs) operating under the National Health Mission (NHM) have received support in 333 out of 672 districts throughout the nation. All Mobile Medical Units (MMUs) have been rebranded as "National Mobile Medical Unit Service" with a uniform colour scheme and design to raise the level of exposure, awareness, and responsibility.

National Ambulance Services (NAS):

The feature that allows individuals to contact an ambulance by dialling either the 108 or 102 telephone number is available in 31 states and territories as of this date. Dial 108 is mainly an emergency response system that is largely focused on providing assistance to patients who are in critical care, victims of trauma and accidents, and other similar situations. The services provided by Dial 102 are mostly comprised of basic patient transportation that is geared towards meeting the requirements of pregnant women and children. However, other groups are also receiving benefits and are not barred from receiving them. The 102 service places a primary emphasis on JSSK rights, such as free transportation from the mother's house to the facility, inter-facility transfer in the event of a referral, and drop-off services for the mother and her children. A call to a call centre that is free of charge may be made in order to have access to this service. At the moment, there are 7358 Dial-108, 400 Dial-104, and 7836 Dial-102 Emergency Response Service cars that are operating under the National Health Service (NHS). Additionally, there are 6290 empaneled cars that are used for transporting patients, mainly pregnant women and ill newborns, from their homes to public health facilities and back again.

Mahila Arogya Samiti (MAS) -

MAS serve as a community organisation and are active in service referrals, inter-personal communication, community-based monitoring, and community awareness. Between fifty and one hundred households (HHs) might be served by the

MAS, with an ASHA providing assistance for an elected Chairperson and Treasurer. This group focuses on enabling access to designated facilities and managing a revolving fund while also providing preventive and promotion health care.

Free Maternity Services

Pregnant women in urban slums and vulnerable communities can get free maternity services, including pre delivery care, delivery services, and after delivery care.

Pradhan Mantri Surakshit Matritva Abhiyan:

The Ministry of Health and Family Welfare (MoHFW) of the Indian government has initiated a programme known as the Pradhan Mantri Surakshit Matritva Abhiyan. An emphasis has been placed on prenatal care, pregnant women's nutrition, and giving moms a happy delivering experience as part of attempts to improve maternal and new-born care. The programme seeks to offer guaranteed, thorough and high-quality prenatal care to all pregnant women on the ninth of every month, free of charge. For instance, this scheme aims to increase the scope and calibre of diagnostic and assistance with counselling while also guaranteeing free access to complete, high-quality prenatal care.

In the Mann Ki Baat segment from July 31, 2016, the Hon. Prime Minister emphasised the goals and rationale for the launch of the Pradhan Mantri Surakshit Matritva Abhiyan. Under the Pregnancy and Child Health Act (PMSMA), women who are in their second and third trimesters of pregnancy are guaranteed a minimum package of prenatal care services at government health facilities that have been allowed to provide them. The strategy has a methodical approach to working with the non-public sector, which contains encouraging private practitioners to volunteer for the cause and creating plans for raising awareness and attracting the private sector to participate in the Abhiyan at government health facilities. The main objective of PMSMA is to guarantee safe pregnancies and deliveries by providing pregnant female with high-quality prenatal care, especially those who live in rural and disadvantaged regions. This scheme is a centrally sponsored DBT programme that offers cash incentives to pregnant women and lactating mothers in the amount of 5000 rupees (in three installments). Pregnant women are urged to visit medical institutions for prenatal checkups on the ninth day of each month under the PMSMA.

The check-ups include physical examinations, blood pressure monitoring, ultrasound imaging, and consultations with obstetricians and gynecologists. The effort seeks to lower maternal death rates and enhance the health and wellbeing of both mothers and newborns in India by detecting high-risk pregnancies and offering required medical care. Pregnant women who attend their first antenatal check-up (ANC) receive a cash incentive of Rs. 1,000. If they attend their second ANC, they receive an additional Rs. 1,000. After attending all recommended ANC check-ups, they are eligible for the full incentive amount of Rs. 2,000. According to recent statistics 14.2% population registered on PradhanMantriSurakshitMatritvaAbhiyan from Maharashtra state.

Significant improvement has been made in lowering maternal mortality in India as a result of these measures. However, there are still issues such geographical differences in healthcare access, care quality, and socioeconomic considerations. To further reduce maternal mortality rates and enhance maternal health outcomes throughout the nation, ongoing initiatives, investments, and innovations in maternal healthcare are required.

POSHAN Abhiyaan

As part of the principal initiative that the government is doing to improve nutritional outcomes, known as the POSHAN Abhiyaan, pregnant women are one of the core target demographics. The Indian government has made maternal and child health the main emphasis of the 5th Rashtriya Poshan Maah (September 1–30, 2022) in order to highlight the nutritional requirements of this group. The goal this year was to start Poshan Maah by using Gramme Panchayats as Poshan Panchayats, with a particular emphasis on "Mahilaaur Swasthya" and "Bachaaur Shiksha."

Pradhan Mantri Matru Vandana Yojana (PMMVY)

The government has established the above (PMMVY), which is a direct benefit transfer programme that provides directly depositing monetary incentives into the bank accounts of pregnant mother. The purpose of this programme is to meet the increased nutritional needs of pregnant women and partially compensate for increased wage loss. The goal of this programme is to ensure that pregnant female do not experience any financial stress during their pregnancy.

The government of India has implemented several projects, which have played a significant role in maximizing the percentage of births that take place in hospitals throughout the country. In India, institutional deliveries have significantly grown, rising from 79% in 2015–16 to 89% in 2019–20. Institutional deliveries account for nearly 87% of births in rural regions and 94% of births in cities.

1.8.1 World Health Organization (WHO) Standards of care and quality statements

The Global Health Organisation is an organisation that plays a significant part in the process of setting quality statements and standards of care for healthcare practises all over the globe. These standards are being created to guarantee the delivery of healthcare services that are not only effective but also safe and of a high quality. In accordance with the guidelines of the World Health Organisation (WHO), every mother and newborn should get consistent care and treatment that is based on evidence throughout labour, delivery, and during the first postnatal phase, if feasible. The health information system facilitates the use of data to provide prompt and suitable intervention for the enhancement of care for each mother and infant. The WHO offers standards and guidelines for prenatal care, including the suggested number of visits, crucial elements of treatment, and risk assessment. Norms for human and safe delivery are expert medical assistance during labour, the avoidance and treatment of problems, and postpartum care. The usage of data is made possible by the health information system, ensuring that every woman and infant receive better care. Every woman and new mother with a problem or conditions that cannot be adequately treated with the resources at hand are appropriately referred. Communication that is effective with female and their families, we evaluate their needs and circumstance the preferences and needs of the subjects of the conversation. Care is given to pregnant women and babies while maintaining their dignity. Every woman receives emotional assistance that is attentive to their requirements and builds the lady's capacity for her family. Competent and enthusiastic professionals are constantly accessible to give routine care and handle difficulties for every mom and infant. The medical facility is physically suitable, with sufficient resources for energy, water, sanitation, and medications for normal treatment of pregnant women and new mothers as well as for the handling of difficulties.

1.9 Antenatal care

The care encompasses medical attention provided by a physician or healthcare professional throughout pregnancy, either in a medical facility or in the home setting. Antenatal care encompasses the timely enrolment of all pregnancies, preferably during the first trimester (before to 12 weeks of gestation). Regardless of the timing of a woman's registration throughout her pregnancy, she should still be enrolled and receive medical care that aligns with her gestational age. Minimum of four antenatal checkups is needed for pregnant women. The initial visit to the prenatal clinic should be made as soon as it is believed that a pregnancy is occurring. Subsequent visits should be made between the fourth and sixth month (about 26 weeks), once more at the eighth month (roughly 32 weeks), and once more at the ninth month (approximately 36 weeks respectively). Because antenatal care involves counseling on proper eating and giving pregnant women iron and folic acid pills in addition to medical care, it can considerably reduce maternal morbidity and death. A healthy motherhood may be promoted by a number of variables, one of the most significant of which is antenatal care. This may assist to lower the incidence of low-birth-weight infants, which in turn can help to reduce prenatal, neonatal, and infant mortality enhanced nutritional status, when combined with enhanced antenatal care, can further contribute to this reduction.

Excessive bleeding, infections, pregnancy-induced hypertension, obstructed labor, and improper abortions are among the leading causes of maternal mortality in India. These issues emerge during the delivery period as a result of a lack of understanding of hospital-based maternal health care programs for reproductive women.

The town of Baramati, which is part of the state of Maharashtra in [Country], is a vibrant area with a significant proportion of women who are of reproductive age. The degree of knowledge and use of ANC services among these women has significant consequences for the region's health system. Disparities in maternal healthcare use continue, particularly in poor and rural communities like Baramati, despite medical improvements and developing healthcare systems. The primary goal of this thesis is to perform a thorough analytical investigation of the level of antenatal care knowledge among reproductive women in Baramati. In order to better mother health, to enhance maternal health services, and to reduce barriers between health systems operating at all levels, this study is being performed to identify, address, and evaluate the awareness and understanding of women's health throughout pregnancy. The study explores a variety of aspects of awareness, such as recognizing the value of ANC, being familiar with services offered, being aware of suggested visit frequency, and being aware of potential hazards related to pregnancy.

The therapy that a woman gets all over pregnancy to ensure the health of both mother and the unborn kid is referred to as intrauterine contraception (ANC). It is the promotion of mother and child health that is the primary constituent of the family welfare programme undertaken by the Indian government. Promoting, preventing, and protecting maternal and prenatal health is important for the nation's long-term growth and development. Unfortunately, a lot of women in underdeveloped nations do not get this kind of treatment. Within the context of maternal health and perinatal health, one of the most fundamental aspects is the provision of proper prenatal care (ANC). The foundation of obstetrical care and pregnant women's health is antenatal care. Along with providing nourishment and care, it also involves identifying and treating mother and foetal problems during the ANC phase. It emphasizes prenatal care as a crucial component of maternal healthcare since proper treatment will result in a successful pregnancy and healthy offspring. To lower child and maternal death rates and to meet the millennium development objectives, safe motherhood via high-quality prenatal care (ANC) is crucial [Archana G. Dhavalshankh et.al.2019]

One of the key treatments that aim to stop neonatal fatalities and preserve women's health throughout pregnancy is antenatal care, maternity services provided to expectant mothers by medical experts. Antenatal care helps medical personnel to spot possible dangers for pregnancy or delivery and to quickly treat expectant mothers who are having health issues **[Christiana R Titaley et. Al. 2010]**

In accordance with WHO Coverage of antenatal care (ANC), is a measure of access to and utilisation of prenatal care. Pregnant women can get interventions throughout the prenatal period, which may be very crucial for the maternal well-being as well as the wellbeing of her unborn child. It is more likely that pregnant women will receive effective maternal health treatments if they receive prenatal care at least eight times. One of the tracer indicators of health services for universal health coverage, this is one of the indicators in the Global Strategy for Women's, Children's, and Adolescents' Health (2016-2030) Monitoring Framework. Between 2010 and 2016, 62% of expectant women worldwide underwent the minimum of 4 prenatal consultations, as advised by the WHO. Recent studies have shown that women who have at least eight prenatal visits had a lower chance of stillbirth. As a consequence of these findings, the minimal number of prenatal contacts that is recommended has been increased from four to eight. From 2006 to 2016, the proportion of pregnant female in India who received at least four prenatal visits has been raised from 37.0% to 51.2%. This is a significant increase. When compared to the expansion in delivery of services provided by an institution, which tripled from 38.7 to 79% over the same time period and was mostly powered by the government's conditional cash transfer schemes, this is a relatively insignificant increase. Given that preeclampsia, eclampsia, and antepartum haemorrhage account for nearly one-fourth of maternal mortality and might have been detected and treated during antenatal encounters, this disparity in coverage represents a squandered opportunity. In India, public health facilities offer free antenatal care. However, because private health care providers are crucial to delivering maternity treatments in India, households must pay out of pocket for these services. However, there is a paucity of comprehensive research about the variables that determine the frequency with which women in India avail themselves of prenatal care. It is crucial to have an understanding of the elements that influence usage to assist in the development of a well-informed policy in light of the increased emphasis that the Indian government has placed on prenatal care via the Pradhan Mantri Matru Vandana Yojana , which is a conditional cash transfer programme. In order to be eligible for this programme, a pregnant mother must register for it at Within four months after conception, it is recommended to visit an anganwadi Centre (AWC), attend at least one prenatal care consultation, and adhere to the intake of iron-folic acid tablets and TT (tetanus toxoid) injection.**[Gunjan Kumar et. Al.2019]**. Moreover, research conducted in India has shown that women who used prenatal care services had a higher probability of using skilled birth attendants throughout labour or opting for an institutional delivery. **[Christiana R Titaley et. Al. 2010]**

ANC services provide pregnant women with access to the healthcare system. These services also promote the engagement of women in finding a skilled birth attendant for their delivery by offering suitable evaluation, intervention, and medical care throughout the whole of their pregnancy. A sufficient number of evidence-based therapy interventions are provided to women who attend ANC visits. This helps to improve the health of both the mother and the baby by ensuring that the mother is monitored extensively during the pregnancy. **[Mekuanint Simeneh Workie et.al.2018]**.Numerous variables influence how well ANC treatments may be used in underdeveloped nations. These determinants include women's socioeconomic position, demographics, education, and understanding of the value of ANC services, cultural attitudes, and prior maternal reproductive background. They also include the availability, accessibility, and quality of health care, including ANC treatments. [**Shivam Gupta et.al. 2018]**. In order to help women and their families prepare for pregnancy, birth, and postpartum recovery, it entails offering the required guidance, supplements, and support. Family planning, early breastfeeding, and early, exclusive nursing are all encouraged by ANC. In order to fully realise the potential of ANC, it is vital to have a prenatal care package that is individualised and consists of four visits with therapies that are supported by research. Because it links pregnant women to a formal health system, increases the possibility that competent birth attendants will be present, and improves overall welfare throughout the life cycle, antenatal care (ANC) is a crucial component for the health of pregnant female and their unborn children.**[Jehan M Al hazmi et.al. 2017]**.

1.9.1 Delivery Type

Vaginal Delivery (Normal Delivery):

The most popular way to give birth is vaginally. The baby is delivered through the birth canal (vagina) after passing through the cervix and the mother's pelvic bones during a vaginal delivery. The two types of vaginal births are spontaneous (when labour starts on its own) and induced (where labour is started under medical supervision).If there are no difficulties that call for a different procedure, the majority of infants are delivered vaginally.

Caesarean Section (C-Section):

A caesarean section, sometimes known as a C-section, is a medical operation in which the mother's belly and uterus are cut open and the baby is delivered via there.

C-sections may be performed as an emergency procedure during labour if difficulties occur that render a vaginal delivery risky for the mother or baby (such as a breech presentation or certain maternal health conditions) or they may be scheduled in advance for medical reasons.

Although some women could be eligible for a vaginal delivery following caesarean under certain conditions, C-sections are also conducted in situations when prior C-sections have been performed.

The selection of delivery method is contingent upon many elements, including the maternal and infant health and welfare, any pre existing medical conditions, the baby's position, and the progress of labour.

According to earlier research, as a country moves from a lower to a higher income level, there is a significant increase in the rate of C-sections in both developed and developing countries. Accurate prediction of pregnancy delivery mode is still difficult since it is frequently misinterpreted. Early detection can lessen tension and anxiety. C-section and normal or vaginal birth are the two basic forms. Vaginal birth is a natural process, whereas a C-section is a surgical treatment. Although both are typical, caesarean delivery carries risks and difficulties. Funding and pain management are necessary for this preparation. Therefore, selecting the optimum delivery technique based on logistical and medical considerations is essential for a healthy birth. Early detection and prediction might lessen the stress and anxiety related to delivery.[Alisha Kamat et. Al. 2105].Medically recommended caesarean sections have been shown to be a powerful technique in lowering maternal and perinatal mortality. However, both in wealthy and developing nations, the prevalence of caesarean sections have steadily increased recently, raising concerns among the international community. Worldwide rates of caesarean sections (CS) have climbed from 7% in 1990 to 21% in the present, above the WHO's optimum range of 10%–15%. But not all caesarean sections (CS) are medically necessary; in fact, there are an increasing number of unnecessarily performed CS and "caesarean on maternal request." Unmet needs and overuse are predicted to coexist with the estimated worldwide rate of 29% by 2030 in this trend, which is expected to persist. While CS lowers morbidity and mortality among pregnant women and newborns, it also puts mothers and infants at risk for needless complications and no communicable illnesses. Spending on healthcare can be reduced by lowering the SC rate. Public health education, supporting vaginal birth techniques, regular external evaluations, and educating physicians and pregnant women about WHO guidelines on nonclinical treatments to decrease unnecessary CS operations are all part of the solution to this problem.

Between NFHS-4 (2015–16) and NFHS-5 (2019–21), the proportion of caesarean deliveries grew from 17.2 to 21.5% throughout all of India. The percentage of caesarean deliveries in Maharashtra increased significantly from 20.1% during NFHS-4 (2015–16) to 25.4% NFHS-5 (2019–21).

1.10 Low Birth weight

Definitions provided by the WHO, infants that are prematurely born before to 37 weeks of gestation are considered to have a low birth weight (LBW), whereas infants who are born prematurely have birth weights that are less than 2.5 kg. In addition to being a significant indication of the health of the baby, having a low birth weight is related with an elevated risk of a variety of health issues and difficulties for the child. Babies born with low birth weight may be premature or full-term (born at or after 37 weeks) but still weight less than 2,500 grams. It's important to note that low birth weight can result from a variety of factors, including premature birth, maternal health, nutrition during pregnancy, and other environmental and genetic factors. Monitoring and addressing low birth weight is a crucial aspect of healthcare services focus on the well-being and medical needs of mothers and their kids. Prematurity and LBW are estimated globally to be between 15% and 20%. 91% of the projected 20.5 million live births in 2015 were LBW, with the majority occurring in low- and middle-income nations. It is estimated that sixty to eighty percent of infants who pass away are premature and/or underweight for their gestational age. In addition, infants account for forty-five percent of all children below the age of five who died. (in 2014). When compared to infants that are born full term (at least 37 weeks gestation) or with average birth weight (at least 2.5 kg), those who are born prematurely or with low birth weight (LBW) have a risk of death that is two to ten times higher. WHO said that about 20 times as many low birth weight babies die as bigger ones. Low birth weight is a serious problem that affects 15% to 20% of all newborns globally, with South Asian nations having the greatest frequency at up to 28%. ABOs are more prevalent than 25% overall in rural India, exacerbating the already dire public health situation. India may still encounter difficulties in meeting the child health and mortality objectives set by the SDGs, despite the fact that the prevalence of LBW has fallen there from 21% to 18% during the past ten years. In this research it observed that there are near about 25% baby's which low birth weight i.e less than 2.5 kg.

1.11 Need of New Guidelines

The World Health Organisation has issued a new set of recommendations aimed at improving the quality of prenatal care, with the goal of reducing the occurrence of stillbirths and pregnancy complications and promoting a positive pregnant experience for women. These recommendations emphasise having a pleasant pregnancy experience in order to promote not just a healthy pregnancy for the mother and the foetus but also a smooth transition to optimistic childbirth and, ultimately, a favourable maternal interaction. The thoroughness of these recommendations is a key quality. Additionally, they offer advice on prenatal nutrition, physiological problems may be prevented and treated that are frequently experienced during pregnancy (such as nausea, heartburn, etc.), and preventative measures for specific situations (such as malaria and/or HIV).Recommendations for counselling and helping women who may be victims of intimate relationship abuse are also included in the guidelines. Additionally, there is advice on how prenatal care services might be offered more successfully and in various settings. For further details, see the WHO guidelines for prenatal care for a healthy pregnancy.

1.11.1 New Guidelines of WHO For 8 ANC Visits

A higher frequency of regular interactions with healthcare professionals throughout pregnancy (eight routine contacts; up from four routine contacts) was one of the 2016 WHO Recommendations on an optimistic maternity visit, which were new prenatal care recommendations. Due to the importance of ANC in preventing stillbirths, the WHO evaluated and issued guidelines on the quantity and timing of ANC encounters in 2016. Eight regular interactions are advised by the new WHO standards for a positive pregnancy experience at 12, 20, 26, 30, 34, 36, 38, and 40 weeks.5 compared to the previous WHO prenatal recommendations of at least four interactions released in 2001, the revised ANC regimen includes more encounters. This 'interaction' between a pregnant woman and a medical professional ought to be a chance for high-quality treatment throughout pregnancy. These new recommendations are meant to guarantee a healthy pregnancy as well as a smooth transition to labour and delivery. These recommendations are also more thorough, emphasizing counselling, topics covered include maternal nutrition and strategies for preventing and treating common diseases, support for women at risk of experiencing violence at home, and preventative measures for specific regions like malaria and/or HIV endemic areas. They also focus on maternal and fetal screening.

To supplement the current WHO recommendations published since 2000 on the management of pregnancy-related problems, the WHO produced updated ANC guidelines for regular ANC in 2016 based on the suggestion. Instead of the prior recommendation of four focus ANC visits, the new WHO recommendations call for eight routine ANC encounters.

1.12 Scope of Research Work

In addition to being a vital component of public health, antenatal care and maternal health are also critical to ensuring the health of both pregnant women and infants to ensure that they are healthy. This research focuses on conducting an analytical study to assess the levels of awareness regarding antenatal care among reproductive women in Baramati, an area characterized by unique socio-economic and cultural factors. Despite the recognized importance of antenatal care, there exists a gap in our understanding of the awareness levels among reproductive women in Baramati. The objective of this study is to ascertain the variables that have an effect on awareness and to investigate the influence those factors have on the utilisation of prenatal care services. Evaluate the current levels of awareness among reproductive women in Baramati regarding antenatal care practices. Determine which variables; including education, culture, and their economic standing, affects fertile women's level of awareness. Analyze the impact of awareness on the utilization of antenatal care services. What is the current level of awareness among reproductive women in Baramati regarding antenatal care? How do socio-economic, cultural, and educational factors influence awareness levels?

What is the relationship between awareness and the utilization of antenatal care services?

This study is essential as it addresses a critical gap in current knowledge, providing insights into the awareness of antenatal care in a specific regional context. Enhancing the health outcomes of mothers and children in Baramati may be achieved via the establishment of focused interventions and policies, which can be advanced by a better knowledge of the variables impacting awareness. The study will focus on reproductive women residing in Baramati, considering both urban and rural areas. The research will cover data collected over a specific period, ensuring relevance to the current context. The study will assess awareness in terms of understanding, beliefs, and behaviours around prenatal care. The research will consider socio-economic, cultural, and educational factors influencing awareness levels. The findings of this research are expected to contribute to academia, healthcare practices, and policy development. By identifying key factors influencing awareness, the study aims to inform targeted interventions that can enhance antenatal care utilization and, consequently, improve maternal and child health outcomes in Baramati.

Need for the Study

Improving mother health and reducing the maternal death ratio (MMR) have been ongoing national priorities for India due to the country's long-standing concern over maternal mortality. The maternal death rate is the rate of maternal mortality as a percentage of live births during a certain time frame. The rate of maternal death serves as an indicator for assessing the reproductive health status of women in a certain region. Many women in the reproductive age group die due to complications during pregnancy, childbirth, or abortion. There were 556 maternal deaths for every 100,000 live births in 1990, making India's Maternal Mortality Ratio (MMR) very high. Problems during pregnancy and delivery cause the deaths of more than 1.38

lakh women annually. At the time, the worldwide MMR was substantially lower, at 385. The 2017 National Health Policy (NHP) set a target of less than 100 per 1,000,000 live births for India's MMR by 2020. The government of India has worked tirelessly to reduce the MMR to 97 per 100,000 live births in 2018–20, which is a major milestone that was achieved far earlier than expected.

The rate of death of mother has significantly dropped over the course of the previous eight years as a direct consequence of the coordinated initiatives implemented by the government of India to improve all facets of maternity care. MMR fell from 130 per lakh live births in the nation in 2014–16 to 122 in 2015–17, and then fell further 9 points to 113 in 2016–18. India's MMR dropped to 103 by 2017–19, compared to a global MMR of 211 that same year.

The town of Baramati, located in Maharastra state Pune represents a diverse demographic with a significant population of reproductive women. The quality and extent of antenatal care available and the awareness of reproductive women about its importance in Baramati are factors of paramount significance in improving maternal and child health outcomes in the region.

In Baramati, there are a number of elements that highlight the important need for an analytical research on the knowledge of prenatal care among women who are currently pregnant or in the immediate pre-pregnancy stage.

Maternal and Neonatal Health Outcomes

In Baramati, as in many regions, maternal and neonatal health outcomes are directly influenced by the utilization and awareness of antenatal care services. Most of the population belongs to rural area. Rural areas might have lower income levels and fewer economic opportunities, which can influence the ability to seek and afford healthcare services. Investigating the economic barriers to antenatal care is important in rural contexts. In rural areas, access to healthcare facilities may be limited, and there might be longer distances to travel to reach healthcare providers. Both the time and the number of prenatal care appointments may be affected as a result of this. This approach will allow us to provide a comprehensive analysis of antenatal care awareness while accounting for the unique characteristics of rural and urban areas within Baramati. Timely and adequate antenatal care can help identify and address pregnancy-related complications, thereby reducing maternal and neonatal mortality and morbidity rates.

1.13 Policy and Program Development

Accurate and up-to-date information on the awareness of antenatal care can inform local health policies and programs. By understanding the specific challenges and knowledge gaps among reproductive women in Baramati, policymakers and healthcare providers can develop targeted interventions to improve antenatal care awareness and utilization.

1.13.1 Contribution to Existing Knowledge

While research on antenatal care has been conducted in various settings, there may be unique cultural, socioeconomic, and geographic factors that influence awareness and utilization patterns in Baramati. This study contributes to the existing body of knowledge by providing context-specific insights.

1.14 Research Objectives

The suggested thesis is no different from other doctorate theses in that it contains several of objectives. It also has a number of objectives, which are mentioned and briefly explained below.

- The aim of this research is to evaluate the extent of understanding among reproductive women in Baramati about the use of prenatal care offerings.
- To find out the issues related to the utilization of antenatal care faced by reproductive women in Baramati.
- Compare the awareness levels between women in rural and urban areas from Baramati.
- Is there a notable disparity in the use of prenatal care between rural and urban sections of Baramati?
- To determine the correlation between financial, social, and other variables and the use of prenatal care in both urban and rural regions of Baramati.
- Is there any challenge rural women face related to antenatal care access?
- To determine the correlation between demographic characteristics in selected rural areas regarding selected antenatal care services.
- Investigate the various factors, including maternal age, previous pregnancy history, medical complications, and socioeconomic status, that are associated with the type of delivery.
- To determine the correlation between demographic characteristics between the quantity of prenatal care visits and the kind of birth that occurs?

- Does there exist any correlation between the number of visits to prenatal care and the weight of a newborn baby?
- To find a predictive model with high accuracy related to the response variable.

Our objective is to evaluate the parameters that are linked with the utilisation of the new WHO ANC recommendations in Baramati. These criteria included the required number of ANC contacts, the timely commencement of these interactions, and the appropriate components of these contacts.

1.15 Structure of the Thesis

The organisation of this thesis is comprised of numerous chapters, each of which is devoted to investigating a certain facet of ANC knowledge among fertile women in Baramati respectively.

The Literature Review chapter, which provides a thorough analysis of the body of knowledge on prenatal care awareness among reproductive women, serves as the theoretical foundation for this study. It examines how prenatal care practices have changed historically, looks at pertinent theoretical frameworks, and conducts a thorough analysis of the many variables affecting awareness, such as socioeconomic, cultural, geographic, healthcare system, and information source issues. The review identifies gaps in the literature and emphasizes effective interventions and programmes, highlighting the necessity of this investigation. It also results in the creation of a conceptual framework, laying out a clear course for the next study investigation. The context and significance of antenatal care awareness in Baramati are crucially understood in this chapter, which also affects the study topics and technique that come next.

Chapter 3, "Methodology," outlines the comprehensive research approach for investigating antenatal care awareness among reproductive women in Baramati. The research design is explained, emphasizing its alignment with the study's objectives, followed by a description of the study setting, participants, and sampling methodology. Data collection method and procedures are detailed, ensuring cultural sensitivity and reliability. The planned data analysis methods, ethical considerations, and potential limitations are discussed. This chapter establishes a robust foundation for the systematic study, ensuring the validity and effectiveness of utilising data collecting and analysis methodologies to accomplish the study objectives.

In Chapter 4 of this thesis, we delved into the crucial aspect of Exploratory Data Analysis (EDA) to comprehensively study the awareness of antenatal care among reproductive women in Baramati. EDA serves as the initial step in the data analysis process, enabling us to gain a profound understanding of our dataset and lay the foundation for subsequent statistical and analytical investigations. The importance of EDA in healthcare research cannot be overstated, as it provides the necessary insights to formulate meaningful research questions and hypotheses. Our EDA commenced with a preliminary examination of the dataset's characteristics. Descriptive statistics, such as mean, variance, maximum, minimum, standard deviation, and data distribution, were calculated for key variables related to antenatal care awareness. One of the primary objectives of EDA was to discern any apparent trends or patterns within the dataset. Through graphical representations, we identified potential associations between variables, such as age, education, income, and awareness of antenatal care. These visual cues were instrumental in formulating hypotheses and research questions for subsequent analytical studies. Outliers, if present, can significantly impact the reliability of data analysis. During EDA, we employed various techniques to detect and assess potential outliers within the dataset. By identifying and understanding the nature of outliers, we were better equipped to decide whether to exclude them from the analysis or consider them as valuable insights into the variation in awareness levels. From bar chart we get an idea about mean birth of weight of baby's in various categories.

In the framework of research aimed at determining the level of knowledge among reproductive women in Baramati, the fifth chapter on maternal health care provides a thorough analysis of the landscape of maternal health services, particularly antenatal care. In this chapter, we delve into the statistical analysis of three key outcome variables: type of delivery, newborn baby weight, and ANC (Antenatal Care) visits among the reproductive women in Baramati. The purpose of this chapter is to investigate and comprehend the connections and factors influencing these outcomes. To achieve this, we applied various statistical techniques, including the chi-square test, variance analysis, and odds ratio, to analyze and interpret the data. The chapter presents with an in-depth discussion of antenatal care, highlighting its importance in maintaining safe pregnancies and successful results for mother and child health. Highlighting the numerous services and tests that help with early diagnosis and management of possible issues, the significance of early and frequent antenatal care visits is emphasized. One of the most important aspects of maternal health care is the way of delivery, which may have an impact on the maternal and foetal well-being. This can pertain to either a normal birth or a caesarean section (C-section). The chapter offers the Chi-square test, t test for birth weight of baby and odds ratio relating to this topic. Antenatal care is crucial in determining whether or not a certain delivery technique is necessary depending on a variety of variables, including the mother's health, her prior pregnancies, and probable difficulties. In terms of the infant's overall health and development, the weight at delivery is an extremely important factor to consider. To monitor and control elements that may have an impact on the baby's weight, such as maternal nutrition, antenatal tests, and early diagnosis of growth-related problems, adequate antenatal care is crucial. So, the Chi-square test and a t test are used with the response variable newborn baby's weight. Investigating the link between the mode of birth and the baby's weight within the context of our study on antenatal care awareness among reproductive women in Baramati might offer insightful information regarding how knowledge levels affect mother choices and health outcomes.

The fifth chapter provides a thorough investigation of the complex interactions between numerous socio-demographic parameters and reproductive women's knowledge of antenatal care in Baramati. The research population's age, matrimonial status, educational attainment, employment, and parity are thoroughly analyzed in the first portion of the chapter. These factors are crucial markers for comprehending the participant pool's heterogeneous makeup and any potential consequences for antenatal care knowledge. The chi-square test for the measure of independence and a model of logistic-regression are used in order to conduct an in-depth investigation into the relationship between awareness levels and socio-economic parameters. These factors include income and socioeconomic position, education, distance from ANC centre, employment, residing area age, and so on. As the urban-rural gap might impact access to healthcare services and awareness efforts, it is also taken into account in this chapter. Compared to their peers in rural regions, women who live in cities may be exposed to healthcare messages more frequently. Pie charts offer a simple and quick approach to illustrate how categorical data is distributed. So, it is used to analyze the percentage of certain levels of some demographic variables. The socioeconomic and demographic variables chapter offers an in-depth evaluation of how many factors interact to affect reproductive women's knowledge of antenatal care in Baramati. At the same time, it calls attention to the complex network of social, educational, occupational, and cultural elements that may either enhance or hinder people's awareness of the importance of maternal health care. The logistic-regression model and the decision tree algorithm are tested on identical datasets to determine their predictive performance, focusing on accuracy. The study gains important insights into the various backgrounds and situations that affect women's engagement with antenatal care by recognizing these connections, ultimately assisting in the development of more focused and efficient interventions to increase awareness and improve maternal health outcomes.

In Chapter 6 represents a pivotal stage in our thesis, where we harnessed advanced statistical techniques, including logistic regression models and decision trees, to understand and predict three crucial outcome variables. The utilization of these predictive models enabled us to unearth the significance of various independent variables in influencing these outcomes. Through the use of the strong technique of logistic regression, we were able to evaluate the connection that exists between the independent variables and the likelihood of encountering certain outcomes. We came upon a number of significant realisations as a result of our investigation. We observed that the length of time a mother had been pregnant, the maternal educational attainment, and the dwelling location were significant predictors of the method of delivery chosen. Mothers living in rural or urban areas exhibited varying likelihoods of having cesarean or vaginal deliveries, as did mothers with different levels of education. Additionally, the duration of pregnancy played a key role in determining the mode of delivery. The exploration and visualization of complicated decision processes are both facilitated by the use of decision trees. During the course of our inquiry, the decision tree models provided support and enhancement to the outcomes that were produced by the logistic-regression models. We verified the significance of the mother's education, living area, length of pregnancy, and ANC visits as drivers of our outcome variables by using decision trees. In conclusion, Chapter 6 not only confirms the statistical significance of key independent variables but also demonstrates the effectiveness of both models in predicting outcomes related to type of delivery, newborn baby weight, and ANC visits. The insights gained from this analysis provide a foundation for data-driven decision-making and targeted interventions, ultimately working toward the improvement of maternal and neonatal health in the region.

Analytical study on childbearing women's knowledge of prenatal care in Baramati is brought to an end in the seventh chapter, which gives a comprehensive evaluation of the results and their implications for efforts pertaining to maternal health care. At the beginning of the chapter, there is a brief summary of the study's aims, highlighting the main purpose of measuring antenatal care knowledge and comprehending the influencing elements within the Baramati environment. It emphasizes the value of the study in improving mother and child health outcomes through well-informed treatments. This chapter will also delve into a thoughtful discussion of the implications of these findings, their significance in the broader context of mother and new born baby, and their alignment with existing literature.

CHAPTER-2
REVIEW OF LITERATURE

2.1 Introduction

Antenatal care is essential for providing medical, educational, and supporting services to advance health and wellbeing for both mothers and their unborn children. It improves overall health outcomes and lowers maternal and neonatal mortality. For healthcare services to improve, reproductive women's awareness must rise.

This chapter contains a summary of the research that has been conducted in order to provide a greater understanding of why antenatal care is so important, which factors affect the utilization of antenatal care, health issues related to newborn babies, and delivery types among the reproductive women in the Baramati region. The review is limited to works released after 2009, and an effort is made to cover the most recent works. Additionally, research articles are prioritised over books, primarily because research papers report the most recent discoveries before books do. Additionally, an effort is made to include research articles that cover the full range of methodologies and application areas regarding the study of an ANC.

This chapter seeks to lay a strong basis for the other chapters of this thesis by synthesising the material that currently exists on prenatal care awareness. It would be an important point of reference for comprehending the contextual elements that affect reproductive women's awareness levels in Baramati, highlighting knowledge gaps and areas in need of focused interventions. By ensuring that pregnant mothers receive the care and support they require for a successful pregnancy and delivery, this literature evaluation ultimately helps to further the larger objective of enhancing maternity and child healthcare services in Baramati and comparable places.

2.2 Literature Review Related to Maternal Health Care

Muhammad Nazrul Islam et. al. (2022)

Machine learning has been extensively utilised to identify possible maternal risk factors during pregnancy and forecast the type of delivery. This review study's main goal is to examine current research and development views that use ML approaches to forecast the ideal delivery mode and identify various complications during delivery. A systematic review may be thought of as a way to compile, assess, and analyse prior research on a given subject or field of study. In this review of research, algorithms and characteristics are explored, while current studies on pregnancy outcomes utilising machine learning (ML) are examined. It also looks at the development of objectives and how they relate to data sources. Utilising unsupervised and deep learning techniques, creating ML-based clinical decision support systems, improving dataset accessibility, and investigating surgical robotic equipment are some future research objectives. The results help create a cutting-edge paradigm for ML-based maternal healthcare by supporting clinical decision-making, identifying pregnancy issues, and providing medical diagnosis and treatment.

Afaya A et al. (2020)

The writers of this study conducted research to determine the variables that are connected with the usage of prenatal care in rural sections of Ghana. Between the months of October 2018 and January 2019, data were gathered. As part of this research project, a total of 322 female that had just given birth and sought care at a postnatal clinic were chosen for participation. Using STATA version 14.0, the authors of this article carried out a logistic regression model in order to investigate the degree of relationship that exists between the predicted variable and the regressor variable as well as to determine the confidence interval for this correlation. The authors found that out of 322 participants, only 69% had attended ANC visits a minimum of four times. There were a number of relevant factors that determined whether or not women attended ANC four or more times. These factors were included women's age, level of education, and NHIS insurance. Those who were not married or divorced were also linked with four or more visits to ANC services. Finally, the author reveals the conclusion that while the majority of the women had a decent understanding of ANC services, a substantial percentage of them did not attend at least four ANC consultations throughout a normal pregnancy.

Muluneh, A. Get al. (2020)

The goal of this study was to determine the geographical clustering and determining variables of home birth in Ethiopia following prenatal care visits. For this study, the author collected data on women of reproductive age using a structured questionnaire in two groups: the first group includes 2110 women who had their babies at home following ANC, and the second group consists of 2510 women who gave birth in hospitals after attending ANC. For this study, a logistic regression model was fitted. After conducting their research, the authors came to the conclusion that the income index, individual’s profession, age, religious affiliation, and interest in pregnancy where they had their ANC visit, frequency of ANC visits, exposure to media, awareness of birth prevention strategies, the number of previous pregnancies, the mother's level of education, marital status, and having health coverage are all factors that are linked to giving birth at home after an ANC visit. The p-value for this association was 0.25, and the authors found that these factors fit the logistic regression equation. An increase in family wealth, women being educated, antenatal care visits, and the provision of additional information on birth preparedness plans are all essential, according to the authors, in order to reduce the number of home births that occur following prenatal care visits.

Birhanu, Set al. (2020)

The study aimed to analyse being satisfied of pregnant female with prenatal medical services and related characteristics at public medical services in Ethiopia. The selection of 531 pregnant women from a health facility was carried out via the use of a systematic random selection approach. Following the use of a bivariate logistic model, it was shown that a significant proportion of pregnant female are content with the services provided by prenatal care (ANC). The arithmetic mean and S.D. of the respondents were 23.9 and 4.4 years, with 40.5% aged 20–24. The majority were urban dwellers, with 74.4% being Muslims. 41.1% had no formal education. 99.6% were married, and 66.7% were housewives. The ANC was rated satisfactory by over two-thirds of pregnant women. The study concluded that satisfaction with ANC services was linked to the type of health institution, educational status, antenatal visits, history of stillbirth, and the time it took to acquire the service.

Neves, Paulo A.R et al. (2020)

The present prospective investigation made use of data obtained from the Pelotas Birth Cohort, which is a population-based longitudinal research that was conducted in southern Brazil in 2015. More than 93% of the city's population roughly 340,000 people reside in a city area. During the study's initial year, 99.9% of every birth that takes place inside the city in hospitals. Daily visits to the five hospitals in the city that provide maternity wards allowed researchers to track down every hospital delivery from January 1 to December 31. Shortly after birth, the mothers were interviewed and the infants were assessed (a perinatal study). Home visits were used to do follow-up assessments on children at the ages of three and twelve months, and a research facility was used to conduct evaluations at the age of twenty-four months. Using logistic and linear regressions, the authors examined associations between maternal exposures and a child's development. The G-formula was used to examine the presence of mediation in the association between BMI and growth of children via

GWG. With the exception of motor development, gender differences in child development were seen in every area. Maternal prior to pregnancy underweight in girls elevated the likelihood of suspected delays in growth in the linguistic, motor, and global domains. (OR: 2.14; 95% CI: 1.05-4.33); for boys, excessive GWG raised the odds of SDD in the language, cognition, and international domains (OR: 1.59; 95% CI: 1.13-2.24; and OR: 1.59; 1.15-2.22). The link between pre-pregnancy BMI and percentiles of global development was reduced across the board in the sample by total GWG. The development of boys and girls was severely impacted by maternal underweight and high GWG, respectively.

Prince Kubi Appiah et al. (2020)

The authors of this study made a conscious decision to include all nine health facilities in their investigation. It was completed between June 1, 2017 and May 31, 2018, a sampling strategy based on probability proportional to the size was employed to apportion a certain sample size to each health facility. After establishing the sample size for the health centres, the number of deliveries documented in every health centre's delivery record was utilised as a sample frame. A systematic sampling method was used to allocate the number of women allocated to each health facility. Using the contact information in their health records, the selected ladies were tracked down to their residences. Information was gathered via the use of a questionnaire that was well-structured. The authors of this research focused on many factors including age, educational level, religion, parity, gestational age at the first antenatal care (ANC) visit, number of ANC visits, child's birth weight, live birth, stillbirth, and counselling received during ANC. We performed chi-squared and logistic model to investigate the relation between the variables that were independent and those that were dependent. According to this study, only 62.2 percent of pregnant female attended four or more ANC appointments, and 70% of mothers did not get complete ANC treatment. Low birth weights occurred in 24.5 percent of pregnancies, while stillbirths occurred in 0.9 percent of pregnancies. Maternal religion, educational attainment, marital status, the use of long-lasting insecticide-treated nets, and urine testing are all associated with an average birth weight. To guarantee that women who contact ANC clinics get all necessary care it is imperative to address any discrepancies in transportation and medical supplies available to health facilities in the area.

Vuppu Sitalakshmi et al.(2020)

Authors have studied pregnant women's knowledge, attitudes, and practices regarding prenatal care that go to antenatal tertiary care hospitals'. 500 pregnant women who attended the antenatal care centre at the department of obstetrics and genecology, Narayana Medical College and Hospital, Nellore, between June 2017 and June 2019 were the subjects of a cross-sectional study through a face-to-face interview with a structured questionnaire. There were a total of 13 questions about prenatal care knowledge and perceived danger signs. The knowledge score for antenatal care is then determined by the following relationship:

$$\text{Score of knowledge} = \frac{Sum\, of\; correct\; response\; given\, by\; all\; respondents}{Total\; number\, of\; respondents}$$

The respondents will be questioned about their attitudes towards prenatal care, pregnancy-related illnesses, and diet in order to determine their attitude score whereas seven questions were related to practices regarding antenatal care.

The authors arrived at their conclusion that the average age of the pregnant women was 25 years old by using a pie diagram to illustrate the age-wise distribution of the pregnant women. People in their twenties and thirties had the largest proportion of pregnant women (86%) across all age groups. This was followed by the age range of 30 to 39 years old (5%), the age range of more than 40 years old (5%), and the percentage of women less than 20 years old (4%). The maximum number of respondents (24.4%) has a primary education, followed by 23.8% who have a postsecondary degree, 19.8% who have completed middle school, 13.8% who have completed their undergraduate degree, 15.4% who are illiterate, and 2.4% who have a professional degree. The remaining 15.4% have no formal education. A total of 67.2 people live in rural areas, with the remaining people living in cities. Twenty-six percent of pregnant women said they had completed three antenatal visits, while 26 percent believed that at least five ANC visits should be completed. 96.1% of expectant women said that signing up for antenatal care and visits is crucial. Eighty-seven point two percent of respondents say they take both iron and folic acid when they are pregnant, while eleven percent say they do not. Tetanus toxoid (TT) should be administered during pregnancy, according to 92% of pregnant respondents; 3.2% said they were unsure. When asked how much time they spend sleeping, 24.2% said 5–6 hours, 35.4% said 7-8 hours, and 35.6% said >8 hours per day. 55.8% of women who were pregnant said they had decided to give birth to the child in a hospital.

Pregnant women reported that they were aware of the risks associated with pregnancy in 71.2% of cases. The reasons given for not going to an antenatal check up were cost, lack of transportation, illiteracy (15.4%), and ignorance of ANC.

The authors came to the conclusion that women who are trying for a second or subsequent pregnancy are more knowledgeable and aware of the checkups with the ANC are quite important throughout pregnancy.15.4 percent of sample lack literacy, which prevents them from knowing about their prenatal health. Some of the respondents gave birth to their child at home due to their own fair share of miscarriages or risks at the hospital.

To overcome this, increased information, education, and communication efforts on ANC should be made through community campaigns and media outlets such as regional radio stations, daily newspapers, and TV networks are examples of mass media.

Sonia Silvestrinet al. (2020)

The authors of this article have produced an essay on how maternal education is one of the most major social variables that contributes to the discrepancy in birth weight that occurs in developing countries. The goal of the current study was to examine long-term trends in health inequality while taking into account the variance in average birth that exists between the two peaks of mother educational attainment in Brazil. Within the scope of this time-series analysis, all live births that occurred between the years 1996 and 2013 in the 26 state capitals of Brazil as well as the Federal district were included.

The outcome that caught people's attention was the change in the mean birth weight over time, shown as a continuous variable. There were two extremes used to categorise the variable under investigation, which was the level of maternal education: either high or low. These extremes correspond to a formal education level of less than eight years and more than twelve years, respectively. The researchers discovered that there was a progressive decrease in the disparities in the mean newborn weight between the two extreme levels of mother educational attainment for the infants. The normal birth weight of newborns that were born to mothers with greater levels of educational attainment was found to be significantly lower, while the aveage birth weight of newborns who were birthed by women with lower levels of educational was found to be somewhat higher. One of the most important contributors to the decrease of inequalities was the rise in the number of prenatal or antenatal consultations.

Aziz Ali, S et al. (2020)

Within the population of women in age of reproduction in Thatta, Pakistan, the purpose of this research was to assess the utilisation of prenatal care (ANC). The sample consisted of 380 women, with 329 utilising ANC and 51 non-utilizers. The study found that the distance from home to the service centre significantly influenced ANC use. The majority of participants had no formal education and had access to electricity in their homes. A further finding of the research was that women under the age of 25 were more probable to use ANC than those under the age of 25. The research also indicated that ANC services were 1.21 times greater among women whose homes were less than 5 kilometres from the hospital. Additionally, antenatal care use was 4.10 times more likely to occur in nulliparous women. Women who were aware of ANC services were also 6.60 times more probability to use ANC services. Researchers concluded that educating rural nulliparous women on the benefits of ANC and how it relates to their financial situation will significantly boost their use of the service. Pregnancies should include promotion of health and health literacy sessions to help pregnant women learn more about antenatal care options. Geographic accessibility was also identified as a crucial factor in gaining access to ANC services.

Ziad El-Khatib et al. (2020)

The authors of this research gathered information from the Nigeria Demographic and Health Surveys in the years 2008, 2013, and 2018. This information was then combined for the purpose of conducting a cross-sectional comparison. 52,654 women of reproductive age who had reported at least one birth in the five years prior to the surveys were participants. The patterns of prenatal care utilisation and inadequate use of ANC are investigated in this study, as is the connection between these patterns and a few socio-demographic characteristics that are located in close proximity.

For this, we turned to multivariate logistic regression model, and the response factors that were analysed were late attendance, initial contact after the first three months of pregnancy, and less than four prenatal visits. It was found that the frequency of late timing was 74.8% overall, and the prevalence of inadequate ANC visits was 46.7%. These conclusions were derived from the data of the research. Researchers who also looked at the multivariable regression analysis discovered that factors like media exposure, family size, educational attainment, geographic area, type of residency, use of contraceptives, distance to health service, and overall number of children were significantly linked to both inadequate and late ANC attendance. This was the conclusion reached by the researchers. Finally authors gave the suggestion to the development of ANC service utilisation in Nigeria may be made easier by spending money on initiatives to raise women's socioeconomic status, addressing the disparities in service utilisation between Nigeria's urban and rural areas, and reducing higher fertility rates.

Sommer Albert, Jet al. (2020)

The goal of this research was to assess the structural and procedural quality of ANC services given in two big hospitals in Islamabad, Pakistan, as well as the satisfaction levels of women getting ANC treatments. For this research, the authors collected data from the hospital on a sample size of 138 women in the reproductive age group. In the first portion of the questionnaire, care methods, interpersonal interactions, information quality, and privacy were all examined. In the second portion, it also evaluated the technical and structural quality, taking into account the physicians' backgrounds in obstetrics, health education, and infrastructure. The ratings were divided into three categories: excellent, ordinary, and subpar. 17 questions evaluating overall satisfaction were in the third segment. In this research, the authors are interested in outcome variables, i.e., quality of ANC services and satisfaction. The t-test was used in order to make a comparison between the quality of treatment that was supplied by public and private hospitals. The authors come to the conclusion that the total services were rated satisfactory by 86 percent of the ladies. Finally, the researchers suggested that through various audit programmes in public hospitals, government healthcare institutions should improve the standard of antenatal care, provide adequate training to healthcare staff, and develop technical capacity through continuous education and supportive supervision to train healthcare providers to adhere to standard protocols for providing high-quality ANC services.

Balhasan Ali and Shekhar Chauhan (2020)

The National Family Health Survey's third and fourth rounds of the survey revealed a significant decrease in maternal health care use in rural India between 2005 and 2016. According to the findings of the research, there was a considerable increase in the use of experienced attendants who assist during deliveries, comprehensive prenatal care, and postnatal care between the two years. However, the concentration index for skilled attendants at birth decreased significantly, while the complete ANC concentration index decreased. The study also found that scheduled tribes, media exposure, secondary and higher education contributed to the disparity. To eliminate maternal health service inequity, the study recommends maintaining maternal and child health care programmes under NRHM and targeting lower socioeconomic groups and marginalised mothers.

Devdatt Laxman Pitale (2020)

The COVID-19 pandemic has significantly impacted daily life worldwide, with severe sickness in high-risk groups and an elevated mortality rate. As there is no established protocol for pregnancy hazards, research on pregnancy hazards is necessary. Social distance is the most effective safeguard for patients and medical staff. This study evaluates the effectiveness of protocol-based prenatal care during the pandemic, conducted by the gynaecology and obstetrics section at Naval Hospital Sandhani. The study included 40 participants who were admitted to a prenatal clinic and documented their family, obstetric, and pregnancy histories. Regular check-ups included measurements of the mother's weight, obstetric exams, blood tests, and profiles of the foetus' development. Pregnant women were encouraged to stay at home, practice self-monitoring, and take social isolation precautions. When it came to telephone consultations, a hotline was made available. Eighty percent of the births that took place were natural, and the bulk of the expectant individuals were first-time mothers who were between the ages of 21 and 25. There were no first-trimester COVID-19 instances documented, and the research revealed no correlation between virus exposure and spontaneous abortions in pregnant women. Pregnant women did not have an elevated risk of COVID-19 or other severe infections. However, exposure to asymptomatic careers among healthcare personnel raises stress levels and highlights the importance of protocol-based prenatal care management during the pandemic. Effective management of antenatal care during this epidemic depends on adhering to a protocol-based strategy that is affordable, simple to learn, and provides the strongest defence against COVID-19.

Ngatho Samuel Mugo et. al. (2020)

For the early detection and prevention of obstetric problems during pregnancy, early access to quality prenatal care (ANC) from trained practitioners is essential. This research was carried out with the intention of evaluating a variety of factors of the implementation of the new WHO ANC guidelines in Myanmar. These aspects included the recommended number, the initiation of the process at the suitable time, and the appropriate elements of ANC contacts. For this study, data from 2943 women between the ages of 15 and 49 whose most recent birth took place in the five years prior the 2015–2016 Myanmar demographic information and health Study were reviewed. Using multinomial logistic-regression and multivariate models, an investigation was conducted into the elements that are associated with the utilisation of the revised ANC that was advised by the WHO. To calculate the predicted probability of the components strongly related to the three ANC measures, the authors implement a multiple logistic regression model. 3176 women between the ages of 15 and 49 who had ANC contacts with trained providers throughout their most recent pregnancies in the five years before the study provided the pertinent information on ANC services. By analysing the 2015–2016 MDHS dataset, this research evaluates the current WHO standard ANC criteria. The first result is the recommended commencement of the first ANC contact, which is the proportion of women who had a live delivery in the five years before the survey who started their first ANC contact with qualified healthcare professionals during the first trimester. The second result is the new advised number of ANC contacts, calculated by identifying pregnant women who had a minimum of eight professional ANC encounters and a birth that occurred during the last five years. The number of mother who had a live delivery in the previous five years and who had adequate access to ANC is the third result. After performing multinomial logistic regression, the authors found results such as eight ANC contacts, as recommended by the WHO, in about 18% of mothers, with 58% obtaining sufficient components. If all women resided in cities, Myanmar might reach 70% coverage and 63% if ANC was provided by for-profit hospitals. Mothers in the highest wealth quintile received eight or more ANC encounters, and urban women were more likely to obtain appropriate ANC components. The majority of women in Myanmar are still falling short of the WHO ANC goal for 2016. The results of this investigation demonstrate the necessity of addressing the disparity in health access experienced by women from lower socioeconomic categories, those who are younger, and those who reside in rural regions.

Tina Lavin et al. (2020)

An investigation on the impact of the 2016 World Health Organisation suggestions carried out from this research. The writers of this study have conducted research on the effects of prenatal care on pregnant females. For this study, data on prenatal mortality collected at the provincial level by the Prenatal Problem Identification Programme (PPIP) were used in an interrupted time-series research design. Before and during the implementation period, the authors assessed stillbirths and early neonatal deaths in women who had accessed any ANC. They also looked at overall pregnancy stillbirth risk, the leading cause of death, and maternal health both before and after implementation. For research purposes, data were collected for each month during the study period for live births and perinatal deaths. Before and after implementation, time-series analyses were conducted to look at changes in prenatal fatalities, death rates among just born and those who do not survive to birth. The authors found that there was a decline in stillbirths from 15.5 per 1000 births to 14.5, and early neonatal deaths decreased by 12.8% in the >2500 gm weight group. Time-series analysis both before and after the adoption, were conducted to look at changes in prenatal fatalities, stillbirths, and early neonatal deaths. New stillbirths >2500 g were reduced by 17.2% with a 95% confidence interval of 0.70% to 0.94% when stratified by weight, while early neonatal mortality dropped by 12.8%. While pregnant, where extra ANC contacts were planned, the number of dead babies did not decrease significantly between the pre- and post-periods.

Ashenafi Habte Woyessa and Tahir Hasen Ahmed (2019)

The authors of this research assessed focused antenatal care utilisation and associated factors in West Ethiopia**.** The investigation was carried out using a research methodology based on descriptive cross-sections. The participants in the research were chosen using a systematic sampling procedure. Mothers who were attending their ANC more than (or equal to) four at random were chosen as participants for this study. The questionnaire covered socio-demographic information, obstetric and fertility history, the perceived value of ANC, and variables affecting ANC use. In this study, 42 women participated, with nearly half of them being between the ages of 18 and 25, and 45.2% being between the ages of 26 and 35. Out of 420 women, 309 (73.6%) delivered their babies, whose age group was 18–25 years. The results of this study show that more than 76% of the 330 clients started the services after the second trimester. 1.9%, 8.3%, and 7.4% of clients were lacking crucial elements of the services, such as nutritional guidance, family planning, and HIV/AIDS treatments, in that order. It was discovered that delivering and getting high-quality ANC resulted from a variety of factors associated with mothers, carers, and facilities. The overall ANC utilisation seen may appear to be excellent on the surface, but it was not entirely thorough, targeted, or up to par with contemporary standards. Therefore, the authors strongly advised that more work be done to plan, monitor, and evaluate the service effectively.

Singh, L et al.(2019)

The objective of this study was to evaluate the coverage and appropriateness of antenatal care (ANC) services accessible to women and to look at the socioeconomic factors influencing service uptake. For this, the authors included women in the data set whose age group was between 15 and 49 years. The quality of care, which was classified as appropriate acute care (ANC), insufficient ANC, or complete absence of ANC.

After statistical analysis it was found that the greatest percentage of women receiving ANC from a qualified healthcare professional was 79.3%, while the lowest percentage of women receiving ANC with the proper nutritional value was 45.5%.Over 50% of women in three states (Goa, Kerala, and Sikkim) received adequate ANC coverage. However, in the states of Nagaland, Bihar, and Uttar Pradesh, less than 10% of women obtained enough ANC. Following the bivariate analysis, the authors drew results that indicate a stark contrast in the percentage of illiterate women (9.9%) and literate women (37%) who obtained enough ANC. Urban women received sufficient ANC visits (i.e 32.9%), which was more than compare to rural area. After fitting logistic regression model authors of this study came to some conclusions using odds ratio. Women who had completed at least 12 years of school had a 55% higher likelihood of acquiring sufficient ANC compared to illiterate women. Women who had previously suffered any unfavourable pregnancy outcomes had about 12% more chance of getting enough ANC than their counterparts. The findings indicate that women who have made use of the government and privatised healthcare systems had a 67% greater likelihood of receiving adequate antenatal care compared to those who had exclusively utilised a public healthcare facility.25% of women of all ages currently obtain enough ANC. It was necessary to raise the standard of ANC services received.

Saidi Mgata and Stephen Oswald Maluka (2019)

The author has done an exploratory qualitative study that was carried out in the medical care for women and children in Tanzania for the period April to June 2017. Data were collected through interviews, which were conducted with the help of health care providers. The data sample included of women who were currently receiving prenatal care and mothers who had just given birth within the last 1 year and were physically present at the clinic during the visit.

Output of descriptive statistics showed that women's median age was 26.4 years, with a range of ages from 19 to 37. 40.0% of pregnant women were unmarried, which is the majority. 75% of the women had gestational ages under 19 weeks, 25% were between 20 and 32 weeks, and 45% were expecting their first child. 13 women, or 65.1% of all women, had completed elementary school; 25.1% had completed middle school; and only 5% had completed high school. The main individual and societal reasons for late ANC attendance were each person's opinions of prenatal care, their prior pregnancy experiences, their fear of pregnancy disclosure, and their socio-cultural attitudes.

The study's findings suggest that community members need to be made aware of the value of early ANC attendance.

Abadi Kidanemariam Berhe et. al. (2019)

The researcher wants to examine the effects of hypertension during pregnancy and its impact on unfavourable perinatal outcomes in the Tigray Regional State of Ethiopia. The research involved multiple hospitals in the region, including women with perinatal hypertension (PIH) and normotensive women. The study found that PIH women live in rural regions, were more chances to be primi-gravidas, and have a history of anaemia. Negative perinatal outcomes were observed in the neonates of 66.4% of mothers with PIH and 22.2% of normotensive women. PIH newborns had a higher rate of birth asphyxia, low weight at birth infants, and lower dates of conception at delivery. The study suggests that healthcare professionals should improve pregnancy prevention, early detection, and fast management of PIH to lessen the harmful perinatal effects of this condition.

Afulani, P. A et al. (2019)

For this study, the researcher collected data from a cross-sectional survey. The survey was performed in August and September 2016 between female aged 15 to 49 who had just baby within the last nine weeks. Data was gathered as part of research on how the community in Migori country felt about the quality of maternity care by conducting a cross-sectional survey with mothers who had just given birth. The experimenter used data from ladies who underwent a minimum of one ANC contact during their most recent pregnancy from government as well as private hospitals. The characteristics of the sample and the distribution of all factors linked to ANC quality were examined using descriptive analysis. The mean age was 25 years, while 17% of the population was under 20. With an average parity of three and 79%

of them being married, 30% had four or more kids. 76% of people were literate (could read and write very well), while around 60% had only received an elementary education or less. Only 23% of the population was gainfully employed or working for pay. A little more than two-thirds of patients began ANC in the second trimester and had more than four visits. A nurse or midwife provided ANC to the majority of women (88%) and only a health centre or dispensary (55%). 34% of patients received some ANC from a hospital, whereas 10% received ANC exclusively from a private provider. 34% of patients received some ANC from a hospital, whereas 10% received ANC exclusively from a private provider. Eighty-eight percent of women attended their initial ANC exam, yet 46% of them had pregnancy complications, and 31% of them thought the issue was serious. He used both linear and logistic regression for prediction purposes. The majority of women obtained some of the recommended services once, but not at the frequency that the Kenyan Ministry of Health recommends. During ANC, just 16 percent of women had an ultrasound. About half of the ladies were unaware of the dangers of pregnancy. In addition, roughly a third of those polled said they didn't always grasp the purpose of tests and drugs. After doing multivariate analysis, the author came to the conclusion that women who were literate, employed, and received all of their ANC at a health facility scored higher than women who were illiterate, jobless, and received some ANC at a hospital. According to the author, the chance of getting an ultrasound was twice as high for women who belong to high-class families than for women who belong to middle-class families.

Woyessa, A. H., & Ahmed, T. H. 2019

This study was conducted to evaluate the usage of specialised prenatal services and related characteristics in western Ethiopia. A descriptive qualitative research approach was used to perform the examination. The research participants were chosen using a systematic sampling procedure. Mothers who were making their fourth ANC appointment or more were randomly selected for an in-depth interview. Out of 420 respondents, 87.9% were aware of maternal education. After doing statistical analysis, the authors found that approximately 19.8% of mothers had inconsistent ANC visits. While more than three-quarters of the 330 (78.6%) began in the second trimester, 42 (10%) began in the third trimester. The results of this study suggest that, while overall ANC consumption appears to be satisfactory, it is not of high quality. Overall, the study's findings suggest that although ANC use as a whole superficially appears to be satisfactory, it was not as high-quality and narrowly focused as anticipated. The observed insufficient use of targeted ANC was shown to be caused by many factors, indicating the necessity for additional measures.

Ijeoma Nkem Okedo-Alex et.al. (2019)

The goal of this investigation was to identify the determinants that impact the use of prenatal care (ANC) in sub-Saharan Africa. For this review, the authors considered a total of 74 studies that matched the inclusion criteria. The data extraction form captured the following information: the name of the first author, the publication year, and the where the study will be conducted, the study design, the study participants, the sample size, and the determinants. To determine the studies' quality, researchers used the observational cohort and Cross-Sectional studies quality assessment tool, and the findings were reported using the Andersen framework. Based on the majority of the study, it has been shown that factors such as socioeconomic position, living in urban areas, being older or experiencing age-related increases, having a limited number of children, having an education and an educated spouse, being employed, being married, and practising the Christian faith are all indicators of participation in and punctuality of antenatal care (ANC). This analysis shown that higher attendance rates and early initiation of antenatal care (ANC) in the first trimester were associated with factors such as knowledge of warning signs, adherence to recommended timing and frequency of prenatal visits, exposure to media messages, and a favourable attitude towards using ANC services. The total uptake, timing, and frequency of prenatal visits were negatively influenced by an unexpected pregnancy, past pregnancy difficulties, impaired autonomy, a lack of husband's support, a greater distance to the health center, the absence of health insurance, and the high cost of services.

Priya Somu and Sakthi Narmatha D. (2019)

Death rates for mothers and babies are alarmingly high in India, when compared to a number of other nations. Pregnant women are more likely to use prenatal care if they understand and are aware of the basic care offered throughout pregnancy. Thus, this research examined how much primi gravid women attending a tertiary health care centre understood about prenatal care services. For this cross-sectional study authors considered data from June 2018 to May 2019 among primigravid females who visited Medical College Hospital and Research Institute in Chennai. The research comprised 280 primigravid moms in total. Face to face interviews were used to gather data, which was then analysed using SPSS. In this study, 82.9%, 70.4%, and 80.7% of the women were aware of the need for appropriate ANC visits, IFA tablet use, and TT injection, respectively. 76.1% of the participants were aware of the PNDT legislation. 91.8% of individuals of study were aware of the Dr. Muthulakshmi Maternity Benefit programme, but just 12.5% of primigravidae were aware of the Janani Suraksha Yojna (JSY) plan. Authors found conclusions that the primi moms' knowledge of ANC services was found to be fair but insufficient. This demonstrates the need to encourage young women to use the free healthcare services offered by all government health facilities. It is important to provide enough education starting in the adolescent years in order to raise awareness of ANC among primi moms.

Felix AkpojeneOgbo.et.al. (2019)

The current study looked at the factors that encourage and discourage Indian women from using ANC services. The study considered information from the 2015–2016 India Demographic and Health Survey, which included 183,091 women. According to the WHO's definition, the amount of times of using ANC services was the dependent variable. These services include visits to doctors, nurses, midwives, and lay health visitors. There were three groups of women in this study according on how often they used the ANC service: those who never used it, those who went once every three months, and those who went four times or more. In order to examine the relationship between the research variables and the response variable, multivariate multinomial logistic- regression models were used. According to collected information, the authors of the research concluded that over 50% of Indian women went to the ANC four times or more. Factors that allowed for the required ANC (four) visits were higher family income and parental education, membership in diverse tribes or castes, the freedom of women to visit the health related services, residency in southern India, and exposure to the media. Fewer household wealth, a females' lack of independence, and a woman's domicile in East and Central India, on the other hand, were impediments to proper ANC service utilisation. Our findings imply that socioeconomic and health policy actions in India can help overcome barriers to the utilisation of prescribed ANC services.

Nuamah, G. B et al.(2019)

In this paper, the authors studied the utilisation of maternal healthcare in a rural district in the forest belt of Ghana. For this study, the authors collected data of sample size 720 from prenatal clinics for the period February 2015 to May 2015 by using systematic sampling methods. Authors used the student t-test for variables with categories and the chi-squared test for univariable relationships in this investigation. After analysing the data, the authors found that 68.5% of women had greater than 3 antenatal care visits, 83.6% had utilised skilled delivery, and 33.6% had postnatal care. Also, the authors come to the conclusion that the use of mother's related care was impacted by socioeconomic factors and healthcare access. Intervention is necessary to promote maternal medical care usage, according to this research.

Bedru Hussen Mohammed et al. (2019)

This study's goal was to investigate the relationship between male partner involvement in a mother's medical care and the use of maternal health care services. In Addis Ababa, Ethiopia, a community-based cross-sectional research of couples with infants younger than six months old (N = 210) was carried out. Husband's participation in during wife's pregnancy is considered a primary independent variable. Men and women were given two structured questionnaires to complete in order to gather data.

It's important to look at how the independent factors affect the result, the authors of this research applied models for logistic regression with two and more variables. Based on the predictors, to determine if differences in maternal medical treatment utilisation were statistically significant, the chi-square test was employed. After analysing the data, the authors found some descriptive statistics. Of the 210 women surveyed, 10 did not get any prenatal services (ANC), 35.2% had four or more ANC appointments, and almost half (49% to be exact) did not have their first ANC visit within the first trimester of their most recent pregnancy. At the initial ANC visit, the average gestational age was 3.5 months, with a standard deviation of 1.29. However, 85.7% of the women had a skilled healthcare provider present during their delivery, and 77.6% gave birth in a medical facility. Women with her husband who took the time to know what happened throughout their pregnacy follow-up and reminded them of their ANC follow-up had a higher likelihood of having a skilled birth attendant. Last but not least, women with higher scores on the involvement of their male partners had higher odds of having at least one ANC, their first ANC visit within the first trimester, getting tested for HIV, having a skilled birth attendant assist them, and giving birth in a medical facility.

According to the study, 20% of male partners received HIV counselling and testing along with their partners. This is less than a current Addis Ababa findings report a research in Gondar found that 40.1% of male partners had counselling and testing while their wife was pregnant, and another one that found that 60% of males tested for HIV. The authors found that there is a significant link between male participation in specific activities and their partners' use of specific maternal services.

Teketo Kassaw Tegegne et al. (2019)

Antenatal care (ANC) service accessibility and use vary depending on various geographic locations, socio demographic factors, political factors, and other factors. The objective of this study was to evaluate the spatial patterns of ANC use and pinpoint any contributing elements affecting Ethiopian pregnant mothers. Data from the Ethiopian Demographic and Health Survey and the Ethiopian Service Provision Assessment Plus survey were taken into account in this study. The number of prenatal visits a woman had for her latest delivery in the five years preceding to the survey served as a measure of antenatal care utilisation. In this study, women were divided into three categories based on the number of ANC visits: none, one to three, and four or more. Using principal component analysis methods, the authors of this research identified nine general service dimensions for the general service readiness score, out of twelve variables used by the WHO to measure general service readiness. The results related to socio-demographic details show that the average age of women giving birth over a five-year period was 29.27 years. About 28% of the women were between the ages of 25 and 29. More than 59% of the women were uneducated, while 27.37% had only completed elementary school. In terms of wealth, 32.56% of the women were classified in the poorest quintile, while 23.45% of the women belonged to the richest quintile. The percentage of female who belonged to the Orthodox Christian and Muslim faiths, respectively, was about 34 and 45%. The majority of the women, 78%, came from rural areas. In order to pinpoint the hot spot areas, spatial regressions and hot spot analysis were also used. And although Addis Abeba had a high prevalence of antenatal care use overall, the majority of its clusters had very low values, according to the findings.

With the quantity of ANC visits as the outcome variable, a multinomial logistic-regression model has been constructed for further analysis. The risk of additional ANC visits increased fivefold as the mean score for the availability of ANC services in a typical area increased by one unit. Furthermore, in a typical region, having at least four ANC visits was negatively correlated with every 1 km increase in distance to the closest ANC facility. The region of residence accounted for 25% of the variation in having at least four ANC visits. The Southern Nations, Nationalities, and Peoples region had many clusters of at least four ANC visits, according to the spatial analysis. Additionally, it was predicted that the spatial variations in the use of at least four ANC visits would affect the coefficients of having the first ANC visit during the first trimester.

Sanni Yaya et al.(2019)

The authors looked at changes in the access to healthcare facilities for mothers between 2007 and 2016 to better understand how the healthcare system is recovering in a post-war nation. The population-based surveys conducted in Liberia provided the information for this study. This research looked at information from 7092 women in 2007, 9239 in 2013, and 4290 in 2016. The response factors include the quantity of appointments for antenatal care and the location of the birth. The count of ANC visits is a self-reported indicator of how frequently a pregnant woman receives treatment or attention from a skilled provider. The place of delivery, which can be either at the respondents' home or other traditional homes or at a medical facility, is another way to determine where a child was born. Maternal age, region, place of residence, education, religion, sex of the household head, income index, first birth age, number of children born, and how frequently mothers read newspapers or magazines, listen to the radio, and watch television were considered explanatory variables. After diagnosing multicollinearity among explanatory variables, researchers fit a binary logistic regression model. Results of descriptive statistics showed that the appropriate visits to hospital increased from 71.20 to 79.8% between 2007 and 2016, and the proportion of deliveries that took place in facilities increased from 40.90 to 74.60%. After fitting the logistic model, results showed that the likelihood of delivery in a facility increased significantly in 2013 compared to 2007. Compared to women aged 15–19, the odds of giving birth in a facility were significantly lower for women aged 20–24 and 25–29. After adjusting for other covariates, regional diversity and facility-based delivery were associated. In addition, compared to urban women, rural women had a 55% lower chance of giving birth in a facility. Antenatal care visits significantly increased the likelihood of delivery in a hospital, as did maternal education, households headed by women, media use, particularly among women who listen to radio, and households with a female head of household. Women's odds of receiving facility-based care significantly increased for those with middle, higher, and highest wealth indices compared to those with low wealth indices. Women from South Eastern had a 39% appreciable decrease in proper ANC when compared to Morovia, according to geographic division. There was a statistically significant 49% decline in ANC visits for ladies living in countryside compared to their urban counterparts, even after controlling for other variables. Women with formal education, religious conviction, and media use, such as radio listening, significantly increased their chances of having adequate antenatal care. Women from the wealthiest households were threefold more likely than those from the poorest households to use adequate antenatal care visits. Furthermore, after adjusting for other factors, respondents living in rural areas and in 2013 were 1.83 times more chances to use appropriate ANC visits compared to individuals living in urban areas and in 2007 in 2007. The authors state that the worldwide coverage objective remains unmet, despite improvements in required ANC attendance and formal delivery at institutions between 2007 and 2016.

Kristy Hackett et. al. (2019)

In this cross-sectional qualitative study, authors considered 112 teenagers between the ages of 15 and 20 from the Volta and Eastern Regions of Ghana and the Singida region of Tanzania who had used ANC during their most recent pregnancy to have participated in 14 focus group discussions. They were especially eager to learn what these young women loved and comprehended about their ANC experience since it would shed light on the reasons for their decision to seek care. Conventional content analysis was used to examine the transcripts. A conceptual framework was created based on emerging themes and using the Health Belief Model (HBM) as an analytical tool to show the many reasons affecting teenagers' decisions to attend ANC. Results interpretation using an adjusted HBM shows that teenage health-seeking habits can differ greatly between people and within communities, are impacted by peers' and family members' perceptions, and are inherently affected by variables at the level of larger health systems. Our adaptation of a theory-based framework was created in response to the findings to demonstrate the complexity of teenage care-seeking during pregnancy in contexts with limited resources. We show that although an adolescent mother is capable of exerting her own agency, she is also developmentally susceptible to other influences and needs assistance in order to be able to make independent decisions. Although the approach discussed here is mainly focused on ANC usage, it might be used to understand how teenagers interact with health care more generally.

Jalloh, M. Bet al. (2019)

This research examined the impact of the free medical care initiative on disparities in the use of maternal and child health services in Sierra Leone, specifically focusing on wealth-related inequalities. For this study, the authors collected secondary data from interviews conducted in 2008 and 2013, which conducted an interview. a total of 7374 and 16,658 women respectively. The author used a binary logistic -regression to assess the extent of wealth-based inequality in the usage of institutional delivery services.

The disparity in access to delivery services provided by institutions based on wealth has increased, mostly benefiting those who are affluent, well-educated, and residing in metropolitan areas. According to the inequality data, the distribution of PNC reviews in 2008 was more balanced compared to ANC visits. In 2013, the respondents with the lowest income index utilised more PNC reviews than those who were richer. With respect to education levels and place of residence, the percentage of institutional delivery also varied significantly. The authors found that the FHCI appears to be increasing access to and consumption of MCH services, reducing disparities in ANC visits and PNC reviews, but it falls short of addressing wealth-related disparities in institutional delivery. The authors revealed that a free healthcare campaign improved the use of a few MCH services, but it did not benefit the wealthy for ANC visits and PNC evaluations. Poor people suffer from wealth-related inequalities, and women without formal education or living in rural areas receive inadequate care. Important efforts include addressing injustices, encouraging women's education, hiring more trained personnel, and ensuring treatment that is sensitive to cultural differences.

Noh, J. Wet al. (2019)

For this study, researchers collected data from 2013 to 2014 from Pakistan, with a sample size of 10,200 females who had given birth recently. Researcher’s interest was in measuring who had taken at least four ANC visits. The authors performed a binary logistic regression model for ANC attendance, which was split into at least four ANC visits and fewer than four visits. The authors found that ANC was given to 83.5 percent of women during their last pregnancy; Over 50% of the female population went to the ANC four or more times, as indicated. 53.1% of women began having their initial antenatal care (ANC) visit during the initial trimester., whereas 18.8 percent did not have their first ANC visit until the third trimester. Nearly 70% of women preferred ANC from non-public medical facilities to government health care facilities. From the logistic regression model, authors conclude that after adjusting for all independent factors, proper ANC usage was linked with a smaller household size, a major city domicile, more education for women, better family affluence, and MCH information from LHWs mother-in-law and other.

Tikmani, S. S et al. (2019)

The authors of this study focused on prenatal care changes in low- and middle-income countries throughout pregnancy. The study's main goal was to look at trends in prenatal care utilisation in low- and middle-income countries during a seven-year period. The authors wanted to see how much ANC was used, as well as how much vitamins and iron, tetanus toxoid vaccination, and HIV tests were used. In this research, by controlling factors such as maternal age, education level, and parity, the authors used a regression model to analyse the patterns of women who had either one or four prenatal care visits, broken down by location and year. After analysing the data, the authors observed that a large percentage of women at each of the six locations visited at least one ANC. In all sites, there has been a tendency towards an increasing number of women getting at least one and minimum 4 visits to a hospital over time, with the exception of Guatemala, where there has been a reduction in ANC. At the end, the author wants to say that except in India, in terms of preventative care services, there were disparities across all locations.

Gunjan Kumar et. al (2019)

The study examined the utilisation, fairness, and variables impacting on the use of comprehensive antenatal care (ANC) in India. Comprehensive ANC is defined as having at least 4 prenatal appointments, receiving the required tetanus toxoid shot, and taking iron the vitamin diet supplements for a minimum of 100 days. Researchers examined data from India's National Family Health Survey 4, which included 190,898 women. The variables related to complete ANC use were investigated using a multivariable logistic regression model. The research used logistic regression that is binary to analyse the association among reggressor variables and the utilisation of full ANC therapy. It focused on the prenatal care received during the most recent live birth in all 36 states and union territories of India. The primary focus was on the proportion of pregnant women who got comprehensive antenatal care .Using concentration curves and concentration indexes, the study investigates wealth-based inequalities in the context of comprehensive prenatal care (ANC) in India and states and union territories. Concentration curves plot the percentage of full ANC usage against wealth index, with lower-income people using the service more frequently. A concentration index of 0 means there is no socioeconomic disparity and goes from -1 to 1. Twenty-one percent of expectant mothers used complete ANC, with state-specific percentages ranging from 2.3 to 65.9%. In the United States, 51.6% of women got a minimum of four antenatal care (ANC) visits, whereas the proportion of women who ingested iron and folic acid supplements for at least 3 months of pregnancy varied between 4.5% and 85.5%. In the United States, 91.1% of women aged 70 to 98.6% got at least one dose of tetanus toxoid. There were 4 prenatal visits on average for nation. From the multivariate logistic regression model, it was concluded that women who lived in rural locations had a decreased likelihood of using all of their ANC (adjusted odds ratio, AOR 0.90; 95% CI 0.84-0.96). Women with health insurance had a greater likelihood of utilising all of their ANC benefits. Also, lower chances of complete ANC usage (AOR 0.86; 95% CI 0.79–0.93) were associated with maternal ages under 19 at conception. There was a gradient in the use of full ANC across educational levels, with those with no formal education receiving the least amount of use. There was a correlation between birth order and a lower probability of a full ANC. Full ANC use was associated with decreased chances of unintended pregnancy. Pregnancies that were not reported and lower chances of full ANC usage were linked to the father's absence at the child's ANC visits. Women whose first ANC appointment was in the middle of the third trimester were less likely to utilise the service to its fullest extent. Fewer women who had not received ICDS assistance used their ANC services to their fullest potential. Caste was not linked to complete ANC usage. Finally, the study concludes that the use of prenatal care known as ANC in India is insufficient and unequal, with 50% of women not obtaining the advised minimum number of visits. To reduce the high rates of maternal death, the WHO suggests eight ANC visits. Counselling newlywed couples, disseminating prenatal care messaging, and recording specific care details are tactics to implement WHO recommendations. States with poor ANC utilisation should give improvement of services and use of opportunities top priority. Outpatient-based prenatal care should be given priority under the Ayushman Bharat programme.

Kotoh, Agnes Millicent and Michael Boah (2019)

The study want to determine the age at which a pregnancy begins at the time of the first antenatal care (ANC) visit in Ghana's Upper East Region, Builsa South District. Mothers who recently gave birth within the last six months were the ones whose data was obtained. The study found that 98.8% of the 431 respondents used ANC at least once in the past pregnancy, with 68.3% going four times or more before giving birth. The only significant predictors of commencing ANC in the first trimester were educational achievement, employment position, and the number of children still alive. Women with junior high education had 57.5 greater chances of starting ANC early, while those with secondary education or above had 163.2 higher odds. The study concluded that ANC initiation is influenced by contextual circumstances and recommends investing in female education and health promotion efforts.

Shah, Muslim et.al. (2018)

In order for women to get the right health treatments, health literacy is essential. According to a survey conducted in Nigeria, 87.7% of women of childbearing age were aware of the advantages of prenatal care, with 25.9% having only a passing familiarity. 4.2% had little knowledge, compared to 69.9% who possessed high-quality knowledge. In this study, pregnant women in the rural Lahore village of Gajumata were asked how much they knew about antenatal care. This study employed a quantitative descriptive study design to evaluate pregnant women in the Gajumata Village in Lahore's knowledge about antenatal care. From the total population of 105, a sample of 83 women was finalised by using the convenience sampling method. A comprehensive survey was used by the authors in order to obtain details from the ladies who were pregnant. The graph above shows that 10.8% were under 20 years old and that 44.6% were between the ages of 21 and 30. Looking at the aforementioned graphs, it can be seen that 16.9% of people were illiterate, 44.6 percent were in primary school, 28.9% were in secondary school, and 9.6% had graduated from high school or above. The aforementioned graph shows that 59 percent of participants were in their second trimester, 41% were in their third trimester, and trimester one was removed. 75.9% of respondents said that pregnant women need to go for an ANC, whereas 9.6% said no and 14.5% said they didn't know. The participants' responses to the question of whether two doses of TT injection are advised in the first pregnancy are as follows: Participants' responses ranged from 54.2% saying "yes" to two doses, 20.5% saying "no," and 25.3% saying they were unsure of the number of TT doses as indicated in the table above. When asked if pregnant women needed more nutrition, the majority (74.7%) said that they did, 9.6% said they didn't want it, and 1.7% said they weren't aware of what pregnant women needed to eat. It indicates that in Jempol, Nigeria's Semilan, the incidence of good knowledge was also lower, at 44.2%. More than one of our results fell short of research conducted in South-West Nigeria, where the stated average level of knowledge was 74.6%. Once more, a different survey from north-central Nigeria revealed that 69.9% of people had strong understanding. This research found that over fifty percent of those interviewed had a positive attitude for solid understanding of ANC, and the majority of the women had strong knowledge of it. They were still ignorant of specific aspects of prenatal care. In addition, women who have their spouse's support are more likely to be knowledgeable and strategic. Women with less education than elementary school were probably minimum chance to have a good quality attitude, in contrast to those with educational levels higher than secondary school. Additionally, it was less expected of women who visited a health facility for ANC during their virtually entire most recent pregnancy to have a positive attitude.

Mahima Venkateswaran et al. (2018)

This research was conducted with the intention of achieving how standard prenatal care health information system indicators may alter with the implementation of the registry. Clinical prenatal paper records of pregnant enrolments for 2015 were obtained from 17 basic healthcare clinics that were chosen by chance from five West Bank districts.

The authors reached the conclusion that 501 of the 1369 females were nulliparous. At the time of enrolment at the clinic, 16% of the women were under 20 years old, and 9% were over 35. All primary healthcare clinics that participated in the data gathering of the clinical records provided complete RHIS clinic reports for 2015. All of the high-risk clinics that corresponded to each district had RHIS information available.

Benova, Let al. (2018)

Using ten different countries as an example, the author investigated the relationship between the ANC number of visits, the time of the initial visit, and operationalized indicators for the content of care that are conducted among the general public study. Additionally, the author investigated how these two methodologies are related to one another. Using the most recent Demographic and Health Survey, the authors conducted an analysis of the ANC that was connected with individual's birth that occurred recently up to three years before to the survey. The authors made predictions on the percentage of women who used ANC, as well as the percentage of females who got all components, the six standard components, and each component individually. Additionally, they forecasted the utilisation rate of ANC among women. The researcher made the observation after the study was completed that more over half of the women who need ANC services having more than one visit to an ANC provider in each of the ten nations, with almost two-fifths reporting having more than four visits to an ANC provider. When seen from the perspective of the author, a sample of women who adhered to the worldwide standards for care demonstrated that the quality of care they received was still inadequate.

Gedif MulatAlemayehu (2018)

Often, mothers have pregnancy difficulties and delivery issues. Pregnancy and delivery complications are the major reason of maternal morbidity and mortality in underdeveloped nations. The WHO predicts that over 500,000 female die each year as a result of difficulties during pregnancy, and maternal mortality is high in Gubure city due to a lack of prenatal care. The goal of this study is to figure out what factors influence the use of maternal health care services. For this research, the author collected data using simple random sampling without replacing the sample size of 145 people chosen out of a total population of 1624. The study was done with primary data, and the results were analysed using the statistical software SPSS version 23, as well as logistic model with two categories. According to this study, the use of maternal health care services was shown to be influenced by marital status, occupation, immunisation, maternal health service background, and access to adequate medical care. The researcher concludes that many females do not use facilities because there are insufficient health services and vital information available to the public. As a result, we'd like to tell the Gubre sub-city that they have the delegated the responsibility for providing maternal medical care as they build for this region, as well as to offer adequate care for mothers and all females. According to the researchers, the government and health-related agencies should take the necessary action.

Catherine Arsenaultet al. (2018)

The authors of this study gathered data from 91 LMICs using demographic and health surveys as well as multiple indicator cluster surveys. Researchers rated the quality of prenatal care based on whether or not women who had at least one visit with a qualified antenatal-care practitioner received three important services .The authors of this research used the slope and relative indices of inequality to compare quality across national income groups and to quantify within-country wealth-related disparities. They used random-effects meta-analyses to summarise disparities and analyse the extent to which other spatial and socio demographic factors may explain them. Blood pressure monitoring and urine and blood tests were reported by 72.9% of women who received prenatal care worldwide; this percentage varied from 6.3% in Burundi to 100% in Belarus. In low-income nations, where 86.6% of women accessed care but only 53.8 percent reported receiving all three services, prenatal care quality trailed coverage the most. Within nations, the wealthiest women were four times more likely than the poorest to report high-quality care. After accounting for sub national area, urban residency, the age of the mother, education, and the frequency of prenatal care meetings, significant disparities persisted.

Abraham Yenenehet al. (2018)

Furthermore, the authors provided a description of the geographic variation of prenatal care usage in Ethiopia, as well as the factors associated with it. For this research, the authors included 23,179 women in the population of childbearing age 15 to 49 years in Ethiopia who had given any live births that occurred in the five years prior to the surveys. Age, birth order, location, education, income index, and ANC use were included as explanatory factors in descriptive and logistic regression analyses. The variables that influence the usage of ANC were found using binary logistic regression models, both bivariate and multivariable. In order to quantify the impact of each variable, after controlling for the impact of other factors.

Based on the findings of a model based on logistic-regression, it was shown that women who lived in urban areas had a 1.55 times higher likelihood of using ANC compared to women who resided in remote regions. The women's high income and having completed secondary education will increase their chances of utilising ANC. Women in the age groups of 30–34 and 45–49 were 20% (with 95% confidence interval of 0.68–0.95) and 41% (with 95% confidence interval of 0.41–0.85) when comparing to women in the age range of 25–29, women in this age group are less likely to use ANC. It can be seen from the discussion above that there are many factors affecting the use of an ANC during pregnancy as a precautionary step for the better health of the expecting woman and her newborn child. Also, what health issues can expect women with no ANC to face are addressed in the literature review. This overall review motivates me to do research regarding the study of ANC service awareness in Baramati (dist. Pune).

Ewunetie, AtsedeAlleet.al. (2018)

It was discovered by the authors of this research that the length of time that passes before beginning prenatal care has a substantial impact on the outcome of the pregnancy. The goal of this study was to see how long it took expecting mothers in Debremarkos, North West Ethiopia, to have their first prenatal care visit and what factors contributed to that delay. For this research, the authors conducted a survey study in Debremarkos town, north-west Ethiopia, from February to March 2014 with a well-structured questionnaire. 320 women were considered as a sample that was certain of their last menstrual cycle. To determine the amount and variables related to the late beginning of the first prenatal care visit, statistical analysis, logistic models (both binary and multivariate), and descriptive statistics were used. After statistical analysis, authors found that the percentage of people who went to their first prenatal care appointment after 16 weeks of pregnancy was determined to be 33.4 percent. Females who lived in remote areas, had little formal education, had an unwanted pregnancy, and thought the ideal time to start the first prenatal care visit was after 16 weeks of pregnancy were more likely to delay their first antenatal care appointment. Finally, authors suggest that to avoid unplanned pregnancy in the community, especially in rural areas, the health department should promote prompt beginning of initial prenatal care visits and family planning.

Shahnaz Akhtar et al. (2018)

One hundred thirty-three pregnant women in Lahore were examined by Shahnaz Akhtar and her colleagues with the purpose of determining their understanding, beliefs, and behaviours in relation to prenatal care. results showed that 69.1% of women need regular checkups, and 83.1% value them for monitoring mother and foetus health. The study found that women with higher education levels were more knowledgeable about prenatal care, with significant correlations found between qualifications and awareness, attitudes, and practices. The findings highlight the need for improved prenatal care knowledge and attitudes among pregnant women.

GedefawAbejeFekaduet.al. (2018)

In order to establish the effect that ANC visits had on the use of institutional delivery services, the research was divided into two distinct periods. One of the studies investigated the influence that one or more visits from an ANC had on the use of delivery services in institutions, while the other research investigated the impact that four or more visits from an ANC had on the utilisation of delivery services in institutions. For quality evaluation and data extraction, meta-analyses were employed. The t-squared test statistic and Egger's test of significance were used to investigate heterogeneity and publication bias. The odds ratio (OR) with a 95 percent confidence interval was presented using forest plots (CI). After doing an analysis of the data, the authors arrived at the conclusion that moms who had attended one or more antenatal care sessions were more likely to give birth in health facilities. This was in contrast to mothers who had not received any prenatal care. For every mother who reported receiving prenatal care, there was a fourfold increase in the likelihood that she would also get postnatal treatment.

M. Mazharul Islam et al. (2018)

Within the scope of this study, the authors investigated the variables that have an impact on the frequency and kind of prenatal care visits taken place in Bangladesh. For safe motherhood, the World Health Organisation (WHO) recently advised using a core set of ANC services with a minimal number of ANC meets. An investigation on the extent to which pregnant women in Bangladesh adhere to the World Health Organization's recommendations regarding the quantity and kind of antenatal care services was carried out in this research. For this analysis, data came from a BDHS sample of 17,863 ever-married women in the reproductive age group. For the analysis of this study, the authors considered two response variables, namely the number of prenatal care (ANC) visits and items of service given during ANC checkups. The data was analysed using descriptive, inferential, and multivariate statistical approaches. A chi-square test to evaluate on dependent variables with categories and an analysis of variance (ANOVA) for count dependent variables were used to determine statistical significance. For calculating the regression coefficients, the authors used a negative binomial regression model. According to the data, the majority of moms (96%) were under 35 years old when their children were born, with 28% of them being teenagers between the ages of 13 and 19. The majority of moms had parity 1 or 2 (70%), had completed elementary school or above (86%), resided in rural areas (73.9%), presently used methods for contraception (66.5%), had no work (76.3%), and could make decisions about their own health care (62%). More than half (57%) of mothers came from Dhaka (35%) and Chittagong (22%), two significant administrative divisions; the number of moms varied between 5.8% and 10% in the remaining five divisions. According to the data, 49% of the moms reportedly watched TV at least once a week. About 11% of the moms said that they had an unplanned pregnancy. Private healthcare institutions provided ANC services to more than half of women (53%), public healthcare institutions came in second, with 28% of the vote, while NGOs came in third healthcare facilities (9%). For around 10% of moms, ANC services were provided at home. According to the findings, the majority of the moms got a total of 2.7 visits to the ANC, which is fewer than three visits on average. Almost twenty-two percent of the moms were provided with all of the basics that were recommended for ANC treatment. It was shown that there is a high positive link between the number of ANC services received and the frequency of trips to the ANC. On the other hand, frequent visits to ANC and receiving a greater number of ANC contents. That are linked to having a residing in metropolitan settings and certain administrative zones, having planned pregnancies, high income, and low parity being exposed to the media, visiting skilled providers for ANC services, and visiting public or non-governmental organisation health facilities. According to the report, Bangladesh does not adequately follow WHO recommendations for antenatal care (ANC) visits and core information throughout pregnancy. Despite the focus placed on the ANC under safe motherhood policies by the government and non-governmental organisations, the nation continues to confront issues with accessibility, equity, the absence of health scheme, the shortage of competent workers, and underutilization of available funds. Frequent appointments and better ANC content utilisation are related to socioeconomic and demographic characteristics such as high socioeconomic level, low parity, urban living, planned pregnancies, media exposure, and seeing trained practitioners. The study proposes focusing on moms with unexpected pregnancies, high parity, socioeconomic adversity, and low education levels to enhance outcomes. Focus should be placed on increasing female education and access to high-quality ANC services in order to make long-term improvements. The authors suggest that increased public awareness of the advantages of regular ANC visits and adherence to advised practices might improve maternal care.

Akashi Andrew Rurangirwa et al. (2018)

The study analysed 605 ANC medical records from 121 health centres in Rwanda, focusing on the quality of services provided to expectant women using antenatal care (ANC) services. It found that there is a lack of training opportunities for ANC providers, insufficient information for expectant mothers, suboptimal practices for urgent assessment of maternal conditions, and that not all essential ANC services are provided to all pregnant women. The study also found that only 14% of antenatal care providers had received training in handling such patients. The authors suggest updating the curriculum for nursing and midwifery programmes to improve procedures.

Hijazi, H. Het al. (2018)

A method known as cross-sectional evaluation was used to classify the information that was the data was gathered from 831 females residing in nine different sub-districts throughout three governorates in the northern region of Jordan. Within the scope of this study, the authors evaluate the appropriateness of antenatal care (ANC) content in relation to the number of prenatal visits and the duration of each session. The multivariate LR model is the topic that the writers discuss in this particular inquiry. This model demonstrates that the usage of ANC facilities is influenced by a variety of criteria related to service quality. A woman's degree of education, her desire to get pregnant, and whether or not she lives in an area that is serviced by an ANC clinic are all factors that the authors identified as determining factors that impact ANC use at the individual level. It has been suggested by the authors that the degree to which women have feelings of being valued, informed, and active in their own care might have a beneficial impact on the ANC organisation.

Ping Ling Yeoh et al.(2018)

This investigation aims to ascertain whether or not antenatal care (ANC) is adequate and whether or not it has a connection to the outcomes of pregnancies by using a methodology that takes into account both the utilisation and the quality of ANC. In this study, the authors used binary logistic regression using a complete multivariate regression model to assess the relationship between adequate utilisation of content and pregnancy outcomes. A number of factors, including the age of the mother, maternal education, risk status, clinic type, and utilisation or content sufficiency, were taken into consideration throughout the process of modifying the model. For this investigation, 522 records in total were taken into account. The premature birth rate was found to be 7% per 100 live births, which is a lower rate than the 12% that was mentioned in the previous sentence. The decreased prevalence was caused by the first level of healthcare institutions, which frequently referred patients with extremely high-risk conditions—including those who were at risk for preterm birth—to hospitals to be treated. In the case of premature deliveries, the average gestational age was 34 weeks. Nearly equal to the reported rate of 11%, the low birth weight rate was 13%. In terms of the timing of the first visit, fifty percent of preterm neonates had their first visit before twelve weeks, while the other fifty percent occurred later. By 12 weeks, 45% of low-birth-weight babies had their first visit, and 55% came later. The study discovered that 52.2% of women had less than 80% of the advised routine content, whereas 63% of women used their ANC visits "adequate-plus," with no statistically significant difference. Though not statistically significant, women with appropriate levels of utilisation had decreased probabilities of giving birth prematurely than those with poor or intense levels (adjusted odds ratios (aOR) = 2.34, 95% confidence interval (CI) 0.45–12.16, and 3.27, 95% CI 0.73–14.60, respectively). Women who received subpar levels of care were linked to a greater rate of preterm delivery (aOR = 3.69, 95% CI 1.60–8.55), according to research on content adequacy. The findings of the research indicate that inadequate content is associated with a greater incidence of premature births. This may be interpreted to mean that inadequate utilisation raises the probability of having a premature delivery. The necessity of evaluating the quality of ANC by using both utilisation and content evaluation is shown by this case.

Mekuanint Simeneh Workie and Ayenew Molla Lakew(2018)

In developing nations, complications during pregnancy and delivery are the main factors contributing to maternal morbidity and mortality. The purpose of this research was to do an analysis of the existing situation regarding the utilisation of prenatal care and to create a Bayes count regression model with the intention of predicting the variables that affect pregnant women in the Amhara regional state to make use of antenatal care appointments. Individual of study participated in this analytical study that have in fertility age carried out in the Amhara region. Women who had given birth in the five years prior the survey were the ones whose responses were used for the study. The study's outcome variable is defined as the total count of antenatal care (ANC) service visits made by pregnant women from the beginning of their pregnancy to the ninth month. This study makes an effort to take into account factors that may be potential determinants of barriers to the uptake of pregnancy related services. The zero-inflated Poisson model was used to analyse the combination of data formats seen in the zero-inflated count data, using a Bayesian analytical technique. The authors found the results during their pregnancies: approximately 37% of pregnant women did not obtain prenatal care services, while only about 23% had at least four visits. Rural pregnancy, educated female the middle wealth index, and media exposures were found to be linked with no ANC visits in said regression. This study suggests that in order in order to decrease the insufficient frequency of ANC appointments in the Amhara area, it is important to prioritise attention towards rural women and women with poor educational level.

Dauletyarova M. A. et al. (2018)

In this research, the authors were interested in checking whether Kazakhstani women are satisfied with their prenatal care. The authors of this study examined a total of 1496 women who had babies throughout the specified research period. In this research, the authors focused on variables such as the age of women, their education, and the income of each person in the family. In the original questionnaire, authors categorised degrees of satisfaction with prenatal care as "extremely satisfied," "satisfied," and "not satisfied". The authors fitted LR model, which was used to check independent connections between dissatisfaction and its correlates. From this model, the authors observed that about ninety percent of the ladies said they were happy with their prenatal treatment, while 10 percent of women were not satisfied with their prenatal treatment due to their lower education.

Sumiaty Sumiaty et. al. (2017)

In 2013, the Indonesian Ministry of Health reported a 37.2% prevalence of stunting, impacted by maternal factors and nursing practices, with 41% in Central Sulawesi and 21:42% in Palu. This research aims to ascertain how mother characteristics and nursing practices in Central Sulawesi affect stunting. From August to November 2015, the study was carried out in Palu. Purposive sampling approach, 65 total households, retrospective cohort research design A verified questionnaire serves as the research tool. Univariate, bivariate, and multivariate analyses were used to examine the data. Applying Mann-Whitney and Spearman statistics and using linear regression analysis (significant if $p = 0.05$), one may identify connections between variables and other factors related to postpartum depression and the anticipated value. There were 65 kids who responded, ranging in age from 6 to 23 months. The univariate analysis revealed that 17 children (26.2%), KEK-affected women (20%), and mothers with heights under 150 cm (63.1%) had the highest rates of stunting. Respondents who breastfed started early (up to 49.2%), gave the defendant colostrum (up to 70.8%), provided food prior to nursing (15.4%), and finished exclusively (up to 70.8%). As many as 70.8% of respondents are still breastfeeding their children right now. 12.3% of respondents said they breastfed more than six times per day, and 98.5% said they suckled for more than ten minutes at every feeding. Access to health services is increased for respondents by up to 84.6% for ANC and up to 72.3% for PNC services. Pregnant women who attended lessons—up to 29.2% of them—reported consuming up to 87.7% more tablets than usual. Tablet calcium consumption for respondents was as high as 81.5%. Research concludes that mothers with heights below 150 cm have an impact on feeding practices and access to healthcare, while not receiving prenatal care has an impact on the prevalence of stunting in children aged 6–23 months in Palu. To overcome this author's advice, avoid starting nursing too soon and space it out by 3 years.

Andrea Solnes Miltenburg et. al. (2017)

Improved mother and infant health and wellbeing depend on prenatal care. In Tanzania, the majority of expectant mothers go to a minimum of one appointment. Evaluations of care quality have mostly centred on the use of the focused prenatal care model since its implementation and coverage of standard treatments. In a remote Tanzanian region, the quality of prenatal care is being evaluated in this study from a holistic angle. The components of quality's structure, procedure, and outcome are examined. Results from ANC observations, facility inspections of products and services, and departure interviews with pregnant women throughout many time periods (2012–2015) are presented in this research. This study presents information gathered through facility audits of goods and services, ANC observations, and exit interviews with pregnant women during multiple time periods between 2012 and 2015. Interviews, participant observations, and focus group observations were employed as additional qualitative techniques. The results show that regular ANC services function inconsistently, which is partially accounted for by limited resources. Poor performance was also seen in the areas of obtaining an accurate history, caring about the client's wellness, doing a basic physical exam, and providing proper counselling and education. To enhance the quality of antenatal care (ANC), it is essential to place more emphasis on the process of delivering care that falls outside of insurance coverage. This includes prioritising response-based services and evaluating them based on criteria established at the local level.

Ann-Beth Moller et.al. (2017)

The significance of the first prenatal care visit in guaranteeing the best possible health results for women and children cannot be emphasised enough, and it is advised that all pregnant women start treatment in the starting 3 month of pregnancy. National health information systems and nationally representative surveys provided the data. Using 516 logit-transformed data from 132 countries as the basis, linear regression approach was used to determine the coverage of early prenatal care visits. When providing the cut off for the early prenatal care visit, the model took into account variations among data sources. Regional and worldwide estimations are provided by this study of the extent of early prenatal care visits from 1990 to 2013. For this study, linear regression analysis was used to estimate coverage of early prenatal care visits, which was based on 516 logit-transformed data points from 132 countries. The worldwide prevalence of initial prenatal care visits increased by 43.3%, rising from 40.9% in 1990 to 58.6% in 2013. In 2013, the total coverage in underdeveloped areas reached 481%, while affluent nations had coverage of 848 percent. In 2013, low-income nations had a coverage rate of 240% for early prenatal care visits, compared to 819 percent in high-income countries. The authors suggest that early prenatal care visits have made some progress in terms of coverage, but they are still far from universal. Both within areas and between socioeconomic categories, there is a significant disparity in coverage. To enhance monitoring and evaluation, it is necessary to make efforts to gather and document the extent of early prenatal care visits, since there is a dearth of data in several nations.

Enisha Sarin et al. (2017)

This study aims to assess a quality-improvement programme for obstetric and neonatal care in selected public health facilities across six states in India. For this, health professionals documented information about nine regular care components as well as information on prenatal death once a month. To examine the intervention's long-term impact, researchers combined facility-level data and used segmented regression.

Results found that for eight of the nine process aspects, care considerably increased to 90–99% with a 1% commitment error. For all of the indicators, a substantial positive shift of 30–70% points was seen after the intervention, and the segmented data showed advancement of 3–17% points month over month. Perinatal mortality declined with time, with a fall from 26.7 to 22.9 deaths per 1000 live births ($p < 0.01$). More and more, it is understood that poor treatment is a significant reason for deaths of mothers and babies in India and other nations. Standards, standards, training, incentives, and monitoring are often used strategies to enhance the quality of service provision. However, the health industry has access to other options as well. The study indicates methods for enhancing the quality of something, such as goal-setting, team formation, and iterative goal-achieving, can enhance the provision of facility-based regular clinical practices. Upon doing bivariate analysis, it is evident that the process indicators exhibited significant improvement after the intervention, in comparison to their state before to it.

Hazmi, Jehan Al et.al. (2017)

Prenatal care, also known as antenatal care, supports the health of the both by providing education, screening, counselling, treatment, and monitoring. Its significance for both cannot be overemphasized. According to the authors, the purpose of this study is to determine how many pregnant women in Madina who visit prenatal care clinics are aware of the value of antenatal care. Cross-sectional research on 1617 women in Madina, conducted between August and September 2016, using interviews and questionnaires. This study concludes that the majority of women feel that taking supplementary grains while pregnant lessens pregnancy-related issues despite having no illnesses. Also, the interest of mothers in prenatal care has been greatly influenced by education. More than half understand the value of first visits and follow-ups. Age, gravidity, residence, education, and household income are not factors in regular antenatal care (ANC) and follow-up visits. The level of education and ANC attendance do, however, correlate.

Dickson, K. S et al. (2017)

The researchers look at the contribution of different prenatal care providers in Ghana from 1988 to 2014. This survey collects information on a range of demographic and medical issues. The connection between respondents' background factors and suppliers of prenatal care services was investigated using binary logistic regression models. The findings demonstrate that nurses provided the majority of prenatal care services during the study period. From 55 percent in 1988 to 89.5 percent in 2014, a large number of pregnant ladies made use of the prenatal care services offered by nurses. It was discovered by the authors that women in rural regions were somewhat more inclined to choose conventional methods of giving birth attendants for prenatal care, whereas women in urban areas were more likely to use doctors and nurses for antenatal care.

Yaya. Set al. (2017)

The researchers of this study examined the scheduling and adherence to prenatal care visits among women from Ethiopia. Data was gathered from the 2011 Ethiopian Demographic and Health Survey (EDHS) using a sample method called clustering with two steps. For this research, the authors gathered data from 10,896 women who had experienced at least one delivery. The researchers concentrated on two outcome variables: the date of the first ANC visit and the overall count of ANC visits. They used a LR model with multiple variables for the purpose of examining the factors that are linked to the time and frequency of ANC treatments. As to the authors' findings, a significant majority of women (66.3 percent) did not get Antenatal Care (ANC) within initial days of their pregnancy. Additionally, a considerable proportion (22.3 percent) got ANC for fewer than four appointments. The authors discovered that longer age intervals have a greater risk of insufficient ANC visits. More specifically, the type of residence was linked to a delay in the commencement of ANC visits, female in village area having the highest rate.

MAI DO et. al. (2017)

One of the most prevalent ways for women to join the health care system is via prenatal care (ANC), which was the subject of this research. The authors of the research made use of information obtained from the most recent Service Provision Assessment (SPA) surveys conducted in Kenya (2010) and Namibia (2009). These surveys evaluate the efficiency and accessibility of various health services, including ANC systems. Only those institutions that offered ANC services were included in this research, with a total of 564 in Kenya and 303 in Namibia. The authors found that in both Kenya and Namibia, there were significant differences in the components of care quality that were structural and process-based. ANC services should be strengthened and their utilisation should be increased at health clinics and lower-level institutions, as well as ensuring that existing supplies and equipment are employed to offer services. These are some of the primary programming implications that may be derived from the results of this study.

Dubale Dulla et al. (2017)

In developing countries, pregnancy and birthing problems remain the primary reasons for maternal morbidity and death. Antenatal care is a highly successful strategy for reducing deaths of mother and her baby. The authors conducted a cross-sectional research to investigate the advantage of prenatal care and its related characteristics in the context of expecting mothers in the Boricha area in southern Ethiopia between January and October 2015. The researchers discovered that a substantial proportion of participants had never received prenatal care. There was a strong correlation between the educational level of the respondents and the employment of their spouses with the usage of prenatal care. Antenatal care usage was shown to be correlated with the number of pregnancies, live births, venue of delivery, and profession of birth attendants. Community mobilisation and the extensive deployment of community health agents are proposed as strategies to enhance the use of prenatal care.

Patel, B. B et al. (2016)

In this paper, the authors compare the maternal health status of Indian women with that of other developed countries. This study set out to examine pregnant women's prenatal care knowledge, attitude, and behaviour who attended an antenatal clinic at a Pune tertiary care hospital, and to find out how they are related to different socio-demographic factors. According to the findings, around 58 percent of women had an adequate understanding of ANC. Almost all characteristics, including age, education, employment, parity, family type, and socioeconomic position (SES), were found to have a significant relationship with knowledge of ANC. Finally, from the findings of this study, the authors suggest that there is a require assistance in devising a health intervention strategy aimed at enhancing the health condition of women.

Jimoh Maryam Abimbola et.al. (2016)

Pregnancy and delivery illnesses affect millions of women and babies worldwide, resulting in 800 daily deaths. Understanding the use of antenatal care (ANC) is crucial for better planning and evaluating services. A study in Debre Tabo town, Ethiopia, found that 55.7% of ANC was used, with only 2.6% having access to sufficient services. ANC use is influenced by several factors such as educational attainment, profession, intentionality of pregnancy, perceived significance of prenatal care, monthly household expenses, women's autonomy in decision-making, history of abortion and stillbirth, and maternal awareness of pregnancy-related health concerns. In Nigeria, up to 10% of maternal fatalities occur, and a study in the Afon community found that most respondents were aware of antenatal services, with health workers being the most frequent source of information. Out of 145 pregnant women, 15.9% had their babies at home or in a traditional birth home, while 51.2% had them in a government hospital. To increase service usage, female empowerment and education are necessary, and providers of antenatal care must receive training to enhance their job standards.

Adhikari, T et al. (2016)

In this paper, the author has investigated which factors significantly affect the utilisation of pregnancy support programmes for indigenous women. For this study, data collection was done by the survey method. The authors examined the relationship between the usage of ANC services and several independent variables at the person, family, and village levels, as well as motivational factors, using a logistic regression model. Through statistical research, the authors discovered that the percentage of scheduled tribal women who received comprehensive antenatal care was relatively low in Madhya Pradesh (3.6%) and Rajasthan (4.1%), followed by Chattishgarh (10.4%) and Odisha (14%). According to the authors, antenatal care usage among Scheduled Tribe women in four states was extremely low. Furthermore, the study emphasised the significance of raising knowledge about the importance of early ANC treatment among both pregnant tribal women and their family members.

Abimbola, Jimoh Maryamet. et.al. (2016)

Nigeria, comprising a mere 2% of the global population, accounts for as much as 10% of all maternal deaths globally. A study evaluating the use of prenatal and delivery services in the Afon community found that 87.3% of respondents had four children or less, with Muslims comprising 90.8% and Yorubas comprising 78.4%. The most of infant fatalities obtained within the initial days of life, underscoring the close relationship between maternal care and baby survival. The study revealed that 89.4% of respondents used ANC services during their most recent pregnancy, but only 50.2% visited an ANC clinic for the first time during the first three months. Delivery services were used by 51.2% of women, with 62.5% having trained nurses assist. The study suggests that female empowerment and education are necessary to increase service utilization and improve the quality of care provided by antenatal care professionals.

Wairia, S. Ket al. (2016)

The research was carried out at the health facilities in Nakuru County. The research used a cross-sectional design. The research intentionally chose a total of fifteen level four health institutions, consisting of nine private hospitals and six public facilities. The number of samples needed was calculated using the Yamane 1967 method, resulting in the inclusion of 245 mothers as responders in the research. The data was gathered via the use of surveys that are not fully organised. The analysis was conducted via SPSS software and shown through the use of tables and pie charts. The response rate was 233, corresponding to a percentage of 95.1%. The results of this research suggest that a client's demographic factors, such as age, education, religion, marital status, and occupation, have a notable impact on their awareness. Furthermore, the degree of education is the most accurate indicator of a client's knowledge of maternal health system activities. Regarding knowledge of maternal health system activities, emergency obstetric care (EmOC) and no-cost prenatal treatment had the lowest degree of awareness, with a median score of 1, indicating just minor awareness. The P-value of .037 was observed in the category of free maternity care, indicating the lowest significance level. While there were existing maternal health system activities, the educational level of clients served as a reliable indicator of their likelihood to use these initiatives. Additionally, only a small number of moms demonstrated complete awareness of these programmes.

Alvaro, J. M. S., &Oducado, R. M. F. (2015)

Women of childbearing age in a rural municipality in Iloilo were the subjects of a descriptive-correlational research that aimed to gather information on their demographics, level of education, and experiences with basic emergency obstetrics and childbirth services. A total of 346 participants were chosen via the use of stratified random sampling methods. The data was described using univariate analysis, which included examining the frequency, percentage, and mean. To analyse and discover connections between variables, statistical tests such as Chi-square, Gamma, and Cramer's V were used. Based on what they found, it seems that the majority of the individuals involved exhibited a high level of awareness of the Rural Health Unit's status as a Basic Emergency Obstetric and Newborn Care (BEmONC) facility and its corresponding services. The hypothesis testing revealed a very strong correlation between the use of BEmONC services and factors such as job status, income level, educational status, OB score, pregnancy status, and knowledge of BEmONC services. It is crucial to raise knowledge about maternity and child health care and facility-based services. Instructing females on the significance of delivering in a BEmONC facility, where they may get treatment from competent medical professionals, is vital for ensuring the well-being of the mother and child.

Tukur Dahiru and Oche Mansur Oche (2015)

Nigeria's use of prenatal care, institutional birth, and postnatal care is subpar compared to African standards. A research using the 2013 Nigeria Demographic and Health Survey (NDHS) datasets sought to find characteristics linked to these maternal and child health (MCH) outcomes. According to the research, 54% of women had a minimum of four antenatal care (ANC) visits in the five years leading up to the study. Additionally, 37.3% of women gave birth in a hospital, and 28.9% of babies received postnatal care within two months after delivery. Women aged 15–24 are more likely to receive four ANC visits, with urban and southern parts of Nigeria being more effective than rural ones. Women who have completed more years of schooling are more likely to participate in ANC, and women from wealthy homes use it at higher rates than women from other religions. To enhance the utilisation of indicators and improve the accessibility and availability of antenatal care (ANC), it is essential to focus on rural women and those with little educational attainment. Additionally, efforts should be made to generate demand for health facility delivery.

Ikenna K Ndu et. al. (2015)

An investigation that was executed at the Nigeria University Teaching Hospital in Enugu aimed to identify maternal risk factors associated with low-birth-weight babies (LBW) in southeast Nigeria. The research involved 506 live babies delivered between September 1 and December 31, 2011. The study found that 72 of the infants were LBW, with an incidence rate of 14.2%. The infants had a male-to-female ratio of 1 to 1, with an average weight of 2044.4 g. The mothers were all antenatal cared for. The main maternal risk factors for LBW babies in Enugu include primiparity, APH, HIV, and hypertension during pregnancy. Early identification and proper therapies could help reduce the incidence of LBW and the high NMR in the region.

Alisha Kamat et al. (2015)

Author has proposed a classification algorithm to predict mode of delivery. This study's goal is to predict the delivery mode using ten distinct variables. According to author such type of research would benefit to women about type of delivery so that they could mentally and financially prepare.

For this study two classification algorithm have used

i) Naive Bayes Classification:

The Naive Bayes Theorem, which provides a method to calculate the likelihood of a result, forms the basis of this classifier. Based on the provided attributes, this probability of a class provides an estimation of an item's included in that class. Based on the similarities between characteristics of X and those of items in that class, we can determine the class from which X originates. The likelihood of a posterior for this P (C|X) is calculated as

P(C|X) = $\sum_i \frac{P(X \mid C)P(C)}{P(X)}$ where P(X|C) is the conditional probability of X given C.

ii) Iterative Dichotomiser (ID3):

A decision tree is produced for a given data set using the Iterative Dichotomiser 3 algorithm based on the attributes of the data.

Entropy and information gain calculations must be performed for the algorithm's attribute selection during each iteration. Entropy – H (D) for the data set D can be calculated as follows:

H (D) = - $\sum_{x \varepsilon X} p(x) \log_2 p(x)$. Here, X is the no. of classes in D and p(x) is the probability no. of elements in class D.

Information Gain is calculated as follows:

Information Gain = H(D) - $\sum_{t \varepsilon T} p(t) H(t)$.In this case, T denotes the subsets produced for all iterations by attribute-splitting the data set D.

The study analysed 180 pregnancy factors for 814 females from 2012–2015, focusing on normal or abnormal delivery modes. Naive Bayes and ID3 classification algorithms were used, with Naive Bayes estimating conditional probability distributions and ID3 creating decision trees. The system uses numerical and continuous input for each parameter, with internal processing determining feasibility. Out of 671 entries, 223 were tested, with Naive Bayes correctly classifying 210 and ID3 correctly classifying 206, demonstrating good precision and recall in both algorithms.

Joanna Marie et al. (2015) , A descriptive correlational study examined the characteristics, understanding, and usage of Basic Emergency Obstetrics and Newborn Care (BEmONC) among women of reproductive age (WRA) in a rural Iloilo municipality. A total of 346 participants were chosen via the use of stratified random sampling methods. Data were gathered using a meticulously designed and tested structured interview schedule, which was created prior to the actual data collection. The data was described using univariate analysis, which included the use of frequency, percentage, and mean. To analyse and discover correlations between variables, statistical tests were used. The output indicated that the majority of the participants exhibited a high level of awareness of the Rural Health Unit (RHU) as a However, the majority of them have just availed themselves of the prenatal package, neglecting the birthing and postoperative care. The results of hypothesis testing revealed a statistically significant association between the use of Basic Emergency Obstetric and Newborn Care (BEmONC) services and many factors, including occupation, earnings, schooling, OB score, pregnant status, and BEmONC knowledge. It is crucial to raise knowledge about maternity and child health care and facility-based services. Teaching women why to deliver at a BEmONC where they will be treated by experienced medical health professionals, is vital for the survival of both the mother and the infant.

Zeinab Kamil Dhahi et al. (2015)

The purpose of the study was to evaluate various elements of expressed maternal satisfaction with the care received at 34 basic healthcare facilities in Basra City's first and second sectors. A sample of 400 pregnant women receiving treatment was taken as part of the research using a structured questionnaire. Although the age of the study population in interval 14 and 45 years, the majority were in the age groups 20–29 and 30-39 years. whereas roughly half of the study population were either uneducated or did not finish primary school; 24% had attained education up to the intermediate level; 14.8% had completed secondary education; and only 13.5% of the pregnant women included in the study had completed higher education. The majority of pregnant women, namely 86.5%, were engaged in domestic duties as housewives. After studying the data, the authors have said that the majority of women were living a minimum distance from a health centre. It was observed that the waiting time spent by each pregnant woman was higher than the arrival time. Additionally, it was found that the majority of the pregnant research participants often visited health centres for maternal health care.

According to the findings, the majority of prenatal patients' satisfaction with the care received was generally in the middle of the satisfaction scale. 4.5% of women reported dissatisfaction with the care's general quality. When asked to recommend ways to improve care, women suggested adding ultra sonography to primary health care facilities. This was the top suggestion made by 61.25% of women, who were also concerned about crowded waiting rooms and reception areas. Additional recommendations were incorporating dentists, augmenting the physician count by 6.25%, and introducing female personnel to the maternal health care department by 3.75%. The relocation of the health facility and the maternity care unit inside the centre has resulted in a shift of 2.5% and 5%, respectively. The study's final findings revealed that 96% of the expectant women were happy with the care they had received.

Tsega Nebeb et. al. (2015)

Pregnancy and delivery illnesses affect millions of women worldwide, resulting in 800 deaths daily. Understanding the use of antenatal care (ANC) and its influence on usage is crucial for management decision-making. A cross-sectional study in Debre Tabo town, Ethiopia, involved 4227 participants from four public health facilities. The study found that 55.7% of ANC was used, with only 2.6% having access to sufficient services.

The study also identified notable correlations between educational attainment, professional occupation, intentional pregnancy, perceived significance of prenatal care, monthly household expenses, women's decision-making authority, history of abortion and stillbirth, and maternal awareness of pregnancy-related health matters. Multiple analyses revealed a strong relationship between ANC usage and the mother's educational status, employment, household income, view of pregnancy, pregnancy planning, empowerment, and history of stillbirth.

In conclusion, poor overall ANC use was observed, with factors such as monthly income, decision-making ability, and educational status influencing ANC use. It was recommended that accountable entities work to increase women's capacity to make decisions by expanding educational opportunities. Management bodies should improve ANC services by increasing time, frequency, and substance, working with stakeholders, and boosting women's access to education and decision-making opportunities. More study is needed to uncover policy-related elements for higher-level consideration.

A.R.Johnson et.al (2015),

The authors performed a research to assess the level of knowledge of government maternity benefit programmes among women who were visiting prenatal clinics. A cross-sectional research was conducted on women who were visiting a prenatal clinic at a rural hospital in Karnataka. The study used a structured interview schedule. The highest level of knowledge was seen for Integrated Child Development Services regarding maternal nutritional additives, with a rate of 83.6%. The mother's level of education, the socioeconomic condition of the household, the patient's gestational age, and the parity index were all substantially linked with the level of understanding regarding the schemes.

Dutamo, Zet.al (2015)

The research comprehensively identified maternal health care utilisation throughout pregnancy and delivery. In Hossaian town, South Ethiopia, a community-based cross-sectional quantitative research on 623 women supplemented by qualitative inquiry was undertaken January 1–31, 2014. A standardised questionnaire generated quantitative data, and four focus group discussions (FGD) supported the conclusions. Confounding was controlled using multiple logistic regressions. Analysis results were shown using odds ratios with 95% CI. A thematic analysis was performed using FGD data. Results: The survey found that 86.6% of women received prenatal care. Of the 546 women that visited ANC, 61.3% had their first visit in the second and third trimesters and 49% had less than four visits. The research found that 62.6% of births were supported by competent attendants and 51.4% of women had postnatal checkups. Parity, pregnancy intention, and knowledge of pregnancy risks were substantially linked ($p < 0.05$) to ANC use. Certain socio-demographic, economic, and obstetric characteristics were strongly linked with skilled delivery attendance. ANC frequency, average family monthly income, and knowledge of obstetric hazard indicators during recent pregnancy predicted postnatal care (PNC) use.

Onasoga, A. O et al. (2014),

Significant correlations were found between the mother's level of education, the socioeconomic condition of the household, the gestational age, and the parity index, all of which were connected with the knowledge of the programmes. A purposeful sample of 192 women was chosen. Survey information was examined using descriptive and inferential statistics. The majority of individuals, 94.8%, had heard of maternal health services, but only a few knew the main services offered. According to the research, educational level, parity, and age significantly affected maternal health care utilisation. Major barriers to service utilisation included a lack of familiarity with the services that are now available, a poor obstetric history, healthcare provider's attitude, availability, accessibility, and husband's acceptance. The study recommends government subsidisation to make services more affordable, acceptable, and accessible to women and nurses to women who are of reproductive age should be encouraged to make advantage of health services for mothers.

Sarode, V. M. (2014)

This research investigates the usage of services pertaining to prenatal pregnancy and delivery care in the slums of Mumbai, focusing on a standard of living index based on household amenities, housing quality, drinking water, electricity, and toilet facilities. Data was collected from 433 reproductive women in Rafi Nagar slum who had given birth to at least one live child before the study. The research used LR analysis to evaluate the impact of reproductive health concerns in the absence of antenatal care (ANC) on delivery complications. The findings indicated a scarcity of maternal care who are illiterate and reside in the slum area, with a notable prevalence of inadequate care among those belonging to the most economically disadvantaged stratum.The research emphasises the need for knowledge at all stages of ANC, particularly among illiterate and SLI-category slum women, for optimal reproductive health throughout pregnancy.

Shivam Gupta et. al (2014)

Pregnant women in Tanzania are less likely to receive four or more antenatal care (ANC 4) visits. Exploratory study was conducted to determine variables affecting ANC 4 use and decrease among pregnant women over time. Statistical analysis of Tanzania's population and health were conducted in 1999, 2004/05, and 2010; authors used data from 8035 the ladies who have given birth previous two years. The relationship between four ANC visit utilisation and the deterioration of ANC 4 over time were investigated using multivariate logistic regression models. Authors found that higher service quality; HIV testing and counselling during ANC, taking a combination of sulfadoxine and pyrimethamine in two or more doses in order to avoid malaria during treatment , and the woman's higher educational status were all factors that were positively related to the use of four ANC. Living in a zone other than the Eastern zone, being a single woman, reporting travelling a great distance to a medical facility, attending first antenatal care (ANC) appointment at the four-month mark of pregnancy, and wanting to avoid getting pregnant were all factors that were significantly negatively correlated. Researchers found that the ANC 4 rate has significantly decreased over time, breaking the trend of rising maternal health service utilisation. Finally, authors examined focused prenatal care and how it was implemented across various geographic zones, including how it affected women's perceptions of performance and counselling from medical professionals, which may have contributed to the decline in 4ANC.

Mahajan, H., and Sharma, B. (2014)

This research aimed to assess and evaluate the usage of medical services for mothers and children among primigravida females residing in urban and rural areas. A total of 240 people were enrolled in this research, of whom 120 were from remote areas and 120 were from city areas. The information was gathered on the pre-made questionnaire, and for data entry, the author used Excel 2007. For statistical analysis, the authors used SPSS 19.0 software. The chi-square test was used to compare qualitative data. After doing statistical analysis, the authors observed that in both urban and rural locations, there was a lack of awareness concerning prelactation feed, colostrums, tetanus injection, and iron-folic acid pill use. Only a few research participants in both locations were advised to be tested for HIV before getting pregnant. As a result, the authors suggested that there is a need to organise some campaigns to improve awareness of maternity health among the community.

Rahman, M. et al. (2014)

The research evaluated the influence of maternal, socio-demographic, and other variables on the occurrence of caesarean birth in Bangladesh. The study included a total of 1142 women who had either caesarean or non-caesarean deliveries at a combination of four private and four public institutions. The study used chi-square and Fisher exact tests for initial bivariate analysis, followed by a logistic-regression model to identify risk variables linked to c-sections. The most influential risk variables were identified as nine of the 17 risk factors. Prior caesarean delivery was linked to eight risk factors, includes prior caesarean deliveries, pregnancy-induced leg swelling, extended labour, mother literacy level, maternal age exceeding 25 years, low birth order, infant length over 45cm, and irregular diet consumption. Maternal problems shown greater significance in public hospitals compared to private ones.

Fekadu Beyeneet al. (2013)

The objective of the study was to evaluate the level of understanding among expectant mothers regarding the dietary intake throughout pregnancy and related factors in Guto Gida Woreda, East Wollega Zone, Ethiopia. The study was conducted from January to June 2013, employing a quantitative cross-sectional descriptive approach with a sample size of 422 pregnant women. Additionally, a qualitative study was conducted to complement the findings. The quantitative data were examined using SPSS version 16.0 for Windows. Several LR model analyses were conducted to examine the components that were linked to the dependent variable and to account for any potential confounding variables. The study's results indicated that a mere 64.4% of women have enough understanding about nutrition during pregnancy. A strong favourable correlation was observed between nutrition information, maternal education level, family income, and maternal nutrition awareness during pregnancy. The level of knowledge among expectant women was comparatively low in this research. The research found a strong positive correlation between nutrition knowledge of mothers and factors including as nutrition, family income, and educational level of women in the study region. Therefore, it is essential for the government, in conjunction with relevant organisations, to prioritise nutritional education and disseminate information on nutrition. This will enhance the understanding of pregnant women in the study area regarding proper nutrition and enable them to use this knowledge throughout pregnancy.

Kyei, N. N. A et al. (2012)

One of the suggested therapies to minimise maternal and newborn mortality is antenatal care (ANC). In this research author did study about pregnancy care's level of quality in Zambia. The authors created a grading tool and compared the quality of ANC obtained by expectant mothers to the amount of maternal service supply at health institutions in Zambia on a nationwide scale. The authors surveyed 7146 reproductive women and 6500 males aged 15–49 for their research. A variety of questions on maternity care were asked of all individuals who recently delivered her baby. Between 2002 and 2007, the data collection comprises prenatal information on 4,148 newborns. Authors discovered that just 3% prenatal facilities met our specified criterion for optimal ANC service, while 47 percent provided sufficient treatment and the other 50 percent gave unsatisfactory service. Despite 94 percent of mothers reporting at minimum one ANC appointment with a competent health practitioner and 60 percent attending at least four sessions, only 29% received high quality ANC and 8% attended in the first trimester.

Butawa, N.N.et al. (2010)

For this research, the researcher conducted study to investigate the understanding and opinions of maternal wellness and awareness of health services among women and men of reproductive age in rural locations in Zaria, Kaduna State, Nigeria. A descriptive cross-sectional research of men and women in three northern Nigerian villages in 2008 assessed reproductive health knowledge and maternal medical attitudes. With the exception of 17 adolescent married females and 49 individuals who are 50 years old or older, all of the respondents were in the reproductive age group. Dakace, Shika Dam, and Tsibiri all had a health clinic and a public elementary school, but only Dakace had its own secondary school. Only 35.9% of males and 72.6 percent of females in the sample of 647 respondents had attained formal schooling. The majority's understanding of maternal health was quite limited. Only 3.1 percent of male and 1.2 percent of female had good awareness of maternal health on a three-point scale (poor, fair, and good). There was statistical significance between individuals' educational level and their maternal health knowledge. This was a preliminary assessment of maternal health knowledge within three communities located in northern Nigeria, which revealed very low levels of maternal health information. The optimal usage of maternal health services appears to be limited by socioeconomic constraints, poor educational attainment, and community views of treatment quality. According to the author, to enhance reproductive health in rural regions, men and women must be made more aware of the necessity of health care, and the standard of treatment provided in surrounding health care facilities must be improved.

Titaley, Christiana R. et. al. (2010)

This research addresses Indonesian prenatal care underutilization. The Indonesia Demographic and Health Survey (IDHS) collected data from ladies who have been married at least once and men aged 15 to 54 years, covering demographics, reproductive histories, pregnancies, postpartum care, immunisations, and dietary habits. The research used 26,591 singleton live-born from moms' latest births to improve health care and eliminate remembering bias. The main finding was underuse of prenatal care services, which incorporated did not get prenatal care appointments and moms who went to fewer appointments than the four advised. Prenatal care services offered by trained medical professionals were excluded from the analysis. Sensitivity evaluation was conducted for children whose mothers had not used prenatal care during their previous pregnancy. Tabulations of frequencies were done and logistic regression was performed to identify variables influencing the result. The study found that 20% of 26,591 single-birth children were delivered to women who attended fewer than four prenatal care services. Socioeconomic factors, such as low educational attainment and family wealth index, significantly increased the risks of underutilizing prenatal care services. Maternal education level had a significant impact on the relationship between family index of wealth and insufficient use of prenatal care services. Other factors, such as less exposure to media, lack of knowledge about obstetric complications, physical distance to health facilities, and lack of intention to become pregnant, were also considerably linked with inadequate use of maternal services.

Mavalankar D.V et al. (2009), Lack of management competence, scarcity of qualified workers and the lack of access to blood in remote areas, and infrastructure and supply constraints were all cited as obstacles to decreasing maternal mortality ratios in Gujarat state. The Gujarat government has taken a number of steps to improvement on health services, including partnering with obstetricians in private practice to provide delivery care to low-income women, providing medical officers and nurses with comparatively short training in emergency obstetric care and improving the emergency transport system. Expanding maternal health management capacity, operationalising health facilities, and ensuring EmOC on a 24/7 (24 hours a day, seven days a week) basis by posting nurse-midwives and trained medical officers for skilled care, ensuring blood availability, and improving the registration and auditing of all maternal deaths were among the recommendations made.

Babalola, S., &Fatusi, A. (2009)

In this paper, researchers performed research in Nigeria to evaluate the utilisation of maternal health care. Around of 2148 female who had babies were take in research. The usage of maternal care services among 2148 women who gave birth during the five years before the survey was shown to be strongly linked with several characteristics at the individual, household, and community levels. Based on data obtained from the 2005 National HIV/AIDS and health survey, which was conducted using interviewers and aimed to represent the whole population. According to the findings, 60.3 percent of women used prenatal services, 43.5 percent had a hospital birth, and 41.2 percent got postnatal care. The three parameters of maternity and child health care are not being used to their full potential. According to the findings, Nigerian women's awareness of MCH services is inadequate. While education, socioeconomic factors, and city residences regularly serve as reliable indicators of all maternal health services studied, other determinants of service utilisation vary substantially and have significance depending on the method of treatment: antenatal care, skilled caretaker at birth, and care after delivery.

2.3 Concluding Remarks

In conclusion, this literature review has provided an essential framework for our study project. We have conducted a thorough investigation of the corpus of information already available on reproductive women's awareness of prenatal care. We have gained insightful knowledge, discovered patterns, and looked at the many variables affecting the use of antenatal care during this journey. This investigation has improved grasp of the topic while also highlighting certain gaps and contradictions in the literature. These inconsistencies highlight the importance of our analytical investigation in Baramati, which range from geographical differences in awareness levels to variances in the efficacy of awareness efforts. By undertaking a thorough analysis that takes into account the distinctive socio-cultural and healthcare context of this area, I hope to close these gaps. Expectant mothers' knowledge of pregnancy-related issues has a direct impact on their behaviour while seeking health care, the standard of prenatal care they get, and ultimately, the health of the outcome. Increased knowledge frequently results in improved adherence to medical recommendations, prompt care-seeking, and a lower risk of problems during pregnancy and labour.

Improving pregnant women' knowledge of prenatal care is essential to lowering maternal mortality, promoting the health of both the mother and the child, and improving outcomes for maternal and child health. Encouraging campaigns, efficient healthcare communication, and easily available healthcare services are all part of equipping women with the knowledge they need to have a safe pregnancy and delivery. Study will examine our study's findings and conduct a critical analysis of them in the chapters that follow. In the end, this thesis aims to not only deepen understanding of antenatal care awareness but also to educate policymakers, healthcare professionals, and community stakeholders in Baramati and elsewhere with useful insights. Research continues adventure in the methodology chapter, where we turn our research goals into doable plans of action.

CHAPTER-3

METHODOLOGY

3.1 Introduction

The science of knowing how scientific investigations are conducted is known as research strategy. It's one approach to rationally using several steps to tackle an issue in research. It entails defining issues, developing hypotheses, gathering and analysing data, drawing deductions, coming to conclusions, and then testing those findings to see if they agree with the hypotheses that were developed. An academic activity known as research adds to the body of knowledge through analysing, observing, contrasting, and experimenting. It is a technique for learning through methodical, unbiased techniques with the goal of generalising information and developing hypotheses. This curiosity is the source of all information and is necessary for learning. One method of methodically resolving the issue is through a research approach. In the context of this thesis, which investigates the level of knowledge about prenatal care among reproductive women, the methodology serves as the compass that guides the researcher through the complex labyrinth of gathering and interpreting information. It provides clarity and insight into the methodologies employed and the reasoning behind those decisions by outlining the systematic strategy used to answer the research questions or hypotheses. The researcher intended to discuss the analysis approach, layout, investigation environment, public, test, sampling method, selection, description, and development of health instructional modules, variable studies, pilot studies, information collection processes, plans for data analysis, study results, etc. in this particular chapter.

3.2 Research Methodology

The research difficulty may be systematically addressed by using research methodologies. It may be regarded as a discipline that examines the methodology of scientific inquiry. In it, we examine the many approaches often used by a researcher to analyse his research challenge, as well as the reasoning behind them. The researcher must be familiar with both the methodology and the research methods and techniques. Researchers are required to have the knowledge and skills necessary to execute certain research methodologies, establish particular indices or tests, and compute the measures of central tendency as well as the S.D. and chi-square distribution. However, it is also necessary for them to be aware of which of these methods or approaches may be considered significant and which do not, as well as the relevance of what they would signify. Additionally, researchers must be aware of the underlying presumptions of different methodologies and the standards by which they may determine which methods and processes are appropriate for certain challenges. All of this means that the researcher must create his approach specifically for his topic because methodologies might vary from situation to situation. Research techniques are a component of the research methodology, which contains many different aspects. Unlike research methodologies, research methodology has a broader application. Therefore, when we talk about research methodology, we not only talk about the research methods, but we also take into account the reasoning behind the methods that we use in the context of our scientific study. We clarify why we choose one particular approach or procedure and why we are not using others. This is done so that the results of the research can be evaluated by the researcher as well as by other people.

The execution, assessment, and accomplishment of the study are described in the research methodological framework. It examines the techniques for gauging primigravida women's understanding of prenatal care, including sample design, sampling techniques, data collection instruments, questionnaires, and suggested health education initiatives. The main objective of the research is to determine whether or not health education is successful in influencing demographic and knowledge factors. It is possible to draw valid conclusions from experimental designs, plan health education interventions, have positive effects on the variables being studied, easily adopt experimental designs across disciplines, allow for rechecking and verification of results, and occasionally produces superior findings. A study was done to clarify the differences between statistical analysis and experimental studies and to demonstrate which is more successful and frequently employed in research. According to this study, an experimental study serves as a road map for completing the research project and helps readers understand how the research was carried out, as well as the manner in which the data were gathered in order to facilitate the appropriate analysis. In reality, an effective research project's experimental design forms its foundation.

3.3. Research Process

Before delving into the technicalities of research technique and approaches, it is helpful to provide a brief explanation of the process of doing research. The process of doing research involves a number of acts or processes that must be taken in the precise order that is intended. It is also a method of analysing research problems that begins with the discovery of the issue at hand and ends with the interpretation and dissemination of the results. The quantitative research approach was used in the current study to process the data. The research was chosen to explain the research's concept using quantitative research. Researchers chose the variables for the quantitative research procedure in advance, provided explanations, gathered data from participants, quantified the data, and performed statistical analysis to determine the link between the two variables.

There are three distinct categories of research designs, including experimental, non-experimental, and extra research designs. Pre-experimental study style, which falls under the category of experimental research design, is likely the type that is most suited for the current investigation. The following are steps involved in quantitative research:

- Identifying the research problem
- Create the research goal
- Comprehensive literature review
- Defining working hypotheses
- Designing the research study
- The population and sample size should be specified.
- Prepare the instruments for collecting data and thinking ethically
- Carrying out the pilot study
- Collection of Data
- Analyze of data
- Hypothesis-testing
- Interpretation and generalizations

3.4. Need of the Study

Excessive bleeding, infections, pregnancy-induced hypertension, obstructed labour, and improper abortions are among the leading causes of maternal mortality in India. These issues emerge during the delivery period as a result of a lack of understanding of hospital-based maternal health care programmes for reproductive women. The degree of knowledge and use of ANC services among these women has significant consequences for the region's health system. Disparities in maternal healthcare use continue, particularly in poor and rural communities like Baramati, despite medical improvements and developing healthcare systems. The primary goal of this thesis is to perform a thorough analytical investigation of the level of antenatal care knowledge among reproductive women in Baramati. The study explores a variety of aspects of awareness, such as recognizing the value of ANC, being familiar with services offered, being aware of suggested visit frequency, and being aware of potential hazards related to pregnancy. The goal of the research The objective is to ascertain the magnitude of prenatal care among women who are sexually active in the district of Pune in the city of Baramati. The study will reveal the factors responsible for the safe pregnancy of reproductive women and the good health of the new-born child. The study will explore various aspects of awareness, such as understanding the value of ANC, services that are accessible, the recommended frequency of visits, and awareness of potential dangers during pregnancy. This study aims to offer useful insights that can guide strategies to increase ANC utilisation and subsequently improve maternal and neonatal health in Baramati by looking at the factors influencing awareness, such as socioeconomic status, educational background, cultural beliefs, and access to healthcare facilities. The study will further help the medical practitioners to improve upon the ways to make the masses aware of antenatal care, which is an important part of the maternal care programme run for healthy and safe pregnancy among the reproductive women undertaken by the Government of India.

3.5. Objectives of the Study

The suggested thesis is no different from other doctorate theses in that it contains several of objectives. It also has a number of objectives, which are mentioned and briefly explained below.

- The intention of this study is to determine whether or not reproductive women in Baramati are aware of the need of using prenatal care services.
- To examine the challenges that reproductive women in Baramati encounter when it comes to the use of prenatal care.
- Compare the awareness levels between women in rural and urban areas from Baramati.
- Does prenatal care use significantly vary between rural and urban parts of Baramati?
- To find out whether social, economic, and other factors are linked to utilisation of prenatal treatment based on area in Baramati.
- Is there any challenge rural women face related to antenatal care access?

- To find out the connection between demographic factors with awareness of reproductive women in selected rural areas regarding selected antenatal care services.
- Investigate the various factors, including maternal age, previous pregnancy history, medical complications, and socioeconomic status, that are associated with the type of delivery.
- Is there any significance from a statistical perspective between the quantity of prenatal care appointments and the kind of birth that occurs?
- Does there exist any correlation between the number of visits to prenatal care and the weight of a newborn baby?
- To find a predictive model with high accuracy related to the response variables.

3.6. Review of Literatures

A review of research has been given in order to provide a greater understanding of why antenatal care is so important, which factors affect the utilisation of antenatal care, health issues related to newborn babies, and delivery types among the reproductive women in the Baramati region. The review is limited to works released after 2009, and an effort is made to cover the most recent works. Additionally, research articles are prioritised over books, primarily because research papers report the most recent discoveries before books do. Additionally, an effort is made to include research articles that cover the full range of methodologies and application areas regarding the study of an ANC**.**

3.7. Formulate the Hypothesis

In an experimental investigation, developing a hypothesis is crucial because it shows how certain variables or phenomena are related, and validating the hypothesis will demonstrate the validity of the experimental study. The term "research hypothesis" refers to a hypothesis that is either a prediction or a hypothesised connection that will be examined by empirical methods. A prediction linking an independent variable to a dependent variable is the study hypothesis. In most cases, the inclusion of at least one explanatory variable and one response variable is necessary for the formulation of a research hypothesis. Research hypotheses do not include predictions that cannot be objectively validated or correlations that are assumed but not examined.

H_{01}: There is no statistically significant link between ANC checkups and various socio economic and demographic variables.

H_{02}: There is no significant association between Type of delivery and various socio economic, demographic variables.

H_{03}: There is no significant association between new born Baby's weight and various different variables.

H_{04}: The proportion of women having greater than 8 ANC visit is 50% with different associated variables.

H_{05}: Fitted logistic regression model is adequate

3.8. Research Approach

The forms of study described above highlight the existence of two fundamental research methodologies: the quantitative approach and the qualitative approach. The former entails the creation of quantitative data that can be rigorously analysed quantitatively in a formal and disciplined manner. Inferential, experimental, and simulation approaches are some of the subcategories that may be used to this kind of research. A database that can be used to infer population characteristics or relationships is the objective of an inferential research approach, which aims to develop such a database. This often refers to survey research, when features of a sample of the population are examined to make generalisations about the characteristics of the whole population as a whole. The major goal of the current study was supported by a cross-sectional research strategy.

Although a cross-sectional research design is frequently quantitative, it can also include qualitative components. A cross-sectional study is fundamentally a quantitative research design where characteristics, prevalence, or relationships are measured by gathering data from a sample of people or population-level components at a particular moment in time. Quantifying and analysing numerical data in order to draw statistical conclusions is the main focus. To better comprehend the quantitative results, cross-sectional studies might also include qualitative elements, such as open-ended survey questions or qualitative interviews. For instance, after gathering quantitative information on the prevalence of a certain health problem, researchers may speak with a smaller group of participants in qualitative interviews to learn more about their perspectives and experiences with it. The goal of this mixed-methods approach is to create a more complete picture of the study issue by combining quantitative and qualitative data.

The technique of a research study is greatly influenced by the design of the investigation, which ultimately determines the accuracy and validity of the results. The cross-sectional research design in this study, which examines reproductive women's knowledge of antenatal care in Baramati, Maharashtra, India, provides the framework for how we will look into, gather, and analyse data to address important questions about maternal healthcare knowledge and awareness in this particular area. Maternal healthcare, especially during the prenatal stage, is crucial because it has a big impact on result of baby and mother. Also, the type of delivery has been dependent on maternal health care during pregnancy. In order to improve healthcare services, lower maternal mortality rates, and ensure the health of both mothers and infants, it is imperative to ascertain the degree of knowledge among reproductive women of the value and importance of prenatal care. Promoting the health and wellbeing of expectant mothers and their newborns depends on raising knowledge of prenatal care. The early diagnosis and treatment of pregnancy-related problems, improved maternal outcomes, and a decrease in the rates of mother and infant mortality can all result from raising awareness. This study aims to open the door for customized interventions that cater to the particular requirements of reproductive women in Baramati by identifying knowledge gaps and comprehending the obstacles that prevent optimum ANC use.

3.9. Research Design

The most difficult procedure that follows the effort of identifying the research subject is the creation of the design for the research project, which is often referred to as the "research design." An inquiry or research project is said to have a research design when choices are established on the what, where, when, how much, and by what methods of the investigation or effort. On the other hand, a research design is the arrangement of parameters for data collection and analysis with the intention of striking a balance between the relevance of the study aim and the efficiency of the procedures. In actuality, the conceptual framework for doing research is the research design. Because of this, the design has a flowchart that details the steps that the researcher took, beginning with the formulation of the hypothesis and the consideration of its operational implications and ending with the completion of the data analysis. For this study we used cross sectional study design.

3.9.1 Cross Sectional Study Design

This study is an observational approach research that gathers information from a sample of people at one specific period without further inquiry. These investigations seek to characterize the frequency of particular health issues, risk factors, actions, or traits within a predetermined group or subpopulation.

The objectives that follow are often intended to be accomplished by cross-sectional studies:

Evaluation of Prevalence: Identify the percentage of the population that has a specific health issue, risk factor, or trait.

Investigating Associations: Examine any connections or links between different elements (such as demographics, habits, and exposure to risk factors) and the desired result.

The following characteristics of cross-sectional studies are shared, according to WHO:

Observational Nature: Cross-sectional studies are observational, meaning that researchers do not intervene or manipulate any variables; rather, they merely observe and collect data from the study participants.

Single Time Point: Data is collected at a single time point, making cross-sectional studies suitable for evaluating the status quo or prevalence of conditions or characteristics.

Sample Selection: To choose a representative sample from the target population, researchers employ a variety of sampling approaches. This makes it possible to extrapolate study results to a larger population.

3.9.2. Specification of Study Area

There is a connection between this research and the level of awareness that fertile female in Baramati have about prenatal care. In the Pune district of the western Indian state of Maharashtra sits Baramati, a bustling and quickly growing city. Baramati, which is around 100 kilometres southeast of Pune, is renowned for its distinctive fusion of urban and rural life. The population of Baramati is diversified, including both urban and rural populations. Although the city centre is progressively becoming more metropolitan, the outlying districts still have a charming pastoral feel. With such socioeconomic variety, there is a unique framework for researching social dynamics, healthcare, and other facets of communal life. Baramati is characterised by a diverse population, comprising both urban and rural residents. For this study, primary data were collected from the Mahila Gramin Hospital in Baramati. The investigation was carried out at the selected private and public prenatal OPDs in Baramati. Women's Government Hospital here has become a boon for the women of Panchkroshi. As government hospitals, primary health centres are covid hospitals, especially pregnant women are currently relying on this hospital. In the month of August 2020, the hospital recorded a record 431 deliveries, out of which 166 were caesarean. The operation of this hospital started from July 2015. Every year the number of women visiting this hospital is constantly increasing. In the last five and a half years, 1 lakh 51 thousand 627 women have been treated in this hospital. In this, 15 thousand 724 deliveries have taken place, out of which 5445 are caesarean deliveries. Patients do not have to spend a single rupee in this clinic. Medicines, pills, injections, delivery, food, tea, snacks, laboratory tests, x-rays are all free of cost. Bringing pregnant women from home to the hospital and bringing them home by ambulance after delivery is free.

3.9.3 Types of the Statistics Data

When researching any topic, two categories of features emerge:

- Constant: A characteristic is said to be constant if its value does not vary.
- Variables: Variables are qualities that may vary their values. These qualities are referred to as Variables. There are two kinds of variables, qualitative and quantitative variable. A qualitative variable is a candidate's exam results, which are noted as Pass or Fail. Quantitative Variable: The candidate's performance as a proportion of the total marks. The study of variable characteristics is a component of statistics. Nominal scale, ordinal scale, interval scale, and ratio scale are the four different types of measuring scales that Steven S. S. introduced. A qualitative trait is referred to as an attribute and includes things like gender, nationality, religion, exam grade, blood type, education, and employment. Utilising a Nominal and Ordinal Scale, attributes are measured.

  Nominal Scale: The items are categorised into two or more named categories using the nominal scale. For instance, grouping people according to their gender, country, blood type, qualifications, etc are examples of nominal scale. Other instances of nominal scale are mobile numbers, house numbers, survey numbers, and pin codes.

  Ordinal Scale: Using some measurable features, a set of items is assigned a number according to the ordinal scale of measurement. As a result, groups can be arranged in an orderly manner on this scale. For instance, (a) A group of people classified by income, such as the poor, middle class, and affluent. (b) Student groups based on examination grades, such as First class.

Variables: A quantitative attribute, such as a person's weight, exam scores, a nation's population, a salesperson's profit, etc., is referred to as a variable. Using the interval scale and ratio scale, variables are measured.

Scale of Intervals: The scale of intervals has equal measuring units. Zero, however, is arbitrary.

Ratio Scale: Ratio scales of measuring use equal units that are denominated in real zeros. Examples of ratio scales include all measures of the type weight (Kg), height (cm), time (Hours), etc.

3.9.4. Data Collection

The detail discussions were carried out with various experts and reputed gynaecologists from Baramati to form the nature of questionnaire which can cover and could collect the information from the interviewers (pregnant women) for analyzing the problem of the minor research. After through discussions and frequent meetings with the experts a questionnaire was formed.

For this study we considered 430 records of pregnant women of age group 18-45 who have recently given birth to babies and total 92 questions included in this questionnaire. There is no duplicate record in the dataset. There are total six sections in questionnaire, in that first section contains 19 questions on personal information and questions related to socio-economic and demographic variables. Second section contains total 24 questions regarding awareness of maternal health care. There are 7 questions in third section which is related to earlier pregnancy.11 questions included in fourth section related to recent pregnancy of women. And in fifth section there are 31 questions belong to Obstetrical variables.

Information was gathered through the personal interviews from the respondents through the preformed questionnaire which included the records related to their pregnancy. The study population contains all women within the reproductive age group 18-45 years who are attending ANC clinic from various centres around the Baramati. Source of the data for this study is from Mahila hospital Baramti. The questionnaire was filled from the reproductive women who visited the Mahila hosospital, Baramati.

The questionnaire uses the various variables such as number of ANC visits, education, household wealth, age of the respondent, occupation, number of deliveries etc.

The pilot study was conducted on 10 reproductive women aged 18-45 years from Baramati (Dist. Pune). The primary objective of the pilot research was to determine whether or not the questionnaire could be successfully implemented. Data for this study were collected from October 2022 to January 2023 .The data entry of the gathered information is done with the help of MS-Excel and the statistical analysis was carried out by using the Ms- Excel and statistical software R studio.

3.9.5. Data Collection Method and Tool

The phenomena in which the investigator is concerned must ultimately be translated into data that can be assessed. One of the most difficult tasks for a researcher is to define study variables and choose or enhance appropriate data gathering techniques. The precision and robustness of the inference are still issues, even with high-quality data collecting procedures. The most important and fundamental part of any analysis is data gathering, which provides answers to the problems being examined. Tools are the foundation for data collecting. This study's objective is to analyse the influence of pre planned health education on prenatal care providers' knowledge of certain topics in the antenatal outpatient departments of chosen in Baramati. A formal questionnaire was therefore designed and utilized to collect data.

3.9.6 Tool Development

Although all of us are accustomed to asking questions, the right way to formulate a question for a research study is a difficult matter. The questionnaire is a tool or device used to gather information rather than to gather people's attitudes, convictions, experiences, discernments, or mentalities. It may be planned or spontaneous. The questionnaire is often a relatively brief, preplanned series of items designed to gather explicit data to satisfy a specific need for research data regarding a given issue. The investigation's data comes from knowledgeable respondents who are often from a connected intrigue region. A clearer explanation is provided by the term reference definition. A questionnaire is a written or collected document used to collect data on certain topics and consists of a list of questions that must be answered by at least one person. For the purpose of evaluating awareness of ANC visits in Baramati a well structured questionnaire was created with the help of various gynecologist from

Baramati. In this analysis, the standardised questionnaire was created in a way that would lessen the chance of response bias, promote transparency, and show consideration for the rights and needs of respondents, especially when posing very private questions. Professionals who assisted in defining the pertinent problems for discussion were consulted for their expert opinions and recommendations. A literature review and expert guidance were used to complete this**.** The questionnaire contains total four sections given below.

SECTION 1: **Socio Economic and Demographic Variables:**

In this research, various socioeconomic, demographic, variables are related to a mother's health, like

1) Mother's Age: Analysing how various age groups interact with and utilise antenatal care services may be done by analysing age groupings. Additionally, it can provide light on any potential requirements or obstacles that age groups may face with relation to ANC knowledge and use. The target of this study is to determine whether or not there is a significant link between the mother's age and the weight of the infant measured at delivery. Also is there any relation between mother's age and type of delivery.
2) Living Area: With the use of this inquiry, we may group respondents into groups according to their residence in Baramati's urban or rural areas, certain communities, or geographical regions. We can analyse how geographic factors may affect ANC awareness and utilisation by having a thorough understanding of the local region. Residents of urban and rural areas could have varying degrees of access to healthcare resources and information, which could have an effect on the ANC-related decisions they make. The 'Living Area' variable was categorical variable, so in this study we coded 'Rural' as 0 and 'Urban' as 1 for analytical purposes. The research makes a contribution to a deeper and more comprehensive understanding of the numerous factors that influence the outcomes of pregnancy and childbirth. Additionally, it has practical implications for the development of maternal and neonatal care strategies that are specific to a region. This is accomplished by investigating the possible relationships that exist between living area, delivery method, and birth weight.
3) Mother's Education: To understand how the level of education may affect ANC awareness and use, data on educational background must be collected. The availability of information and healthcare services is frequently correlated with higher levels of education, which may affect a woman's awareness of and ability to make informed

choices about prenatal care. While taking into account probable correlations, the study examines this relationship to see if the mother's education is a statistically significant factor impacting the baby's birth weight. For this study we consider educational levels as, no education, primary education, secondary education, senior secondary education, graduate and post graduate.

4) Family type: The social support networks that are accessible to expectant women and how family dynamics may affect their decisions for antenatal care may be learned from the collection of data on family types. The degree to which different family configurations affect medical choices and availability to resources, such as ANC treatment, may vary. When analyzing the data collected on family type, we can explore how the presence of an extended or joint family structure correlates with ANC awareness and utilization. It may be interesting to investigate whether women in joint families are more likely to receive support and encouragement for ANC visits compared to those in nuclear or single-parent families. So that we coded this variable 0 for joint family and 1 for nuclear family.

5) Monthly Household Income: we may evaluate the respondents' economic situation and how financial considerations can affect their access to healthcare and understanding of the value of ANC by gathering information on monthly family income. Due to financial issues, lower-income households may have hurdles to receiving ANC services, whereas higher-income households may have access to more resources and healthcare alternatives. Analyzing the relationship between monthly household income of a family and ANC utilization can provide valuable insights into the socioeconomic determinants of maternal healthcare in study area. It is believed that a woman's appear for and access to specific types of delivery may be greatly influenced by the economic condition of the household, as demonstrated by its monthly income. The study explores whether a household's monthly income has a substantial impact on the probability of giving birth to children that fall into particular birth weight categories, such as low birth weight or high birth weight. In this data we catagoriesed this variable as 0 for below Rs.5,000 , 1 for Rs.5,000 to Rs.10,000, 2 for Rs. 10,000 to Rs. 20,000, and 3 for greater than Rs.20,000.

6) Number of members in the family: Insights into the possible function of family structure in maternal healthcare decision-making and support systems can be gained by analysing the association between family size and ANC use.

7) Number of employed family members: We can evaluate the household's financial stability and prospective capacity to purchase healthcare treatments like ANC by gathering information on the number of working family members. Greater financial means and support for utilizing ANC services may be indicated by a larger percentage of family members who are employed.
8) Mothers Working Status: By gathering information on the mother's job condition, we may evaluate how it may affect her financial means, availability, and flexibility to seek out ANC services. For the purpose of analysing ANC usage trends, it is crucial to identify the working status of women since employed moms may face different possibilities and obstacles than mothers who are not employed. The research explores whether mother's working status significantly affects type of delivery and new born baby's weight. We coded this variable as 1 for working women and 0 for non working women.
9) Mothers Working Type: We can better comprehend the mother's particular employment circumstances by gathering information on the mother's working style. The use of ANC might vary according on the sort of occupation. In contrast to informal or agricultural work, which may include unpredictable hours and restricted access to healthcare services, formal employment, for instance, may offer more stability and access to healthcare benefits. We considered 1 for physical and 0 for non physical.
10) Marriage month By investigating the potential relationships between marriage length type, type of delivery, and birth weight, the research contributes to a deeper understanding of the multifaceted factors that impact pregnancy and childbirth outcomes.
11) Husbands Occupation: It is investigated if the husband's type of work influences the type of delivery chosen during childbirth. It is hypothesised that a woman's desire and access to particular sorts of delivery may be considerably influenced by the nature of her husband's work or occupation. The impact of the husband's job on the wife's (ANC) visits is also investigated. This association is examined in the study to see if the husband's profession has a statistically significant effect on the baby's birth weight. In study it is coded as 0 = Private Service, Government job = 1, Business = 2, Farmer = 3, daily wages = 4.
12) Husbands Age: It is speculated that the husband's age may have an impact on how the couple decides on their healthcare decision-making process.

13) Mother’s Age at the marriage: It is believed that a woman's decision-making process when it comes to birthing care may be influenced by the age at which she marries. Women who marry at earlier ages, for instance, could see childbirth from a different viewpoint and with different desires than women who marry at older years.
14) Nature of work daily done by Mother: The study examines this link to see if the nature of the mother's daily employment has a substantial impact on the number of ANC visits, the type of delivery, and the weight of the infant. For this study we considered two categories 0 for exhaustive work and 1 for light and normal work.
15) Vegetarian diet or non vegetarian: Data consist of information for diet of mother’s.

SECTION 2: **Antenatal Care Knowledge and Awareness**

Following are some questions regarding awareness of antenatal care:

1) Are you aware about ANC?
2) Do pregnant woman to go for ANC?
3) If yes, is it required to go for ANC even if there is no complication during pregnancy?
4) What should be the minimum ANC visits?
5) Is it necessary to give inj. TT during pregnancy?
6) If yes, how many times inj. TT should be given?
7) Is it necessary to take iron folic acid tablet during pregnancy?
8) If yes, how many iron folic acid tablets has to be taken during pregnancy?
9) Is smoking harmful for the foetus?
10) Is alcohol harmful for the foetus?
11) Do pregnant women need to take extra food as compared with non-pregnant state?
12) Do the pregnant women need to sleep at night minimum 8 hr?
13) Do the pregnant women need to sleep during daytime?
14) Where the ideal place pregnant women should deliver her baby?
15) Do you know that HIV test is compulsory during ANC?
16) Do you aware of 102 service provided by our Government?
17) Do you aware of 108 service provided by our Government?
18) Do you aware of ASHA workers who are government help workers working on health awareness?
19) Do you know any type of Family planning method?
20) Do you aware that pregnant women eat fresh food, vegetables, milk?
21) If yes how frequently pregnant women should eat it?
22) Do you know that HIV test is compulsory during ANC?

23) Did you register your pregnancy?

24) If no ANC what were the barriers?

25) During (any of) your antenatal visit (s), did you receive advice on the following at least once? [Need For Institutional Delivery].

These questions are meant to determine the degree of prenatal care knowledge and awareness among Baramati reproductive women. It aids in determining if women are aware of ANC, its significance, and what it entails. A community's baseline knowledge levels must be understood in order to promote health education, enhance healthcare services, and ultimately improve the health and wellbeing of pregnant women and their unborn children. Researchers and healthcare professionals might find knowledge gaps by inquiring about awareness. This information is essential for customizing educational and awareness initiatives to target particular knowledge gaps that women may have. The questions raise awareness about ANC. The questions may educate respondents who may not have known about ANC before the survey or questionnaire, which might result in greater use of ANC services. Healthcare professionals and policymakers can evaluate the calibre of healthcare information transmission by taking into account the levels of awareness of women in the community. It may result in changes to how pregnant women are informed about healthcare. Awareness questions can help identify if certain subgroups within the population have lower awareness levels. This can highlight disparities in access to healthcare information and services, enabling efforts to reduce such disparities.

SECTION- 3: Earlier Pregnancy and Recent Pregnancy

There are some questions related to earlier pregnancy and recent pregnancy of women in questionnaire. Comparing awareness levels between current and previous pregnancies can provide insight into patterns as well as trends in ANC awareness. This can help evaluate campaigns and healthcare interventions, as well as assess the long-term effects of ANC awareness on female and newborn health outcomes. Analyzing awareness in earlier pregnancies can help identify knowledge gaps that persist across pregnancies, enabling tailored treatments. A comprehensive understanding of the variables influencing ANC awareness among reproductive women can be achieved by comparing awareness levels between recent and older pregnancies. This can lead to the creation of custom educational strategies and the identification of ANC-related topics that need additional emphasis in educational programs.

SECTION- 4: Obstrical Variables and Pathological Formation

Questionnaire contains some questions on obstrical variables. Obstetrical factors, such as pregnancies, delivery methods, infant weight, and pregnancy difficulties, have a big influence on how well both the mother and the baby will do. These factors may be used to assess the relationship between prenatal care (ANC) awareness and real health outcomes, giving a thorough picture of ANC's efficacy. They can act as warning signs for potential dangers and difficulties during pregnancy and labour, and identifying women with poor awareness may help determine which ones are more likely to suffer negative effects. Understanding how ANC awareness and obstetrical factors are related can be used to better target treatments and healthcare initiatives to address certain risk factors, such premature births. Findings on obstetrical factors may have implications for policy, such as raising ANC knowledge to decrease medically unnecessary caesarean procedures. The relevance of preventive healthcare and the function of ANC in reducing difficulties and unfavourable outcomes for women and newborns should be emphasized by studying obstetrical factors within the context of ANC awareness.

3.9.7 Population

A statistical population is an accumulation of the objects or people being studied. The size of the population, symbolised by the letter N, is the total number of units that make up the population. A census inquiry is an exhaustive count of all the constituents that make up the "population". For this study, the study population contains all female within the reproductive age in interval 18–45 years who are attending ANC clinics from various centres around Baramati. Women who have recently given birth and received their newborns represent the population of this study.

3.9.8 Sample

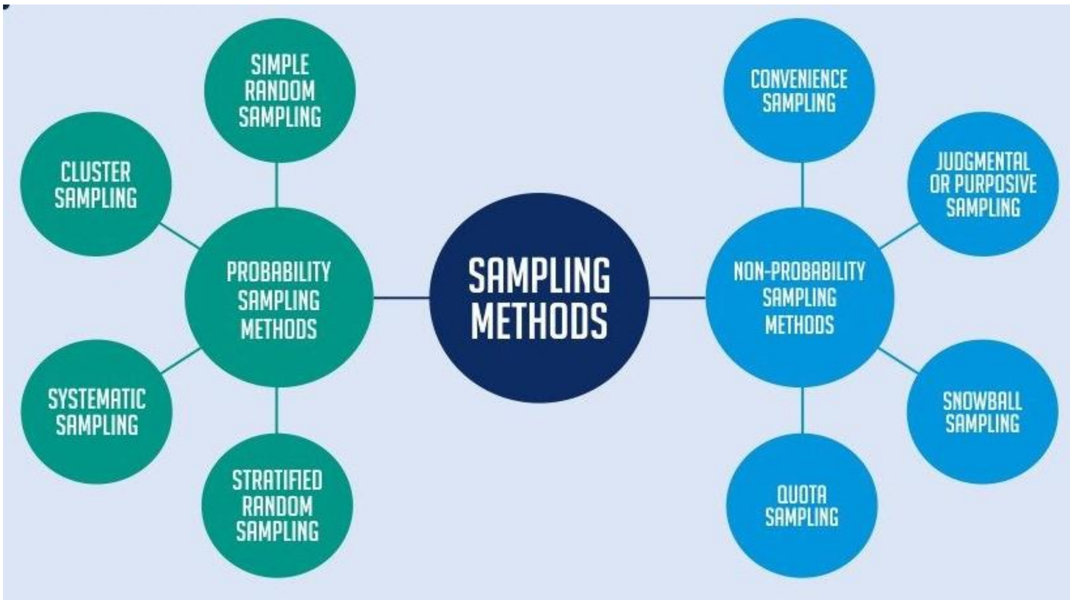
Sampling is the statistical process of choosing a portion of an interest population (referred to as a "sample") in order to make observations and draw conclusions from the data. The general goal of social science research is to deduce behavioral patterns within particular groups. Due to practical and financial limitations, we are unable to investigate whole populations; as a result, we must choose a representative sample from the population of interest to be observed and analysed. A sample is a selection of units selected from an overall population that is relatively small and representative of the whole. Sampling refers to the process of taking a sample. For this study women's in the reproductive age group who recently delivered her baby during the period from October 2022 to January 2023 are considered to be sample.

3. 9.10 Sampling Method And Sample Size

Sampling techniques are essential tools used in research to choose a portion (or sample) of people or things from a broader population. In order to draw inferences about the population as a whole depend on the characteristics of the sample, it is necessary to conduct accurate sampling. There are many different sampling techniques, and each has benefits, drawbacks, and useful applications.

Some sampling methods are probability sampling methods and some are non probability sampling methods. Samples are chosen using a purposive sampling procedure (non-probability). The method of purposeful selection was used in this study to guarantee that the individuals who were selected for participation have the characteristics and experiences necessary to properly address the research goals of the study. This strategy is consistent with the study's goal of gathering in-depth knowledge about prenatal care practices among reproductive women in Baramati. The pilot study was conducted on 30 reproductive women aged 18–45 years from Baramati. The purpose of the pilot study was to find out the feasibility of the questionnaire. A 430 women who had just given birth and received their newborns represent the sample of this study from the date of data collection and were interviewed using a structured questionnaire.

Figure 3.1 Various Sampling Method



3.9.11 Probability Sampling Methods:

1. **Simple Random Sampling (SRS)**

   A SRS is a subset of a statistical population with an the same probability of being picked, providing an objective representation of a group.

2. **Cluster Sampling**

   Multiple groups can occasionally make up a population, making them practical to utilise as sample units. We refer to these collections as clusters. In cluster sampling, we take a straightforward random sample of clusters and use each cluster as a sampling unit.

3. **Systematic Sampling**

   Systematic sampling is a structured method of selecting a sample from a larger population, ensuring randomness and a representative sample. It is commonly used in research and survey methodologies to efficiently gather data from large populations.

4. **Stratified Sampling**

   In non-homogenous populations, SRS is ineffective due to over and under representation. To address this, the population is subdivided into homogenous strata, which are then stratified based on characteristics related to the study units. A random sample from each stratum is then drawn using SRSWOR.

3.9.12 Non-Probability Sampling Methods:

1. **Convenience Sampling**

   A convenience sample is a type of non-probability sampling technique where the sample is drawn from a population that is simple to get in touch with or locate. An illustration of a convenience sample would be to ask individuals to answer questions while you are standing around a mall or grocery store.

2. **Snowball Sampling**

   Sample group is said to expand like a snowball that is rolling. This sampling method is frequently applied to populations that are difficult for researchers to access, such as hidden groups like drug users or sex workers.

3. **Quota Sampling**

   Quota sampling is a method where a population is split into distinct small groups and selected based on a specified proportion. This technique allows individuals to demand their desired sample, making it non-probability sampling. It can be used to save time or find helpful individuals.

4. **Judgmental or Purposive sampling**

The deliberate selection of certain participants based on specified criteria is the non-probabilistic sampling approach known as purposeful sampling, often referred to as judgmental sampling or purposeful sampling. Purposive sampling will be used in this study's context as the sampling technique to make sure that the chosen participants match the study's goals and desirable traits. Purposive sampling is chosen for this study due to several reasons:

3.10 Research objectives

The study's specific research objectives are to examine prenatal care awareness and attitudes among reproductive women in Baramati. Selecting individuals who have pertinent experiences and understanding about this issue is essential to achieving this.

Knowledge: Researchers will use their knowledge to choose individuals who can give in-depth insights regarding prenatal care procedures in the area.

Efficiency of Resources: Purposive sampling can be a resource-efficient method for this study given the emphasis on specified criteria, especially when the population of interest is clearly defined.

Survey

An organized technique of gathering information about individuals and their preferences, opinions, and behaviours is survey research, which uses standardised questionnaires or interviews. Since then, this approach has gained a lot of traction for quantitative social science research. Survey research is a methodical approach to gathering information about individuals through interviews or standardised questionnaires. It was developed in the 1930s and 1940s and is now widely used for quantitative social science research. It may be used for descriptive, exploratory, or explanatory investigations; however respondent bias could occur if the informant doesn't have enough information or insight. For research on team dynamics or employee self-esteem, for instance, CEOs might not be the best informants. Conducting a questionnaire survey using online platforms like Google Forms is a modern and efficient way to collect data from women for research on antenatal care awareness among reproductive women in Baramati. By creating a clear and engaging online survey using Google Forms, we can effectively collect valuable data from women in Baramati by taking interview survey. After conducting the interview survey and collecting responses through the questionnaire, we meticulously downloaded and organized the data. Subsequently, the data were coded in a methodical manner in line with the particular goals that our research aimed to accomplish. This structured approach ensures that the collected information is ready for rigorous analysis and interpretation, facilitating our efforts to gain valuable insights into the awareness of antenatal care among reproductive women in Baramati.

Survey research can be divided into two broad categories:

1. Questionnaire surveys
2. Interview surveys

Qualities and Characteristics of A Good Questionnaire

To determine what should be measured the quality of data collecting is influenced by having a clear knowledge of the data that must be collected.

Should understand how to phrase or frame questions, and phrases should be non-leading and impartial - regardless of your opinion, it should never be reflected in the questions. Both purposefully and unwittingly, this is done, but it needs to be taken care of. Keep the proper words and phrases in mind; the language should be understandable so that the necessary information may be obtained. Additionally, it makes the survey's question and requirements simple to comprehend, which aids in obtaining a better response and response. When conducting a technical survey or a survey that is focused on a particular sector, it is very important to define and qualify terminology. You should clarify any terminology you believe the audience being surveyed may not be familiar with in order to receive an accurate answer. This will improve the content's quality while lowering bounce rates and the quantity of unanswered queries. Avoid using several negative words or double negatives in questions. The psychological impact of using negative language might affect the response. Alternatives that are sufficient or appropriate should be offered. The most likely solutions should be among the available possibilities. Avoid asking many questions at once; just one question has to be answered. If there are many questions, they should all be asked. The avoidance of unwanted assumptions is advised. Assumptions should be avoided because the purpose of a survey is to collect factual facts.

3.10.1 Inclusion Criteria

To ensure that the study group was representative and that the research issues could be appropriately addressed, it was important to specify precise inclusion and exclusion criteria while conducting an analytical study on the knowledge of prenatal care among reproductive women in Baramati. For this study, all female are eligible in the reproductive age group who have recently given birth to their babies in hospitals. The study included only women who are permanent residents of Baramati or have lived in Baramati. This study ensures that they have recent experience with antenatal care. Include only women who provide informed consent to participate in the study. Women who had ethical considerations and participants must willingly agree to be part of the research that was included here. Included women are those who are mentally and physically capable of participating in the study.

3.10.2. Exclusion Criteria

To make guarantee that the study population is both accurately representing of the target group and capable of providing valuable data for related research on prenatal care awareness in Baramati, it is crucial to carefully assess these criteria. Following are some exclusion criteria for the given research:

Exclude women who fall outside the reproductive age range, as they may not represent the reproductive population of interest. Excluded women who do not meet the residency criteria, as their experiences and access to antenatal care may differ from the target population. Women should be excluded who are not currently pregnant and have not been pregnant within the defined timeframe, as their experiences may not be relevant to antenatal care awareness. Women who didn't give informed consent or who later withdrew it were excluded from the research. Women with serious physical or mental illnesses who would be unable to participate successfully were excluded. Women who are either past reproductive age or who have had sterilisation operations that prevent conception should be excluded.

3.11 Variables under Study

While conducting research on the "Analytical Study of Awareness of Antenatal Care among Reproductive Women in Baramati," there was a need to define the variables under study that are central to the current study. Identify those variables that are the key elements we will measure, analyse, and compare to draw conclusions about the awareness of antenatal care. Here are the main variables under study for the research:

3.11.1 Dependent Variable

The variable that is dependent is the major variable of interest that is being investigated in this research with the purpose of explaining, predicting, or comprehending the process. There are three outcome variables for current study.

i) The major outcome variable was interest in evaluating awareness of antenatal care. It displays a level of awareness and comprehension of antenatal care, including its significance, constituent parts, and advised practices, among reproductive women in Baramati. In its new recommendations from 2016, the World Health Organisation (WHO) recommends that pregnant women have a minimum of eight (ANC) visits in order to receive comprehensive maternal care. Here we make a straightforward binary variable based on the number of visits a pregnant lady has attended during her pregnancy to categorise ANC visits as either "less than 8" or "more than 8." The antenatal care visits are considered, and they were categorised by less than eight visits and more than or equal to eight ANC visits. It is coded as 1 for those who attend eight or more than eight antenatal care visits and 0 for those who attend fewer than eight ANC visits. This binary variable can be used to compare outcomes, treatments, or other characteristics between women who had "less than 8" and "more than 8" ANC visits while completing the study.

ii) The second outcome variable is the type of delivery (normal or caesarean). The method of delivery is largely a clinical result that is influenced by a number of medical and obstetric variables, such as the care for both the mother and the child, difficulties during labour, and the medical judgements of healthcare experts. Analysis of the variables influencing delivery type is the goal. For instance, "What factors influence pregnant women's decision to have a caesarean section (C-section) rather than a vaginal delivery?" To examine various aspects of these delivery systems in this study. In this thesis, we investigate two primary methods of childbirth: normal delivery and caesarean delivery. To ensure uniformity throughout our investigation, we have given each approach a number designation. Caesarean births are marked as 1, while normal births are coded as 0. To analyse the data, we used statistical methods, including hypothesis testing. We also performed logistic regression to investigate the factors influencing the choice of delivery method, with the coded variables as the dependent variables.

A) The third outcome variable of the study is the newborn baby's weight. A baby's birth weight is an essential health indicator and is impacted by various variables. According to their weight at delivery, babies should be categorised according to rules provided by the WHO. The health and nutritional state of the infant are evaluated using these categories. These are the weight categories:

B) Low Birth Weight (LBW): Regardless of gestational age, a newborn is considered to have a low birth weight if they weigh less than 2,500 grammes (2.5 kilogrammes or around 5.5 pounds) at the time of birth.

C) Very Low Birth Weight (VLBW): Regardless of gestational age, a newborn is considered to have an extremely low weight at birth if they weigh less than 1,500 grammes (1.5 kilogrammes or around 3.3 pounds) at delivery.

D) Extremely Low delivery Weight (ELBW): Regardless of gestational age, a newborn is considered to have an ELBW if they weigh less than 1,000 grammes (1 kilogramme or around 2.2 pounds) at delivery.

These distinctions are critical since a baby's birth weight can serve as a barometer for their general well-being and nutritional state. Low birth weight, particularly very low and extremely low birth weight, may increase the risk of health issues and the need for specialized treatment. It's crucial to remember that a newborn's birth weight is not the primary consideration when determining how healthy they are. The wellbeing of a baby is also significantly influenced by characteristics including gestational age, mother health, and other elements. To establish the proper care and monitoring required for babies, healthcare professionals combine these criteria. For this study, a new-born baby's weight was classified into two categories: 0 for less than or equal to 2.5kg and 1 for greater than 2.5 kg.

3.11.2 Independent Variable

The elements or characteristics that researchers change or investigate to ascertain their impact on the dependent variable are known as independent variables. In questionnaire there are question related to independent variables of the study. These questions will help you gather information about the factors that could influence ANC utilization. Here's a description of that questions for the independent variables:

In this study we considered following variables as independent variables related to a mother's health and variables related to awareness of antenatal care are to be considered independent variables. Mother's age, mother's education, living area, family type, total number of people living in the family, number of employed family members, Gross monthly household income, mother's working status, mother's working type, marriage month, husband's age, mother's age at the marriage, nature of daily work, place for ANC, etc. are socio-economic and demographic variables that are to be considered independent variables for study. Also, there are some independent variables related to awareness of antenatal care, like iron supplements taken during pregnancy, media exposure, consumption of alcohol, awareness about ANC visits, knowledge about danger signs of pregnancy, etc. Some of the variables, like mother's HB, mother's weight before delivery, ultrasound examination (USE), type of earlier delivery, new-born baby's sex, pregnancy period until delivery, etc., are considered independent variables.

3.12 Statistical Methods Used For Data Analysis

In order to ensure the health and wellbeing of both the female and the infant still in the womb, antenatal care is an essential part of maternal healthcare. An analytical research was conducted in Baramati to determining the degree of prenatal care knowledge among reproductive women. To acquire insights into the awareness levels and variables affecting them, this study included data analytic techniques like pie charts, descriptive statistics, chi-square tests, and proportion tests.

Pie charts were used to illustrate the distribution of knowledge levels among women. The categories for awareness levels, such as aware of ANC and not aware of ANC, how many women live in rural and urban areas, how many women receive fewer than eight ANC visits, and how many receive more than eight ANC visits, mother's educational status, type of deliver, new born baby's weight etc., can be shown by a pie chart. The pie chart may give a quick summary of the percentage of women who fall into each awareness group, making it simple to determine which degree of awareness is most prevalent. Key features of the study population were outlined using descriptive statistics. The average, median, and mode are all the measures of central tendency are included in these statistics for elements like age, education level, and socioeconomic position. They aid in illuminating the respondents' demographic profile and any potential relationships between awareness levels, type of delivery and baby's weight.

The chi-square test is used to examine the relationship between different category variables and awareness levels. For instance, researchers may have looked at whether there is a connection between knowledge of prenatal care and things like money, education, or living in the city or the country. A p-value showing the significance of these correlations would be provided by the chi-square test. Also chi square test is used to check association between type of delivery and various factors. It is used to check relationship between baby's weight and different socio economic and demographic variable as well as obstrical variables. Proportion tests, such as z-tests or t-tests for proportions, can be used to determine if the proportion of women with "Highly Aware" or "Moderately Aware" status is significantly different from a hypothesized value. This can be useful in comparing awareness levels between different groups within the study population, such as urban vs. rural residents or educated vs. uneducated women.

An in-depth insight of the issue is provided by the analytical research of prenatal care awareness among reproductive women in Baramati by combining data analysis techniques. Pie charts provide awareness levels a visual depiction, whilst descriptive data show demographic traits. Chi-square analyses reveal relationships between categorical variables, whereas percentage tests measure variations in subgroup awareness.

These data analysis methods allow academics and medical practitioners to identify regions where prenatal care knowledge may be low and then design interventions to enhance maternal healthcare outcomes in Baramati. The improvement of maternity and child health care as well as evidence-based decision-making are both benefits of this analytical method.

The methodology encompasses three key components: the analysis of "churn of face," the use of odds ratio, and the application of the t-test for assessing baby's weight. For understanding the relationship between antenatal care awareness and various outcomes, we utilized a dataset that included variables related to awareness levels, demographic factors, and health outcomes. We focused on the association between the number of ANC visits and maternal and neonatal outcomes. The odds ratio was computed to quantify the strength of association between the different trips to the ANC and the occurrence of specific outcomes. In order to determine the accuracy of the estimate, statistical software was used to compute the odds ratio, and a confidence interval was also included in the calculation. Through this study, insights were presented on the effect that ANC visits have on the health of both women and babies. We applied the independent t-test to compare the means of baby's weights in different groups or categories, such as babies born to mothers with different nutritional statuses or age groups. The t-test allowed us to determine whether statistically significant differences in baby's weight existed between these groups.

In Baramati, an analytical study was conducted to investigate awareness of antenatal care among reproductive women. This study employed two advanced data analysis techniques: logistic regression and decision trees to identify factors influencing awareness levels.

Logistic regression is a statistical technique used for modeling binary outcomes, making it suitable for analyzing the less than 8 ANC visit and more than 8 ANC visit from this we can say that a women who attend more than 8 ANC visit may be aware about antenatal care and ultimately outcome of pregnancy may be good. LR models were constructed to ascertain the significance and direction of the relationship between each independent variable and awareness status. Odds ratios were used to assess the strength of these relationships. The logistic regression models were evaluated using goodness-of-fit tests and the significance of coefficients to ensure their appropriateness.

In the field of machine learning, decision trees are an algorithm that may be used for classification as well as regression applications. In this study, a decision tree was employed to identify the most influential factors affecting antenatal care awareness.

Logistic regression and decision tree approaches were used in the analytical research of prenatal care awareness among reproductive women in Baramati to acquire understanding of the variables affecting awareness levels.

The statistically significant connections between numerous independent factors and awareness state could be found thanks to logistic regression. Policymakers and healthcare professionals can target particular demographic groups with awareness campaigns and interventions with the use of this information.

A clear visual depiction of the hierarchy of elements impacting consciousness was offered by decision trees, on the other hand. Decision trees provide useful direction for resource allocation and personalized actions by identifying the most important criteria. Together, these cutting-edge data analytic methods help to provide a thorough picture of prenatal care awareness in Baramati, supporting the formulation of focused plans to enhance mother’s positive health outcomes in the area. In this section, we outline the specific procedures and techniques employed to investigate the factors influencing awareness regarding antenatal care among reproductive women in Baramati. Logistic regression analysis will be used to model the binary outcome variable, which represents ANC visits less than 8 (coded as 0) and ANC visits greater than or equal to 8 (coded as 1) of antenatal care. Similarly for second output variable (type of delivery) normal delivery coded as 0 and caesarean delivery coded as

1.Where as for third response variable new born baby's weight coded as 0 for less than 2.5 kg weight and 1 for greater than 2.5 kg weight.

CHAPTER-4
EXPLORATORY DATA ANALYSIS

4.1 Introduction

An exploratory data analysis, often known as EDA, is a method used in statistics that involves analysing data sets in order to emphasise the most important aspects of those data sets. This method usually makes use of statistical graphics and other methods for data visualisation. In contrast to the conventional method of hypothesis testing, exploratory data analysis (EDA) is largely used to investigate what the data might tell us that go outside the formal models. A statistical model can be utilized or not. Since 1970, John Tukey has championed exploratory data analysis to compel statisticians to investigate the data. Exploratory Data study (EDA) is a type of study that seeks for broad trends in the data. These patterns include irregularities and perhaps unexpected aspects of the data. EDA is a crucial first step in every data analysis process. EDA, which usually makes use of data visualisation tools, is carried out by data scientists in order to investigate and assess data collections and to summarise the most important characteristics of such data sets. The process of deciding how to change data sources in order to get the answers that data scientists want is simplified, which makes it easier for data scientists to discover patterns, recognise anomalies, test hypotheses, or validate assumptions. EDA helps to comprehend the dataset we are dealing with better. We can determine the structure, nature, and interrelationships of the data. Any outliers or anomalies in the data that may need more study or cleaning can be found using EDA. We may find patterns, trends, and correlations in the dataset using EDA. Making educated judgments requires this. By checking for missing numbers, discrepancies, and other data quality problems, we may evaluate the data's quality.

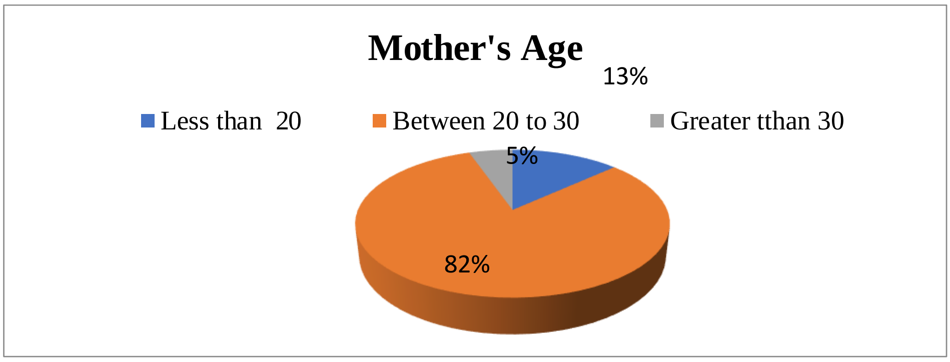
4.2 Graphical representation of data

The creation and presentation of the pie charts that depict the distribution of the categories for the kind of birth and baby's weight within research cohort may now be done after this introduction. Before beginning the statistical analysis, these charts will act as a visual assistance to help readers understand the basic patterns and proportions.

Table 4.1: Distribution of mothers according to their age

Age in Years	Frequency	Percentage
Less than 20	57	13.25581
Between 20 to 30	350	81.39535
Greater than 30	23	5.348837
Total	**430**	

Fig.4.1 : Distribution of Mother's according to age

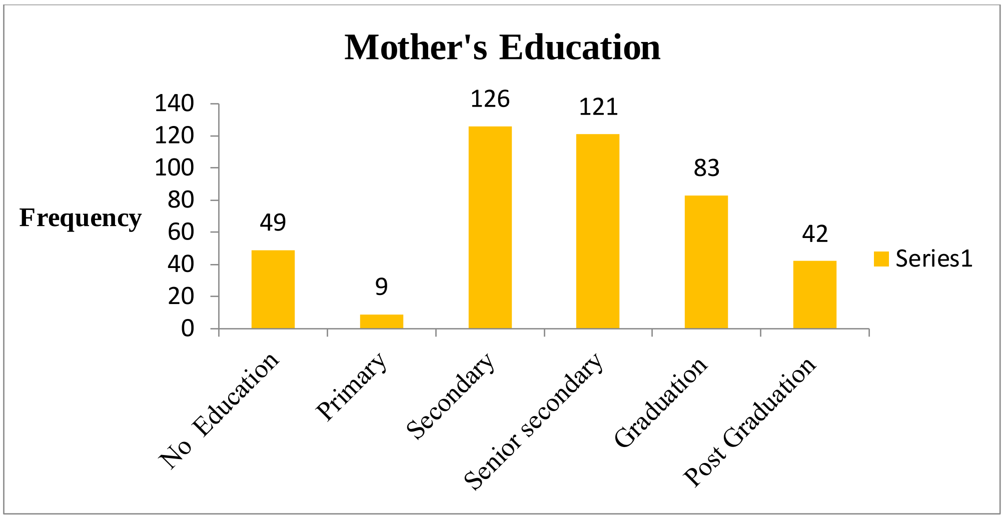


Distribution of mothers by age is shown in Table 1 and Figure 1 in terms of frequency and percentage. Maximum samples 350 (81.39%) were between the ages of 20 and 30 years, according to data. Then, 57 (13.25%) of the samples belonged to the under-20 age group. Less than 23 (5.3%) of the samples were older than 30. The pie chart above reveals that the majority of the females were younger women.

Table 4.2: Distribution of mothers according to education

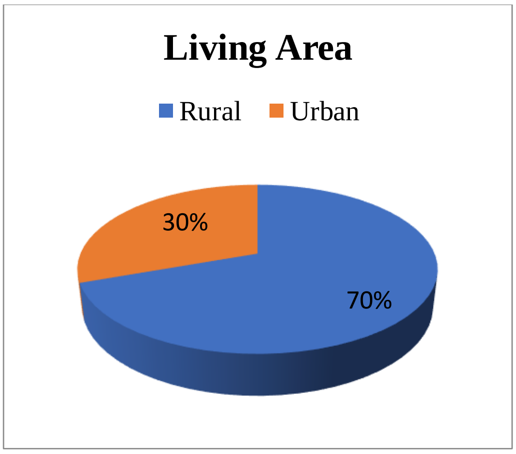
Mother's Education	Frequency	Percentage
No Education	49	11.39
Primary	9	2.09
Secondary	126	29.30
Senior secondary	121	28.13
Graduation	83	19.30
Post Graduation	42	9.76
Total	**430**	

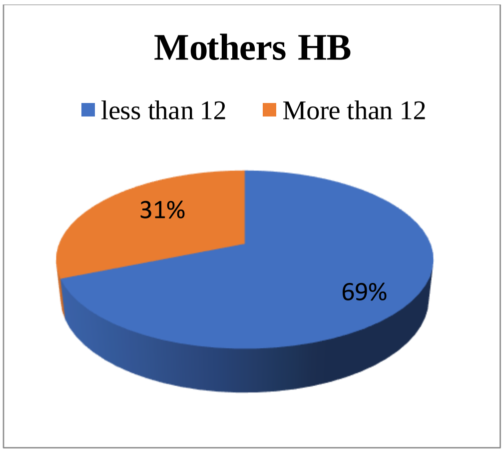
Fig.4.2 Distribution of Mother's according to education



The bar diagram illustrating the educational distribution among women in Baramati offers a clear interpretation of the educational gaps in the region. Bar diagram shows that the majority of women have attained secondary and senior secondary education, constituting a substantial portion of the population at 29% and 28%, respectively. This observation highlights a relatively strong foundation of formal education among the women surveyed. On the other hand, it is concerning to note that 11% of women in Baramati have no formal education, and only 2% have received primary education. These statistics underscore the existing educational disparities within the community, which are critical in the context of maternal healthcare. The diagram highlights the importance of addressing these disparities by focusing on educational initiatives, particularly at the grade levels, including elementary and secondary. This is because women who have completed greater levels of education have a tendency to demonstrate a greater awareness of antenatal care, which in turn influences their behaviour regarding seeking medical attention throughout pregnancy.

Figure 4.3: Distribution of mothers according to their living area

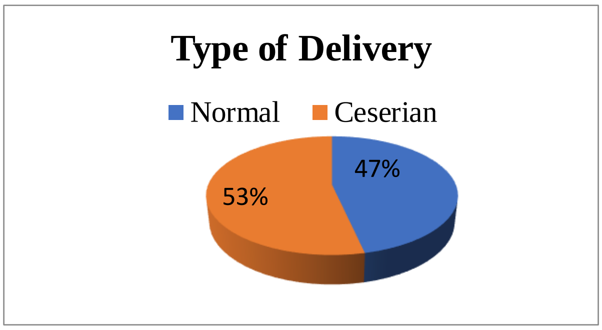




The survey's results, which show that 70% of the women live in rural regions and 30% live in urban areas may be effectively, visualized using a pie chart. The larger piece of the pie, which makes up 70% of the whole, would stand in for the women who reside in rural regions. This large section emphasizes how prevalent women are in rural areas within the studied population. The women who live in cities would be the smaller group, making about 30% of the pie. Although this group is smaller than others, it represents a significant portion of women who live in urban areas.

From pie chart shows that most of the mother's 69% in data have haemoglobin level less than 12 gm/dl. If a pregnant woman's haemoglobin (HB) level is less than 12 grams per deciliter (gm/dl) before delivery, she is considered to have anaemia. The mother's health and well-being may be negatively impacted in a variety of ways if she has anaemia while pregnancy. Severe anaemia during pregnancy is associated with an increased risk of preterm birth, which may have repercussions for the baby health in the long run.

Figure 4.4: Distribution of mothers according to their delivery type

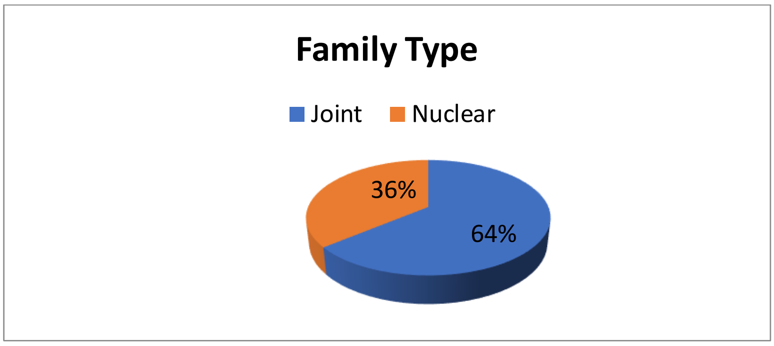


Represented by a segment of the pie chart, this 47% indicates a significant proportion of women who have chosen and successfully experienced normal deliveries. Although this portion of the total is considerably fewer than half of the total, it highlights the significant number of women who have chosen this natural delivery approach. The larger segment of the pie chart, comprising 53% of the whole, signifies the majority of women who have had caesarean deliveries. According to the findings of the survey, more than half of the women have undergone surgical interventions during childbirth.

It is noteworthy that the number of caesarean sections performed has significantly increased and it is indicated by the pie chart. Several factors could contribute to this change, including changes in medical guidelines, maternal preferences, healthcare provider practices, and potentially evolving societal attitudes toward childbirth.

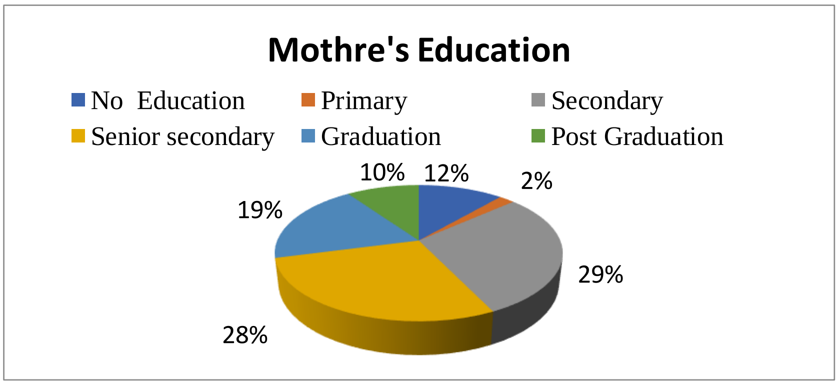
Understanding the reasons behind this increase is essential for healthcare professionals and policymakers. While caesarean deliveries are a necessary and life-saving procedure in many cases, overuse can carry risks and may not always be the best option for all mothers. It is crucial to ensure that caesarean deliveries are performed when medically necessary and align with best practices in maternal healthcare. The relevance of this trend lies in the fact that it highlights the need of ongoing monitoring and study in order to enhance the quality and safety of delivery practises, ultimately benefiting maternal and child health outcomes.

Figure 4.5: Distribution of mothers according to their family type



It can be observed that 70% of the respondents are from rural area in Baramati whereas 30% are from urban area of Baramati. The pie chart indicates a substantial proportion of women residing in rural areas of Baramati. Results for maternal health might vary depending on the family structure, whether it is nuclear or joint. 64% women's belongs to nuclear family and 24% are belongs to joint family.

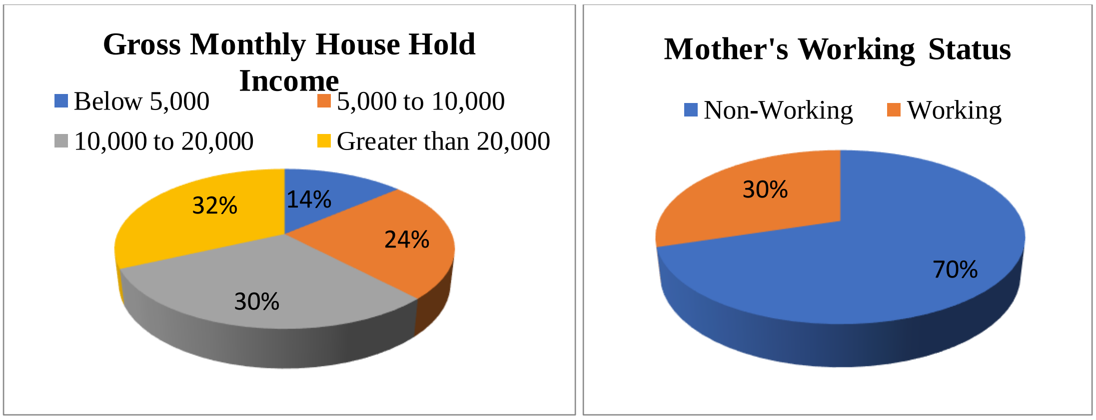
Figure 4.6: Distribution of mothers according to their education



Education wise distribution of data is such that majority of the respondents i.e. 29% is secondary, 28% senior secondary, 19% Graduate, 10% Postgraduate and 12 %

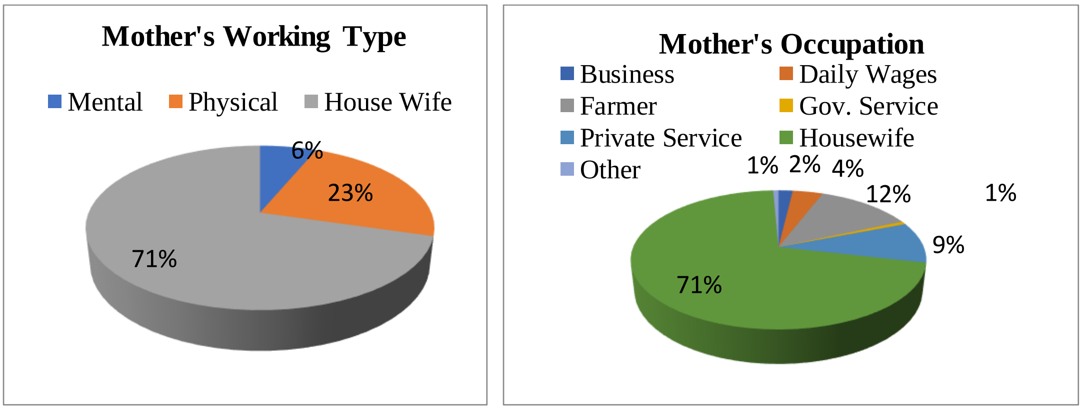
of the respondents with no education. Most of the (82%) mother's having an age group between 20 % to 30.13% of mothers having age less than 20 years and 13% of the mothers having age greater than 5%.

Figure 4.7: Distribution of mothers according to their monthly income and working status



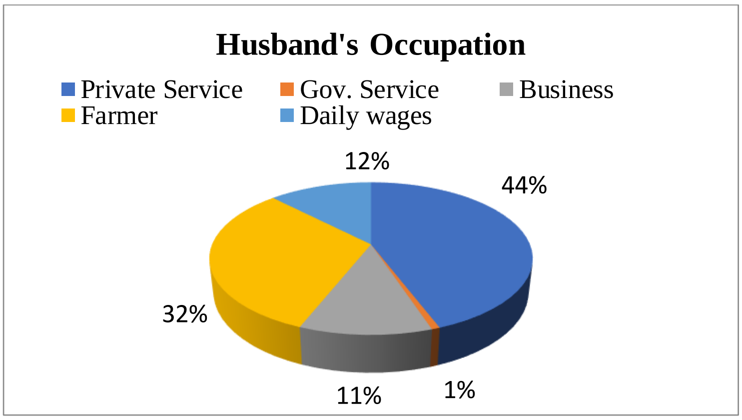
The majority of the families having a minimum income are shown in the pie chart. Only 30% of the total 430 women's have a gross monthly income greater than twenty thousand. Compared to low-income women, these women may have more access to healthcare resources, but they may still face financial challenges and few alternatives for complete maternal health treatments. 14% of the women belong to low income family group. Accessing high-quality healthcare services, such as prenatal care, nutrition, and specialized maternal care throughout pregnancy, may be extremely difficult for women in this category. Majority of the respondents i.e. 70% are non-working whereas 30% women's status is working.

Figure 4.8: Distribution of mothers according to their working type occupation



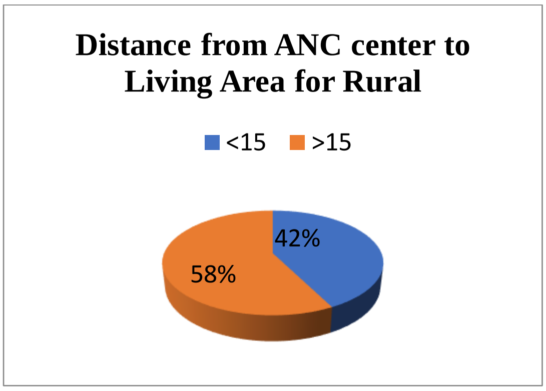
Most of the (71%) women has house wife. Housewives could have more time for self-care and prenatal care appointments. According to graph we revealed that near about one third women's has physical work. As we can see 70% women in Baramati are housewife may have a significant influence on the health of women in Baramati.

Figure 4.9: Distribution of Husband's according to their occupation



The number of ANC visits necessary throughout pregnancy is often not directly influenced by the husband's occupation of work. The woman's ability to get prenatal care, however, may be indirectly impacted by the husband's occupation and the relationships of the entire family. From above graph 44% husbands having occupation farmer and daily wages.

Figure 4.10: Distribution of women's according to distance from living area



42% of women having distance less than 15 km from ANC centre to living area in rural region of Baramati. Whereas 58% of women having distance greater than 15 km. Similarly 42% of women living in urban area whose distance from ANC centre greater than 15 km and 58% having distance less than 15 km in urban area.

Table 4.3 DISTRIBUTIONS OF RESPONDENTS ACCORDING TO SOCIO ECONOMIC DEMOGRAPHIC PROFILE

Variables	Category	Frequency	Percentage
Mother's Age	<20	57	13.26

	20-30	350	81.4
	>30	23	5.35
Mother's Education	Illiterate	49	11.4
	Primary school	9	2.09
	Secondary	126	29.3
	Senior Secondary	121	28.14
	Graduation	83	19.3
	Post Graduation	42	9.77
Living Area	Rural	299	69.53
	Urban	131	30.47
Family Type	Joint	275	63.95
	Nuclear	155	36.05
Monthly Income	< 5000	59	13.72
	5000-10000	104	24.19
	10000-20000	130	30.23
	> 20000	137	31.86
Working Status	Working	128	29.76
	Non-working	302	70.23
Working Type	Mental	27	6.28
	Physical	100	23.26
	Housewife	303	70.47
Husband's Occupation	Private Service	190	44.19
	Government Service	3	0.7
	Business	48	11.16
	Farmer	136	31.63
	Daily Wages	53	12.33
Mother's Age at Marriage	≤18	166	38.6
	>18	264	61.4

In the following part, we will talk about the socioeconomic backgrounds of the people who participated in this research and were from Baramati. The "Distributions of Respondents According to Socio-Economic Profile" reveals the foundational characteristics of the study's participants, offering insights into their socio-economic statuses, educational backgrounds, and occupational diversity. For the purpose of analysing how the socio-economic background of the participants in Baramati may impact their maternal health care, it is vital to have a solid understanding of the participants' backgrounds. The table reveals that 57 mothers, constituting 13.26% of the total, are under the age of 20. A significant majority, comprising 350 mothers or 81.4% of the sample falls within the age range of 20 to 30 years. Additionally, there are 23 mothers, making up 5.35% of the total, who are older than 30 years. This distribution highlights the diversity in maternal age groups within the dataset and underscores the importance of tailoring maternal healthcare strategies to meet the specific needs of each age category. The dataset shows a diverse range of mothers' education levels, with 11.4% being illiterate, 2.09% having completed primary education, 29.3% having secondary education, and 28.14% having senior secondary education. 30% have pursued higher education, indicating a substantial segment with advanced qualifications. This diversity highlights the need for tailored maternal healthcare and awareness programs to address the unique needs and perspectives of mothers across various educational backgrounds.

The distribution of living areas among the women in the dataset reveals a predominant rural residency, with approximately 69.53% of the participants residing in rural areas whereas about 30.47% of the women live in urban areas. This distribution underscores the predominance of rural settings among the study's participants, maternal healthcare and awareness programmes, it is essential to take into account the elements and obstacles that are unique to rural areas. Understanding this urban-rural divide is essential for tailoring programs and services to address the distinct needs and circumstances of women living in different environments. The data indicates that the majority of participants, about 63.95%, are part of joint families, while approximately 36.05% are in nuclear families, underscoring the diversity in family structures and emphasizing the need to consider these variations in maternal healthcare planning.(131).

The income distribution within the dataset highlights a diverse range of economic backgrounds. Approximately 13.72% of the participants have a monthly income of less than 5000, indicating a segment facing financial challenges. Meanwhile, 24.19% fall within the income bracket of 5000 to 10,000, signifying a moderate income group. A significant proportion, 30.23%, earns between 10,000 and 20,000 per month, and the largest segment, 31.86%, reports an income exceeding

20,000. This income disparity among the participants underscores the importance of tailoring maternal healthcare and awareness programs to accommodate varying economic capacities and associated healthcare needs. The dataset shows a significant difference in women's working status, with 29.76% actively in the workforce and 70.23% not. Among that 6.28%doing mental work, 23.26% doing physical work and majority of 70.47% are housewife.

A significant portion, approximately 44.19%, of the husbands is employed in the private sector. A smaller percentage, about 0.7%, is engaged in government service, indicating a limited representation of those within the public sector. The sample shows that 11.16% of husbands are involved in business, 31.63% are involved in farming, and 12.33% work as daily wage labourers. The majority of mothers in Baramati, around 61.4%, were married after 18 years, indicating a mature marriage trend. However, 38.6% were married before 18, indicating early marriages in the dataset. For the study, it is essential to comprehend this age distribution since it has an impact on mother and child health outcomes. Particularly young marriages may present a number of difficulties and may need for specialized assistance and interventions. Insightful information for specialized healthcare programmes and policies may be gained by analyzing these two groups in the context of maternal healthcare and child well-being.

Table 4.4 DISTRIBUTIONS OF RESPONDENTS ACCORDING RELATED TO RECENT PREGNANCY

Variables	Category	Frequency	Percentage
Mother's Weight before delivery	<=50	75	17.44
	>50	355	82.56
Health Problems	No	335	77.91
	Yes	95	22.09
Mother's Diet	Vegetarian	97	22.56
	Non-Vegetarian	333	77.44
Marriage Month	<60	309	71.86
	≥60	121	28.14
Have you go for ANC	Yes	386	89.77
	No	44	10.23
Registered	Yes	386	89.77

Pregnancy	No	44	10.23
ANC Visit Clinic for the 1st time?	First Trimester	325	75.58
	Second Trimester	46	10.70
	Third Trimester	15	3.49
	No ANC	44	10.23
ANC service provider	Doctor	266	61.86
	Nurses	35	8.14
	ASHA	86	20.00
	NA	40	9.30
Took pregnancy test to confirm pregnancy	Yes	396	92.09
	No	34	7.91
Sex of new born baby	Male	215	50.00
	Female	215	50.00
Suffer from Worry During Pregnancy	Yes	54	12.56
	No	376	87.44
Place for ANC	Both	161	37.44
	Public	133	30.93
	Private	92	21.40
ANC Visits	Less than 8 Visits	266	61.86
	> = 8 ANC visits	164	38.14
	No ANC	44	10.23
Days antenatal iron supplement taken	Less than 6 Month	283	65.81
	More than or equal to 6 Month	147	34.19
How often you eat fresh food, vegetable and milk?	Two Times in Week	122	28.37
	Daily	273	63.49
	Very Rare	13	3.02
	Weekly	22	5.12

Interpreting the "Distributions of Respondents According to Recent Pregnancy" within study is essential for understanding pregnancy-related characteristics of the participants. This interpretation provides valuable context for the subsequent analysis of antenatal care awareness. The study found that 82.56% of mothers had a pre-pregnancy weight above 50 kg before delivery, indicating a healthier weight range. In contrast, 17.44% had a weight below 50 kg, indicating a lower pre-pregnancy weight, which could impact maternal health and pregnancy outcomes. Around 77.91% of women in a study report no significant health issues, indicating good health. However, 22.09% of women have some health problems, indicating they may require specific medical attention and support. This subset of women highlights the need for targeted support and medical attention. Most of the 77.44% women's in data set take both type of meal vegetarian as well as non vegetarian. A significant majority, comprising approximately 71.86% of the women, have been marital for a period of time that is less than five years. This majority suggests a relatively recent marital status among the participants, signifying that a substantial portion of the women are in the early stages of their marriages. On the other hand 28.14% of the women report having been married for more than 5 years. This smaller but notable segment indicates that a subset of the participants have longer-standing marriages.

A large majority of the women, or around 89.77% of them, used ANC services during their pregnancies. This concludes that 89.77% women's registered their pregnancy. This significant number indicates that the majorities of participants is aware of the value of ANC and have sought out this essential medical assistance. While a small but substantial portion of participants may have missed out on essential prenatal treatment, 10.23% of the women did not get ANC during their pregnancies. Early involvement with services is shown by the fact that around 75.58% of women began their (ANC) visits within their initial trimester of their pregnancies. However, 10.70% started their visits during the second trimester, indicating a smaller group who may have delayed their care. Similarly, 3.49% started their visits in the third trimester, indicating a subset who started care later. Additionally, 10.23% of women reported not having any ANC visits, indicating concerns about the absence of essential prenatal care for this group.

A significant majority, approximately 61.86% of the women, received ANC services from doctors. This indicates that most participants sought care from qualified medical professionals, which is generally considered a positive practice for ensuring the health during pregnancy. About 20% of the women received ANC from Accredited Social Health Activists (ASHAs). ASHAs play a crucial role in providing healthcare support and information at the community level. Their involvement suggests community-based healthcare efforts. A smaller percentage, approximately 8.14%, received ANC services from nurses. This demonstrates that some participants sought care from nursing professionals, indicating another avenue for healthcare delivery. Notably, about 9.30% of the women reported not receiving any ANC services. This is a concerning statistic, as it suggests that a significant proportion of participants did not access essential prenatal care during their pregnancies.

There were a lot of self-administered pregnancy tests in the dataset, as evidenced by the fact that 92.09% of the participants utilized a pregnancy kit for testing. This proactive method of determining if a woman is pregnant is encouraging since it demonstrates that women are actively involved in their reproductive healthcare. Coincidently in this data sex of new born baby is 50%. It is essential to emphasise that in larger populations, sex ratios at birth can vary, and factors like genetics and chance can influence the actual distribution of male and female births. Around 12.56% of women reported experiencing worry or tension during their pregnancies, indicating some emotional challenges. However, a significant majority of 87.44% did not experience worry or tension, indicating that most participants experienced stress-free pregnancies, indicating a balance between emotional challenges and stress-free experiences. Out of the 430 mother included in the research, it was found that 92 (21.40%) women chose to receive their Antenatal Care (ANC) services from private hospitals, while 133(30.93%) women opted for public hospitals. Interestingly, 161 (37.44%) women decided to access ANC from both private and public hospital sources.

The study found that 61.86% of participants attended fewer than 8 antenatal care (ANC) visits during their pregnancies, possibly below the recommended level. 38.14% attended more than 8 ANC visits, indicating a higher level of engagement with prenatal care. However, 10.23% did not attend any ANC visits, indicating a lack of participation.

About 283 **(**65.81%) of the women used prenatal iron supplements for less than six months of their pregnancies, which is a sizable majority. This group could have started taking iron supplements later in their pregnancies or stopped using them earlier than advised. On the other hand, more than 6 months of prenatal iron supplementation was continued by roughly 147(34.19%) of the women. Throughout their pregnancies, this group took iron supplements for the required amount of time.

A significant proportion of women, comprising 63.49% of the participants, maintained a dietary routine rich in fresh foods, vegetables, and milk throughout their pregnancies. In contrast, the remaining women reported infrequent consumption of fresh foods, with some indulging in a fresh diet only rarely or up to two times per week

Table 4.5 DISTRIBUTIONS OF RESPONDENTS RELATED TO RECENT TO OBSTETRICAL VARIABLES

Variables	Category	Frequency	Percentage
No. of Pregnancies	1	238	55.35
	2	125	29.07
	3	53	12.33
	>3	14	3.26
Pregnancy period	Ideal Period (40 weeks)	332	77.21
	Premature baby(Before 37 weeks)	95	22.09
	Extremely preterm baby(23 to 28 weeks)	3	0.70
Baby's Weight	< 2500	100	23.26
	≥ 2500	330	76.74
Ultra Sound Examination(USE)	Less than equal to 2	40	9.30
	3 to 4	330	76.74
	5 to 7	60	13.95
Abnormality detected during USE	Yes	55	12.79
	No	375	87.21
Mothers HB	Less than 12	296	68.84
	More than 12	134	31.16
Type of Delivery	Normal	200	46.51
	caesarean	230	53.49

This distribution offers a comprehensive look at the obstetrical profiles of the research subjects, providing insights into their most recent reproductive experiences, including the number of pregnancies, outcomes, and delivery techniques.

Understanding the environment in which prenatal care awareness and utilization are situated is critical. The majority of participants (55.35%) are experiencing their first pregnancy, indicating unique healthcare needs. About 29.07% are having their second pregnancy, a significant segment of women with prior experience. 12.33% are in their third pregnancy, a subset of participants with multiple pregnancies. 3.26% have had more than three pregnancies, indicating a distinct group of women with extensive reproductive histories.

332 (77.21%) of the women, or a significant proportion, has pregnancies that were full-term and continued until around 40 weeks. This is often regarded as a normal and healthy pregnancy length. The percentage of women whose pregnancies ended before 37 weeks was about 22.09%. These pregnancies come under the preterm category, which means that both the mother and the unborn child may need special medical care and monitoring. Extremely preterm births, occurring before 28 weeks of gestation, are associated with greater health risks and often necessitate specialized medical care. But in this section only 3 out of 430 women's belong to this category. The distribution of birth weights must be understood in order to evaluate newborn health outcomes and identify possible problem areas. In the context of maternal healthcare, low birth weight is a crucial factor to take into account since it might affect the health and wellbeing of babies. In this data a significant portion of the newborns were underweight, as indicated by the fact that 23.26% of the babies had birth weights of not more than 2.5 kg. Underweight at birth might be linked to particular health issues and may call for further medical care. On the other hand, a sizable majority of the infants—roughly 76.74%—had birth weights more than 2.5 kg. This majority indicates that most infants were healthy. The data reveals that a significant majority of the sample, comprising 76.74% of the participants, underwent ultrasound examinations (USE) three to four times during the course of their pregnancies. This high frequency of ultrasound examinations highlights the extensive use of this essential diagnostic tool among expectant mothers, which can contribute to the monitoring and evaluation of fetal health and the progression of pregnancy.

Before giving birth, a sizable majority, or around 68.84% of the moms, had haemoglobin levels below 12 gm per deciliter (gm/dl). This shows that a significant proportion of expecting mothers had haemoglobin levels that were below optimum, which can be risky for the health. In comparison, before giving birth, roughly 31.16% of the moms had haemoglobin levels that were higher than 12 gm/dl. These people had a decreased, but still substantial, proportion of better haemoglobin values. Nearly 46.51 percent of the participants experienced a normal delivery. The common and often less intrusive mode of childbirth is normal or vaginal delivery.

On the other hand, roughly 53.49% of the participants had a caesarean section. A C-section is a surgical surgery utilized when problems or medical indications call for a different method of birthing.

Analyzing the reasons behind these delivery choices and their potential impacts on maternal condition, it is essential for evaluating the quality of maternal healthcare and guiding improvements in childbirth practices.

Maternal health care is crucial for public health, reducing maternal and infant mortality, promoting healthier pregnancies, and contributing to community health. In Baramati, a region with unique socio demographic profiles and healthcare dynamics, understanding antenatal care awareness is crucial. This chapter analyzes the weight of newborn babies and the type of delivery, focusing on the distribution of newborn baby weights and trends over time. The analysis can inform policy decisions, healthcare initiatives, and community education programs aimed at improving maternal health in the region. It is the results that will serve as a foundation for future chapters, aiming to enhance antenatal care awareness among women in Baramati.

Table 4.6 AREAWISE DISTRIBUTIONS OF RESPONDENTS RELATED TO AWARENESS OF ANTENATAL CARE

		Rural		Urban	
Question	**Response**	**Frequency**	**Percentage**	**Frequency**	**Percentage**
Are you aware about ANC?	Yes	228	76.25	117	89.31
	No	71	23.75	14	10.69
Do pregnant woman to go for ANC?	Yes	260	86.96	125	95.42
	No	39	13.04	6	4.58
What should be the minimum ANC visits?	<8	98	32.78	33	25.19
	>=8	144	48.16	88	67.18
	Don't Know	57	19.06	10	7.63
Is it necessary to give inj. TT during pregnancy?	Yes	276	92.31	127	96.95
	No	7	2.34	1	0.76
	Don't	16	5.35	3	2.29

	Know				
If yes, how many times inj. TT should be given?	1	53	17.73	14	10.69
	2	195	65.22	100	76.34
	Don't Know	51	17.06	7	5.34
Is it necessary to take iron folic acid tablet during pregnancy?	Yes	264	88.29	127	96.95
	No	35	11.71	4	3.05
If yes, how many iron folic acid tablets has to be taken during pregnancy?	>=100	148	49.50	88	67.18
	<100	77	25.75	26	19.85
	Don't Know	74	24.75	17	12.98
Is alcohol harmful for the foetus?	Yes	281	93.98	128	97.71
	No	18	6.02	3	2.29
Do pregnant women need to take extra food as compared with non-pregnant state?	Yes	264	88.29	118	90.08
	No	35	11.71	13	9.92
Do the pregnant women need to sleep at night minimum 8 hr?	Yes	280	93.65	125	95.42
	No	19	6.35	6	4.58
Do pregnant women need to sleep during daytime?	Yes	222	74.25	109	83.21
	No	77	25.753	22	16.79
Where the ideal place pregnant women should deliver her baby?	Hospital	288	96.32	129	98.47
	Home	11	3.68	2	1.53
Is Planned Pregnancy necessary	Yes	251	83.95	122	93.13
	No	48	16.05	9	6.87
Knowledge on danger signs of pregnancy	Better	206	68.90	115	87.79
	Poor	93	31.10	16	12.21
Do you aware of 102 service provided by our	Yes	67	22.41	49	37.40
	No	232	77.59	82	62.60

Government.					
Do you aware of 108 service	Yes	173	57.86	89	67.94
	No	126	42.14	42	32.06
Do you aware of ASHA	Yes	234	78.26	100	76.34
	No	65	21.74	31	23.66
Do you know any type of Family planning method?	Yes	164	54.85	100	76.34
	No	135	45.15	31	23.66
Do you know that HIV test is compulsory during ANC?	Yes	246	82.27	124	94.66
	No	53	17.73	7	5.34
Do you aware that pregnant women eat fresh food, vegetables, milk?	Yes	295	98.66	131	100.00
	No	4	1.34	0	0.00

The information shows to a significant discrepancy in ANC awareness between rural and urban communities. When compared to their counterparts in rural regions, women who live in urban areas seem to be far more alert. Several factors, including exposure to healthcare awareness campaigns, educational opportunities, and healthcare facility accessibility, may be responsible for this discrepancy. Rural women's lower awareness of antenatal care (ANC) may necessitate targeted interventions, considering unique challenges like limited healthcare access, lower literacy rates, and difficulties in reaching remote communities. This data underscores potential health inequality, as disparities in ANC awareness could lead to differences in prenatal care quality between urban and rural women. Addressing this inequality is crucial for ensuring all expectant mothers receive necessary care and support during pregnancy. The majority of women in towns as well as rural locations support antenatal care (ANC), suggesting they are more aware of its importance and have better access to information. To strengthen ANC utilization, educational and awareness campaigns should be continued, addressing the particular requirements and difficulties that women in remote areas are confronted with. The majority's support for ANC is a positive sign, allowing healthcare providers and policymakers to encourage more pregnant women to seek ANC services. According to the analysis of the data, a greater proportion of women living in rural regions (32.78%) consider that frequencies of ANC appointments that are lower than the recommended number are enough, in comparison to women living in urban areas (25.19%). This may be due to unique challenges in rural healthcare access and education, as well as cultural or traditional beliefs influencing perceptions about the necessity of ANC visits. The data emphasizes the need for targeted education and awareness campaigns in both urban and rural areas to address misconceptions and provide clear information about the benefits of regular ANC visits. This raises questions about healthcare access and quality in rural areas from Baramati. The study reveals a high consensus between women in both rural and urban areas about the necessity of Tetanus Toxoid (TT) injections during pregnancy. In rural areas, 92.31% of women consider it necessary, while in urban areas, 96.95% hold the same belief. The data suggests that educational campaigns have effectively raised awareness about the importance of TT injections. The slight difference may be due to differences in access to healthcare information, infrastructure, or education levels. Overall, the consensus on TT injections is consistent across both settings. The presence of a notable percentage of mother in village areas who are not aware of the number of TT injections required during pregnancy (17.06%) highlights a gap in knowledge regarding this important aspect of maternal health. It emphasizes how crucial it is to focus outreach and education initiatives in rural areas. In conclusion, the data indicates a significant difference in beliefs regarding the necessity of supplementation with folic acid as well as iron was administered throughout pregnancy between rural and urban areas. Addressing this gap in awareness is essential to ensure that pregnant women, particularly in rural areas, receive the recommended nutritional support for their health and the well-being of their unborn children. 24.75% women's from rural area don't to how many iron folic acid tablets has to be taken during pregnancy. The data highlights a high level of awareness and understanding among women in both areas regarding the risks of alcohol consumption during pregnancy. 11.71% women belongs to rural area. Pregnant women need not take extra food as compared to non pregnant women whereas from urban area the percentage is less. In rural areas, 68.90% of women have better knowledge about the danger signs of pregnancy, but this percentage is lower than in urban areas. In urban areas, 87.79% of women have better knowledge about signs indicating complications during pregnancy. Early identification of potential complications is crucial for maternal and fetal health. Addressing knowledge gaps in both rural and urban areas is essential, including targeted education and awareness campaigns, ensuring access to healthcare services for all women, and addressing knowledge gaps in rural communities.

In rural areas, 57.86% of women have knowledge about the 108 emergency services. It is essential to be aware of emergency services, such as the 108 service, in order to obtain immediate medical care in case of emergencies, including pregnancy-related problems. Knowing about these programmes can literally save lives. The research reveals a disparity between rural and urban communities' understanding of the 108 emergency services. In order to ensure that pregnant women and others may easily obtain emergency assistance when required, it is imperative that efforts be made to increase knowledge of and accessibility to these vital emergency services, particularly in remote regions. In rural areas, 54.85% of women are aware of family planning methods, while 76.34% of women in urban areas are. Enhancing awareness about family planning methods is essential for helping to promote the cause of birth control and reproductive health protection, especially in rural communities.

This knowledge is crucial for informed decisions about family size and timing of pregnancies, as unplanned pregnancies can lead to inadequate prenatal care and higher health risks. Awareness can result in healthier pregnancies and reduced maternal and infant mortality rates. However, a lack of awareness can lead to overpopulation, straining healthcare systems, education resources, and social services in certain regions. Women's in rural as well as in urban area have better knowledge about that pregnant women eat fresh food, vegetables, milk during her pregnancy period.

During the course of our investigation into a group of 430 women, we made a significant discovery, which revealed that 49 of the women did not report their pregnancies. Because of this discovery, major questions are raised about the possible repercussions of non-registration, and it is necessary to conduct a more detailed investigation into the causes that lie under the surface. The failure to register pregnancies may have substantial consequences for the health outcomes of both mothers and children. The lack of official registration may lead to a deficiency in prompt and specific interventions, such as the availability of crucial prenatal care, health education, and immunisation programmes.

To achieve better female's health in pregnancy outcomes, it is crucial to address gaps in knowledge, logistical barriers, and cultural concerns. This will enable every woman to register her pregnancy and provide timely access to important healthcare services.

We discovered that 44 of the women in our cohort of 430 women did not go to Antenatal Care (ANC) throughout their pregnancies. This information was discovered via the process of analysing the data from the cohort. Taking into consideration this finding, it is necessary to conduct an in-depth investigation into the factors that contribute to the fact that these women do not take part in a vital component of maternity healthcare.

There seems to be a considerable barrier to attendance at ANC centres, and that barrier is the distance from home to the centres. There were a number of women who said that the geographical obstacle was a barrier to their ability to get prenatal care services. Consequently, this underscores the need of strategic planning in the establishment of ANC centres that are accessible to a wider audience, especially to those who reside in rural or distant places.

Another prominent factor for non-participation was found to be financial limits faced by individuals. Concerns were voiced by a portion of the female respondents to the poll over the cost of abortion and contraception services. This highlights how important it is to overcome economic obstacles in order to guarantee that maternity healthcare is accessible to people from all socioeconomic backgrounds without discrimination.

However, there were several women who expressed the opinion that they did not believe ANC services were required. In light of the fact that this perception may be the result of a information that is lacking or a misunderstanding of the significance of ANC in ensuring a safe pregnancy, it is of the utmost importance to investigate and resolve the underlying causes for this thinking.

Through the implementation of community awareness programmes that place an emphasis on the vital part that prenatal care plays in the health of both mothers and children, it may be possible to debunk common misunderstandings and foster a collective comprehension of the importance of antenatal care.

When taking into consideration the major influence that distance has on involvement in the ANC, efforts must to be made towards making the services provided by the ANC more accessible. One possible solution to this problem is the creation of more ANC centres or the provision of transportation options for pregnant women who live in locations that are geographically isolated.

It is necessary to use a diversified strategy in order to overcome financial obstacles. It is possible that the financial burden that is associated with accessing ANC services might be alleviated by the implementation of financial assistance programmes, subsidies, or community-based health insurance efforts.

It is very necessary to tailor interventions to the particular requirements of the community. The creation of interventions that are both targeted and successful may be informed by conducting in-depth community assessments with the goal of gaining an understanding of the specific difficulties that are encountered by various groups.

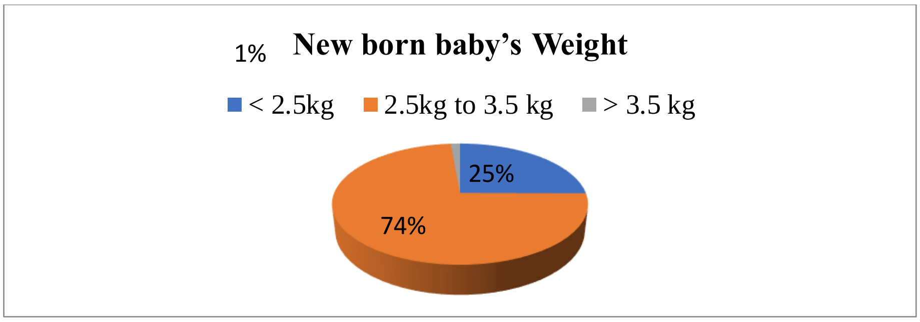
During our study, we asked particularly about receiving guidance on the importance of giving birth at a healthcare facility during antenatal appointments. We made an interesting discovery. Around 44% of the women polled said that they were not provided with any guidance regarding the significance of delivery that takes place inside a medical institution. The lack of guidance on the need of giving birth in a healthcare facility might impact the decision-making of expectant mothers. Ensuring safe childbirth heavily relies on institutional delivery, and insufficient knowledge may lead to less than ideal decisions on the choice of delivery location.

As we discussed in chapter one in this chapter we consider three outcome variable new born baby’s weight and type of delivery and ANC visits. Among this new born baby weight we considered as continuous variable. So we can consider further analysis.

4.3 New Born Baby’s Weight

The descriptive statistics and distribution of newborn baby weights in accordance with WHO recommendations offer important new perspectives on the wellbeing and growth of newborns in the study population. Any departures from the predicted norm, as recommended by the WHO, may point to possible problems with Baramati's prenatal care education and maternal health care system. We consider weight of new born baby’s in the data and then according to WHO categories it as less than 2.5 kg and more than or equal to 2.5 kg. The descriptive statistics and distribution of newborn baby weights in accordance with WHO recommendations offer important new perspectives on the wellbeing and growth of newborns in the study population. Any departures from the predicted norm, as recommended by the WHO, may point to possible problems with Baramati's prenatal care education and maternal health care system.

Figure 4.10: Pie chart for weight of new born baby in Baramati



Above pie chart shows that majority (74%) of the baby's weight lies between 2.5 kg to 3.5 kg, but it is noticeable that 25% of total sample having birth weight less than 2.5 kg.

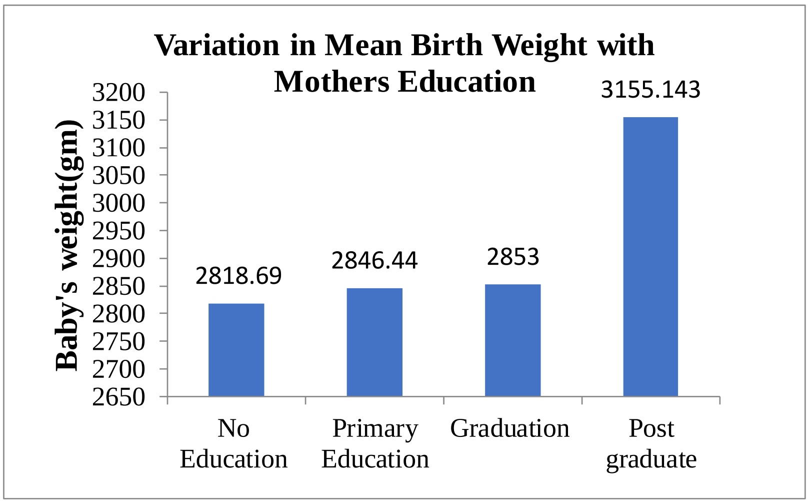
4.4 Descriptive statistics

In order to summarise a specific data set, which may be a sample of a population or a representation of the whole population, descriptive statistics are used. These statistics are brief and informative coefficients. Descriptive statistics may be broken down into two primary categories: measurements of central tendency and measures of variability (spread). Metrics that indicate central tendency include the arithmetic mean, mode, and median. Variability may be measured using the S.D., minimum and maximum values, quartile deviation, and range.

Table 4.7: Mean birth weight of new born baby according to status of their education

Status of Education	Mean birth weight(gm)
No Education	2818.69
Primary Education	2846.44
Graduation	2853
Post graduate	3155.143

Figure 4.11: Variation in Mean Birth Weight with Mothers Education

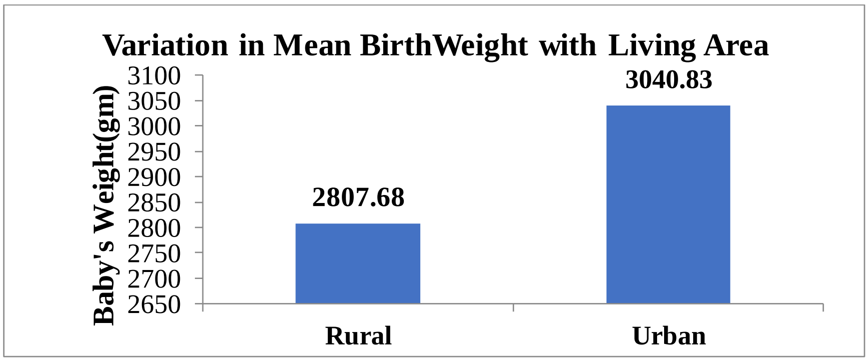


The above histogram of newborn baby's weight based on the educational background of women is a important step in understanding the relationship between maternal education and birth weight. The histogram reveals clear distinctions in the birth weight distribution across different educational groups of mothers. Notably, mothers with post-graduation education tend to have newborns with the highest mean birth weight 3155.143 gm, indicating a potential positive correlation between higher maternal education and infant health. In contrast, mothers with no education have the lowest mean birth weight 2818.69 gm, which may suggest a need for increased awareness and support for maternal and antenatal care in this group.

Table 4.8: Mean birth weight of new born baby according to living area

Area	Mean birth weight(gm)
Rural	2490
Urban	3040.83

Figure 4.12: Variation in Mean Birth Weight with Living Area

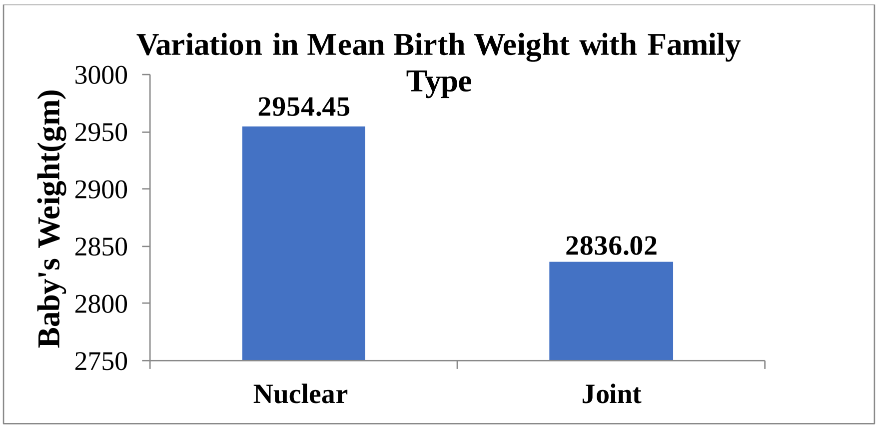


The mean birth weight in rural areas is 2490 grams, indicating a lower average birth weight compared to urban areas. This may be due to a concentration of newborns around this mean, while urban areas have a higher mean birth weight of 3040.83 grams, suggesting a more skewed distribution towards higher birth weights. The histogram for rural areas may show a pattern of lower birth weights. The findings of the research indicate that there is a substantial disparity in birth weight between rural and urban locations, which suggests that there is a connection between the living environment and the health of infants. Urban areas generally have higher birth weights, possibly due to better healthcare facilities, improved maternal nutrition, and socio-economic conditions. This highlights the importance of considering living environment when assessing maternal and infant health. Urban areas may have better healthcare infrastructure, leading to improved birth outcomes. Rural areas may need targeted interventions to enhance maternal and antenatal care.

Table 4.9: Descriptive statistics of weight of new born baby according to family type

Family Type	Mean birth weight(gm)	S.D	Maximum	Minimum
Joint	2836.02	461.64	4000	1234
Nuclear	2954.45	489.69	4050	1500

Figure 4.13: Variation in Mean Birth Weight with Family Type

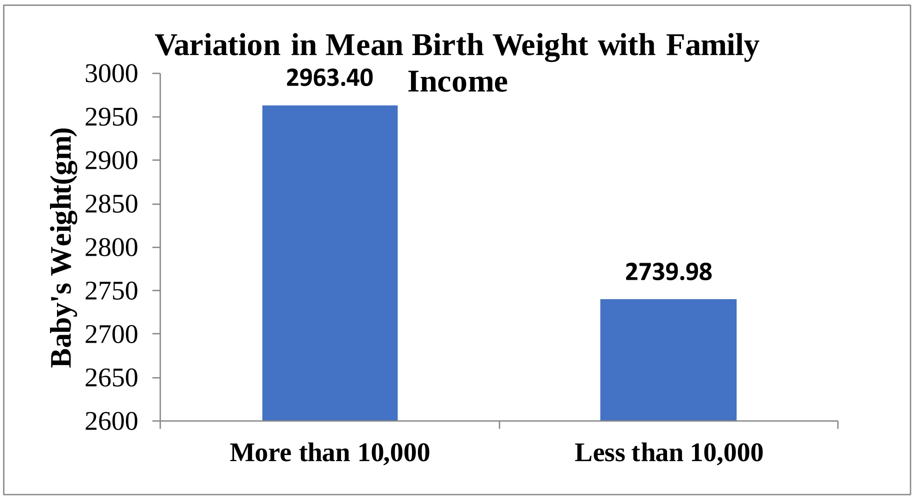


The mean birth weight for newborns in joint families is 2836.02 grams, while in nuclear families; it is higher at 2954.451613 grams. This indicates that, on average, newborns in nuclear families tend to have a slightly higher birth weight compared to those in joint families. The standard deviation measures the spread or variability of birth weights within each family type. In both joint and nuclear families, there is variability, but nuclear families exhibit a higher standard deviation (489.69grams) compared to joint families (461.64 grams). This suggests that birth weights in nuclear families have a wider range and may be more dispersed. In joint families, the minimum recorded birth weight is 1234 grams, while the maximum is 4000 grams. In nuclear families, the minimum birth weight is 1500 grams, and the maximum is 4050 grams. These ranges reflect the variation in birth weights for both family types, with nuclear families having a higher minimum and maximum birth weight. The data shows a slight difference in mean birth weight between joint and nuclear families, with nuclear families having a higher average birth weight. This suggests that family structure may influence birth weight outcomes, possibly due to differences in dynamics, resources, or healthcare access. Nuclear families have a higher standard deviation in birth weights, possibly due to a wider range of socioeconomic backgrounds and healthcare access. This diversity in birth weight outcomes is crucial for assessing maternal and infant health and planning interventions to support families in different family structures.

Table 4.10: Descriptive statistics of weight of new born baby according to monthly income

Monthly Income	**Mean birth weight(gm)**	**S.D**	**Maximum**	**Minimum**
Less than Rs.10,000	2739.98	498.47	3800	1234
More than Rs.10,000	2963.40	439.61	4050	1500

Figure 4.14: Variation in Mean Birth Weight with Family Income

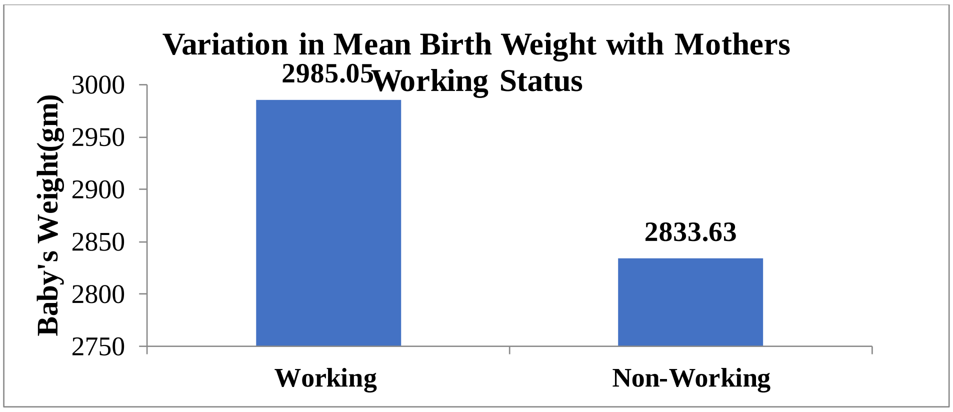


The mean birth weight for newborns in households with average monthly earnings of less than Rs. 10,000, while for families with an income of more than Rs. 10,000, the mean birth weight is higher at 2963.40 grams. This indicates that, on average, newborns in families with higher monthly incomes tend to have a slightly higher birth weight. The standard deviation measures the spread or variability of birth weights within each income group. Families with monthly incomes less than 10,000 have a standard deviation of 498.47 grams, while those with incomes more than 10,000 have a lower standard deviation of 439.61 grams. This suggests that birth weights in the higher-income group have a narrower range and are less dispersed. In families with incomes less than Rs. 10,000, the minimum recorded birth weight is 1234 grams, and the maximum is 3800 grams. In families with monthly incomes more than Rs. 10,000, the minimum birth weight is 1500 grams, and the maximum is 4050 grams. These ranges illustrate the diversity of birth weight outcomes within each income group. The study reveals a difference in mean birth weight between newborns in families with monthly incomes less than Rs. 10,000 and those with incomes more than Rs. 10,000. Newborns in higher-income families have slightly higher average birth weights, suggesting a potential association between income levels and birth weight outcomes. The lower standard deviation in birth weights suggests that higher-income families have more closely clustered birth weights around the mean. The variation of birth weight outcomes within each category underscores the importance of considering family income in assessing maternal and infant health and planning interventions to support families across different income levels.

Table 4.11: Descriptive statistics of weight of new born baby according to working status of mother

Working Status	Mean birth weight(gm)	S.D	Maximum	Minimum
Non Working	2833.639	481.7581	4000	1234
Working	2985.055	441.8459	4050	1789

Figure 4.15: Variation in Mean Birth Weight with Family Income

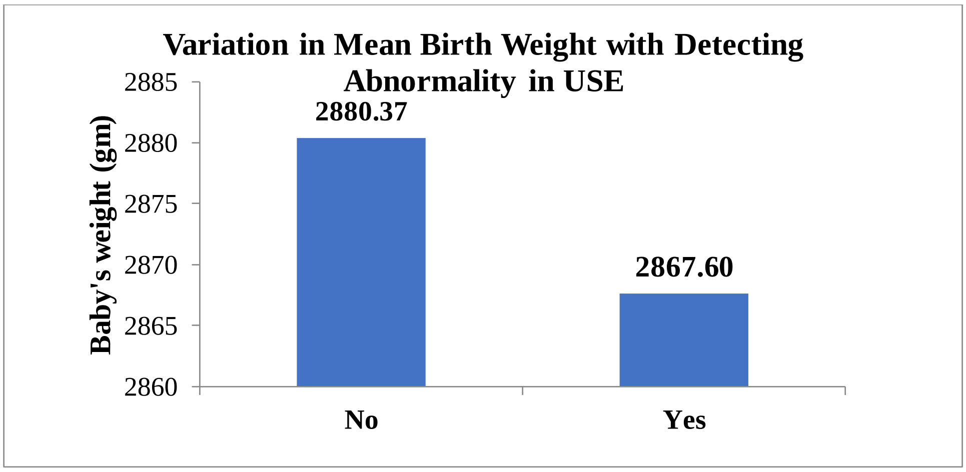


The mean birth weight of non-working mothers is 2833.63 grams, while working mothers have a higher mean weight of 2985.05 grams. This suggests that working mothers have a slightly higher birth weight. The standard deviation measures the variability of birth weights within each group, with non-working mothers having a standard deviation of 481.75 grams and working mothers having a lower standard deviation of 441.84 grams. The minimum recorded birth weight for non-working mothers is 1234 grams, while working mothers have a minimum of 1789 grams and a maximum of 4050 grams, indicating the diversity of birth weight outcomes within each group. The study reveals a difference in mean birth weight between non-working and working mothers' newborns. Working mothers have slightly higher average birth weights, suggesting a potential link between employment status and birth weight outcomes. The lower standard deviation in working mothers' birth weights suggests they are more closely clustered around the mean, with less variability compared to non-working mothers. The minimum and maximum birth weights in both groups highlight the diversity of birth weight outcomes, emphasizing the importance of considering a mother's working status in maternal and infant health assessment and intervention planning.

Table 4.12: Descriptive statistics of weight of new born baby according to USE

Detecting abnormality in USE	Mean birth weight(gm)	S.D	Maximum	Minimum
Yes	2867.607	407.9861	3700	2000
No	2880.374	484.4817	4050	1234

Figure 4.16: Variation in Mean Birth Weight with Detecting Abnormality in USE

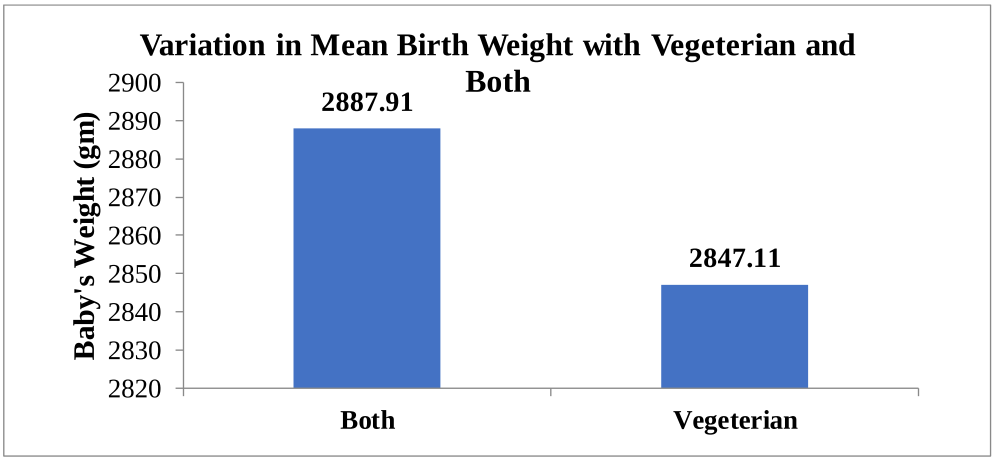


The mean birth weight for newborns when abnormality is detected during pregnancy is 2867.60 grams, whereas when no abnormality is detected, the mean birth weight is slightly higher at 2880.37 grams. This indicates that, on average, newborns in cases where abnormality is not detected during pregnancy tend to have a slightly higher birth weight. The standard deviation measures the spread or variability of birth weights within each group. The group where abnormality is not detected during pregnancy has a higher standard deviation (484.48 grams) compared to the group where abnormality is detected (407.98 grams). This suggests that birth weights in the group where abnormality is not detected are more dispersed and have a wider range. In cases where abnormality is detected during pregnancy, the minimum recorded birth weight is 2000 grams, and the maximum is 3700 grams. When no abnormality is detected, the minimum birth weight is 1234 grams, and the maximum is 4050 grams. These ranges indicate the diversity of birth weight outcomes within each group. The study reveals a difference in mean birth weight between newborns with and without abnormalities during pregnancy. Those without abnormalities have a slightly higher average birth weight, suggesting a potential link between abnormality detection and birth weight outcomes. The higher standard deviation in birth weights suggests more variability and less concentration around the mean, possibly indicating a wider range of health conditions or factors influencing birth weight. The diversity of birth weight outcomes within each category underscores the importance of considering abnormality detection during pregnancy in assessing maternal and infant health and planning interventions. Further statistical analysis and exploration of contributing factors are needed to fully understand the relationship between abnormality detection and birth weight outcomes.

Table 4.13: Descriptive statistics of weight of new born baby according to Vegetarian or Both diets

Meal	Mean birth weight(gm)	S.D	Maximum	Minimum
Vegetarian	2847.113	435.4587	3700	1950
Both	2887.916	485.9016	4050	1234

Figure 4.17: **Variation in Mean Birth Weight with Vegetarian and Both**

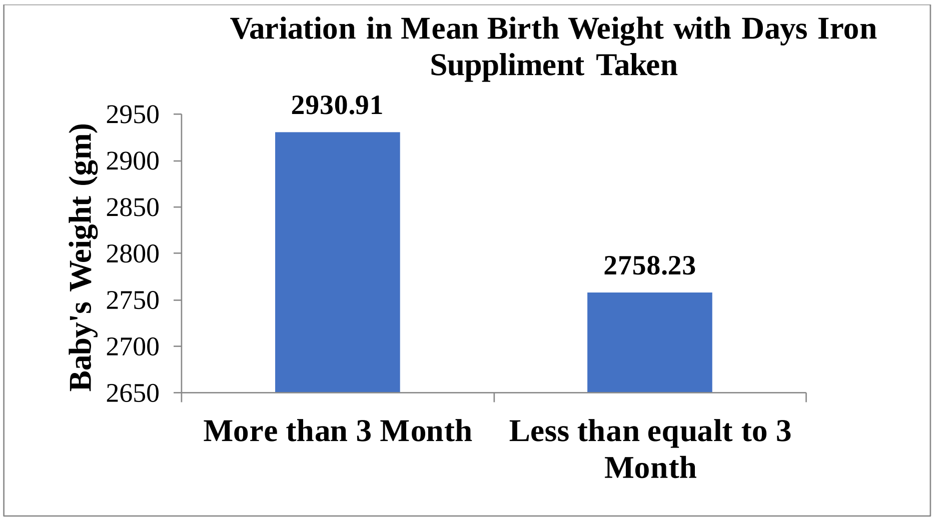


The mean birth weight of newborns is 2847.11 grams when the mother is vegetarian, while 2887.91 grams for those not both vegetarian and non-vegetarian. This indicates that on average, newborns of non-vegetarian mothers tend to have slightly higher birth weights. The standard deviation measures the variability of birth weights within each group, with a higher standard deviation for non-vegetarian mothers (485.90 grams). The minimum recorded birth weight for vegetarian mothers is 1950 grams, while the maximum is 3700 grams. For non-vegetarian mothers, the minimum birth weight is 1234 grams, and the maximum is 4050 grams. These ranges highlight the difference of birth weight outcomes within each group. The study shows a difference in mean birth weight between vegetarian and non-vegetarian mothers, with the latter group having slightly higher average birth weights, suggesting a possible link between the mother's dietary preference and birth weight outcomes.

Table 4.14: Descriptive statistics of weight of new born baby according to Days Iron Supplement Taken

Meal	Mean birth weight(gm)	S.D	Maximum	Minimum
Less than 3 Months	2758.23	501.23	4050	1234
More than 3 Months	2930.91	453.89	4000	1490

Figure 4.18: Variation in Mean Birth Weight with Days Iron Supplement Taken

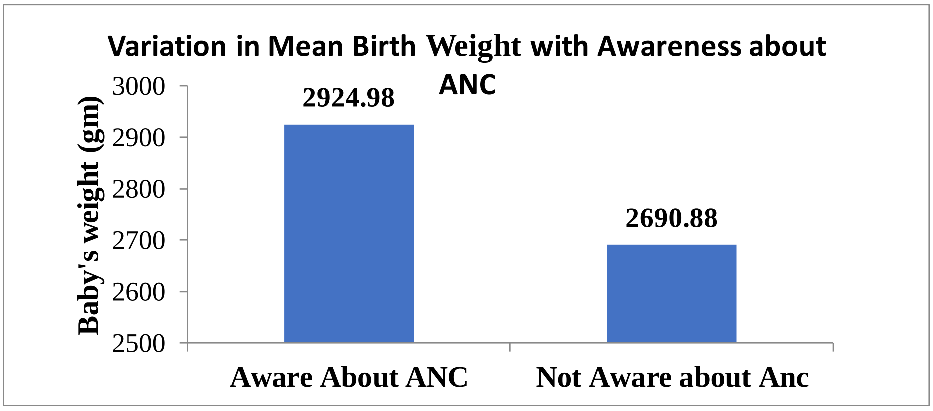


The above graph shows that newborns who took iron supplements before 3 months had a mean birth weight of 2758.23 grams, while those who took them after 3 months had a higher mean birth weight of 2930.91 grams. This suggests that newborns of mothers who took iron supplements later tend to have slightly higher birth weights. The S.D., which measures the spread of birth weights within each group, showed a lower standard deviation for newborns who took iron supplements after 3 months. The minimum recorded birth weight for newborns who took iron supplements before 3 months was 1234 grams, while the maximum was 4050 grams. The ranges reflect the difference of birth weight outcomes within each group. The study reveals a difference in mean birth weight between newborns of mothers who started iron supplements before 3 months and those who started after 3 months. Newborns of mothers who started iron supplements later tend to have a slightly higher average birth weight, suggesting a potential association between the timing of iron supplement intake and birth weight outcomes. The lower standard deviation in birth weights suggests that birth weights in this group are more closely clustered around the mean, with less variability compared to those started earlier. These variations highlight the importance of considering the timing of iron supplement intake in assessing maternal and infant health.

Table 4.15: Descriptive statistics of weight of new born baby according to Awareness about ANC

Awareness about ANC	Mean birth weight(gm)	S.D	Maximum	Minimum
Yes	2924.98	464.23	4050	1490
No	2690.88	473.59	3716	1234

Figure 4.19: Variation in Mean Birth Weight with Awareness about ANC

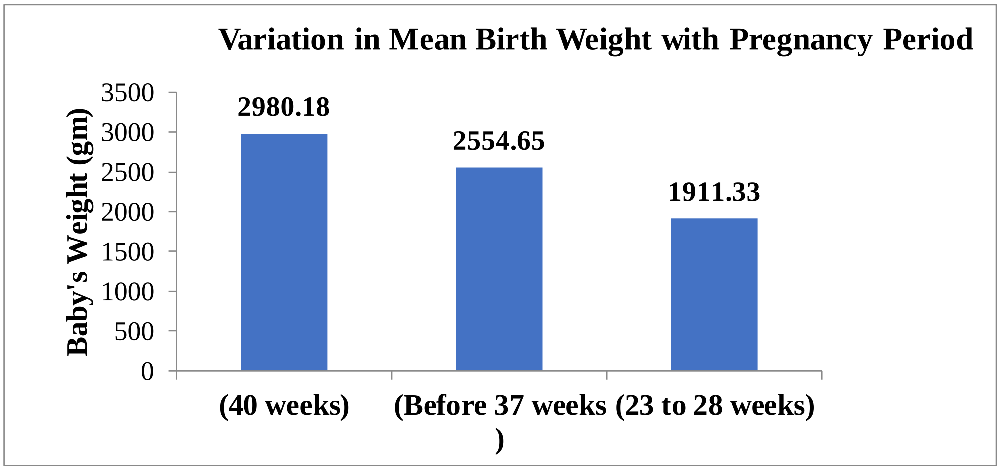


From above graph it is observed that newborns of mothers who are aware of ANC services have a higher birth weight, with a mean birth weight of 2924.98 grams. This is slightly higher than those of mothers who are not aware of ANC services, which has a slightly lower mean birth weight of 2690.88 grams. The standard deviation of birth weights within these groups is lower, with a lower standard deviation of 464.23 grams. The minimum recorded birth weight for mothers who are aware of ANC services is 1490 grams, while the maximum is 4050 grams. In contrast, for mothers who are not aware of ANC services, the minimum birth weight is 1234 grams, and the maximum is 3716 grams.

Table 4.16: Descriptive statistics of weight of new born baby according to Pregnancy Period

Pregnancy Period	Mean birth weight(gm)	S.D	Maximum	Minimum
40 Weeks	2980.18	428.15	4050	1745
Before 37 Weeks	2554.65	451.24	3490	1490
23 to 28 Weeks	1911.33	588.71	2300	1234

Figure 4.20: **Variation in Mean Birth Weight with Pregnancy Period**

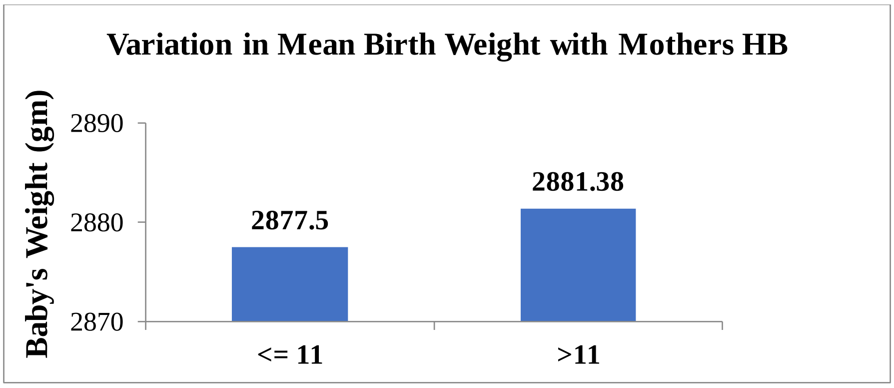


The average birth weight of babies born after a full-term 40-week pregnancy is 2980.18 grams, with a standard deviation of 428.15 grams. This group has less variability, with a range of 1745 to 4050 grams. Babies born before 37 weeks have a lower mean weight of 2554.65 grams, with a standard deviation of 451.24 grams. The minimum and maximum birth weights range from 1490 to 3490 grams. Babies born between 23 and 28 weeks have the lowest mean weight of 1911.33 grams, with a standard deviation of 588.71 grams. The study reveals significant differences in mean birth weights based on pregnancy duration. Babies born after a full-term 40-week pregnancy have the highest mean birth weight, followed by those born before 37 weeks and those between 23 and 28 weeks. Variability in birth weights is lower for babies born after 40 weeks, suggesting a more consistent range. However, babies born between 23 and 28 weeks have the highest variability, possibly linked to increased risks of premature birth. The study emphasizes the importance of considering gestational age in newborn health evaluations and providing appropriate care.

Table 4.17: Descriptive statistics of weight of new born baby according to Days Iron Supplement Taken

Mothers HB	Mean birth weight(gm)	S.D	Maximum	Minimum
Less than 11 gm	2877.5	468.87	4050	1234
More than 11 gm	2881.38	489.42	3800	1490

Figure 4.21: Variation in Mean Birth Weight with Mothers HB



The average birth weight for babies born to mothers with hemoglobin levels less than 11 is 2877.5 grams. The standard deviation is 468.87 grams, indicating a moderate level of variability in birth weights. The minimum and maximum birth weights in this group range from 1234 grams to 4050 grams.

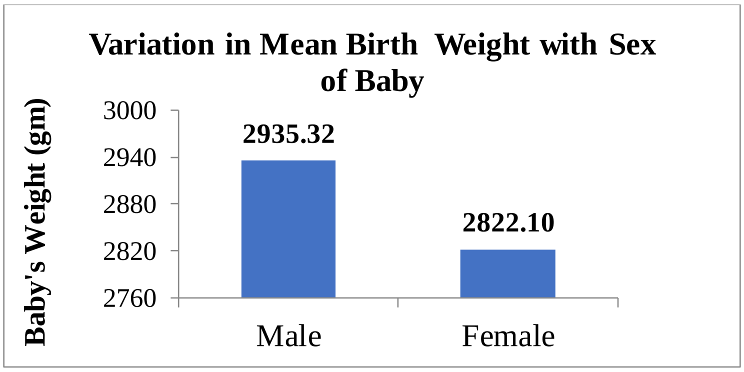
HB Greater Than 11: Babies born to mothers with haemoglobin levels greater than 11 have a slightly higher mean birth weight at 2881.38 grams. The standard deviation is 489.42 grams, suggesting a similar level of variability in birth weights. The minimum and maximum birth weights in this group range from 1490 grams to 3800 grams.

According to the results of the World Health Organisation, there is a connection between the levels of haemoglobin (HB) in a woman and the weight of her child. The protein that is known as haemoglobin is an essential component of red blood cells and is accountable for the transportation of oxygen to the organs and tissues of the body. There is a possibility that the birth weight of the infant might be affected by maternal anaemia, which is characterised by low haemoglobin levels.

Table 4.18: Descriptive statistics of weight of new born baby according to Sex of Baby

Sex of Baby	Mean birth weight(gm)	S.D	Maximum	Minimum
Male	2935.32	499.82	4000	1500
Female	2822.10	442.35	4050	1234

Figure 4.22: **Variation in Mean Birth Weight with Sex of Baby**

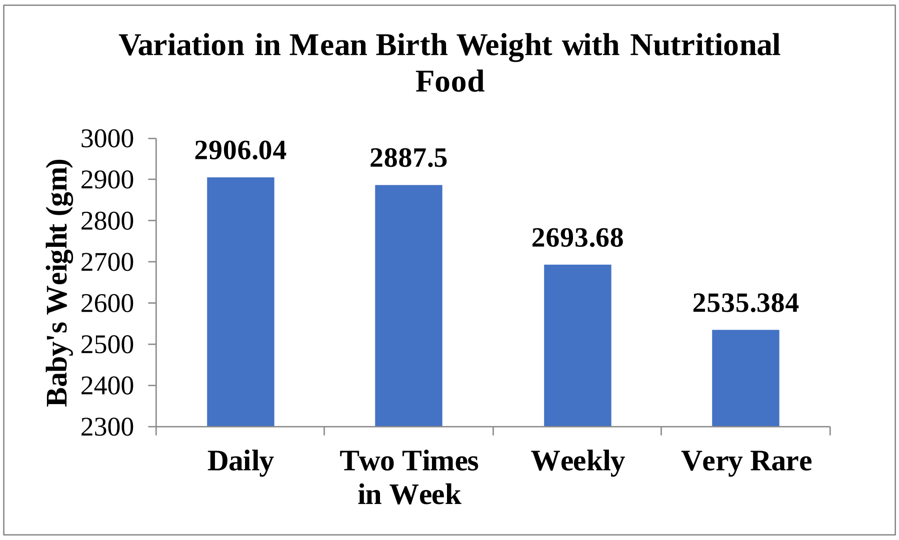


Information on birth weight is one of the many health-related subjects that the World Health Organisation (WHO) provides guidelines and statistics on. According to statistics and guidelines from the World Health Organisation (WHO), male and female babies often weigh more or less at birth. At the time of delivery, male children often weigh a little bit more than their female counterparts do. It is believed that this difference is caused by a number of different factors, including genetics and the effects of hormones on the development of the foetus.

Table 4.19: Descriptive statistics of weight of new born baby according to nutritional food intake:

Frequency of taken Nutritional Food	Mean birth weight(gm)	S.D	Maximum	Minimum
Daily	2906.04	470.12	4050	1490
Two Times in Week	2887.5	473.77	3900	1234
Weekly	2693.68	516.84	3800	2000
Very Rare	2535.38	332.84	3000	2000

Figure 4.23: Variation in Mean Birth Weight with Nutritional Food

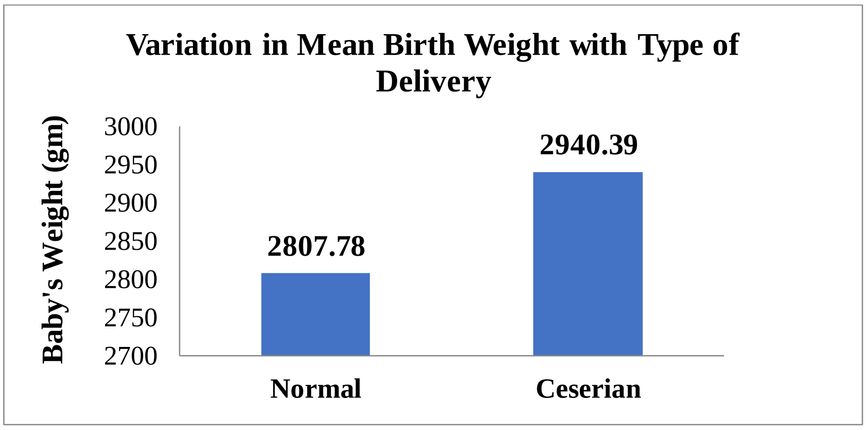


From the analysis of the data, a notable trend emerges regarding the birth weight of newborn babies in relation to their mother's dietary habits during pregnancy. It is evident that the mean birth weight is significantly higher approximately 2906 grams, when mothers consume nutritional food daily throughout their pregnancy. In contrast, when mothers opt for nutritional intake only twice a week, the birth weight slightly decreases to an average of 2887.5 grams. The decrease becomes more pronounced when nutritional food is consumed just once a week, resulting in a lower average birth weight. The most significant contrast is observed in the case of mothers who consume nutritional food very rarely, with their newborns having a considerably lower mean birth weight of 2535.38 grams. These findings underscore the critical importance of maternal nutrition during pregnancy in contributing to the overall health and well-being of newborns. Adequate and consistent nutritional intake during this crucial period can have a positive impact on birth weight outcomes, promoting the healthy development of infants. We can observe there is significant difference between maximum and minimum birth weight in two groups' i.e. daily taking nutritional food and very rarely nutritional food.

Table 4.20: Descriptive statistics of weight of new born baby according to Sex of Baby

Type of Delivery	Mean birth weight(gm)	S.D	Maximum	Minimum
Normal	2807.78	453.53	4000	1234
Caesarean	2940.39	485.15	4050	1490

Figure 4.24: **Variation in Mean Birth Weight with Type of Delivery**



The data reveals a variation in the average birth weight that is substantial based on the type of delivery. Babies born via caesarean delivery tend to have a notably higher mean birth weight compared to babies born through normal delivery. The mean birth weight for babies born through normal delivery is 2807.78 grams. The standard deviation is 453.53 grams, indicating a moderate level of variability in birth weights. The minimum and maximum birth weights in this group range from 1234 grams to 4000 grams. Babies born via caesarean delivery have a higher mean birth weight of 2940.39 grams. The standard deviation is 485.15 grams, suggesting a similar level of variability in birth weights. The minimum and maximum birth weights in this group range from 1490 gm to 4050 gm.

4.5 Chernoff faces

Herman Chernoff, an applied mathematician, statistician, and physicist, developed Chernoff faces in 1973, which show multivariate data in the form of a face. The constituent components, including the eyes, ears, mouth, and nose, serve as a representation of the variables' shapes, sizes, locations, and orientations. The rationale behind utilising faces is that people can recognise faces and readily pick up on slight alterations. Each variable is handled differently by Chernoff faces. The manner that variables are mapped to the characteristics should be carefully considered since the perceived value of the features on the faces varies.Here's an interpretation of Chernoff faces and how they work:

Basic Structure: Every Chernoff face is a straightforward, cartoonish representation of a face. Key facial characteristics including the eyes, brows, nose, mouth, and face shape itself are utilised to symbolise many factors.

Variables Representation: To these face traits, numerous data attributes have to be mapped. For instance, one variable may be the size of the eyes, another might be the angle of the lips, a third might be the width of the face, and so on.

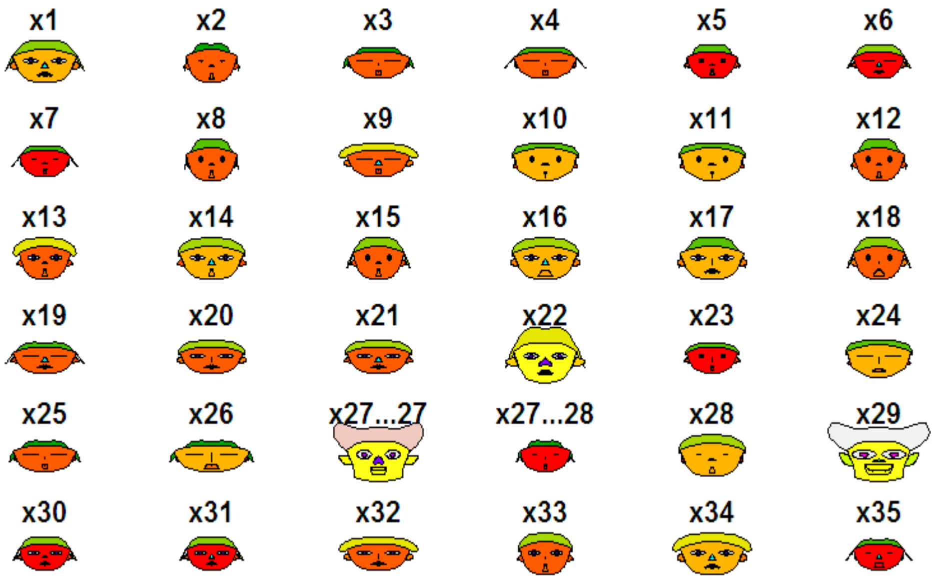
Data Mapping: Chernoff faces can be altered to correspond to the particular dataset being examined. Data values can be mapped to facial feature values. For instance, we might map traits like extroversion, agreeableness, conscientiousness, and so on to various face characteristics if we were studying data about people's personalities.

Interpretation: We must look at the many features and their attributes in order to comprehend a Chernoff face. Patterns and links in the data can be found by comparing the sizes or orientations of features on different faces. For instance, if we see that most faces have wide eyes, this may point to an extroversion pattern in the data.

Comparison: Chernoff faces make it simple to compare several data points visually. We may rapidly identify patterns, outliers, or similarities in the data by glancing at a collection of these faces.

Limitations: Chernoff faces have several restrictions, while being a novel technique to visualise multivariate data. Data can be mapped arbitrarily to face traits, and the conclusions that emerge from this mapping are not necessarily clear-cut or precise. Additionally, the method works best with a small number of variables since a face with too many traits might become confused. When used to study and comprehend complicated information, chernoff faces may be entertaining and interesting. They might not be as useful for all sorts of multivariate data, though, and are best suited for specific types of data analysis. They are but one tool among several data visualisation tools that analysts and researchers may use. Following is the chernoff faces graph for the attributes in the dataset. here the data set cantains 430 sample and 35 attributes. our interest is to group the data according to attributes. so that we can identify the which varaibles behaves in same manner.according to the following graph here it was found that there are mainly three groups found in the 35 attributes such as group I consistes of X_1, X_{10}, X_{11}, X_{14}, X_{16}, X_{17}, X_{24}, X_{26} and X_{28}. This group of variables likely exhibits similar patterns or behaviors in the dataset. This means that these attributes may have some commonality in how they relate to the data or the outcomes we are studying.The variables such as mother’s education, mothers working Type, mother’s age at the marriage, media exposure, pregnancy period till the delivery, milk and vegetables, husband's occupation, type of earlier delivery, USE have in one group. Group II consist of remaining all variables. This group is the largest and might represent a more diverse set of attributes that still exhibit some common behavior or patterns. The variables such as gross monthly household income, husband's occupation, distance from home to ANC center, days antenatal iron supplement taken, mothers occupation, ANC visits, baby's weight , mothers working status, are you aware about ANC?, have you go for ANC, media exposure, new born baby's sex, type of delivery, mother's age, mother's education, marriage month, number of earlier pregnancies, use, aware of 102 service , aware of 108 service , mother's HB, knowledge on danger signs of pregnancy lies in one group. Group III contains few attributes such as X_{22}, X_{27}, X_{29} and X_{34}. like living area, pregnancy period till the delivery, place for ANC, mother height. These variables might behave differently from the variables in Groups I and II, and they might have distinct patterns in the dataset.

Figure 4.25: **Churnoff Faces**



Chernoff faces may be expanded to produce a unique clustering method because of their capacity to represent many factors utilising facial traits. As in the conventional use of Chernoff faces, each Chernoff face in this method denotes a distinct data point within a dataset. However, cluster membership is now communicated through the facial traits. It is feasible to visually arrange and distinguish data points within the same cluster by mapping cluster assignments to certain facial traits or emotions. Data points in separate clusters may have various mouth orientations, whereas those in the same cluster may have identical eye shapes. This visualization technique provides an easy-to-use and welcoming approach for people to explore and comprehend cluster patterns in large and complicated datasets, making it a valuable addition to the tool kit of data analysts and researchers working on clustering and pattern recognition tasks.

4.6 Comparative study of hierarchical clustering techniques: Single linkage, complete linkage and average linkage.

Both the characteristics of the data and the objectives of the clustering analysis should be taken into consideration when selecting the linking technique.

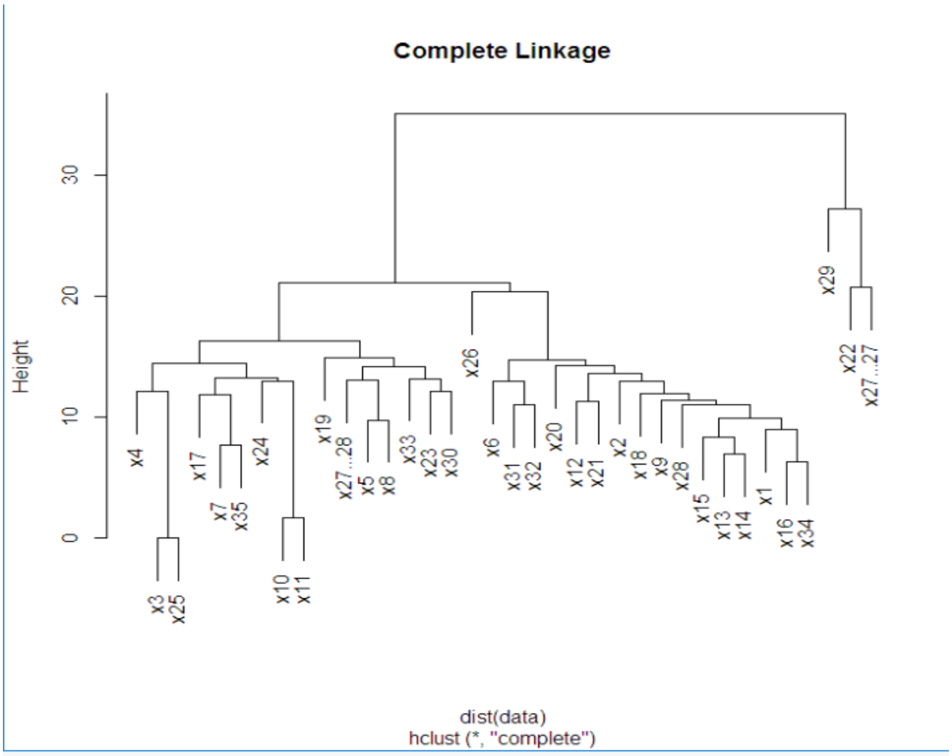
- Single linkage is appropriate for recognizing chains or extended clusters, however it might provide issues when there are outliers.
- Complete linkage is excellent for generating compact clusters, but it may combine data points too conservatively, thereby omitting smaller, more distinct clusters.
- Average linkage is frequently a well-balanced option that performs well in many situations since it considers both minimum and maximum lengths.

In order to arrive at a conclusion that is well-informed, it is necessary to conduct experiments using a variety of connection techniques and evaluate the results of these experiments. This is because the efficacy of each approach may vary based on the shape, density, and size of the data. Data pre-processing and outlier management are other critical factors to take into account in clustering analysis since hierarchical clustering can be vulnerable to noise and outliers and the choice of linkage might affect the cluster structure.

4.6.1 Complete Linkage Clustering:

```
> # Perform hierarchical clustering with complete linkage
>complete_hclust<- hclust(dist(data), method = "complete");complete_hclust
Call:
hclust(d = dist(data), method = "complete")
Cluster method   : complete
Distance         : euclidean
Number of objects: 36
> # Plot for complete linkage
> plot(complete_hclust, main = "Complete Linkage", sub = NULL)
```

Figure 4.26: **Complete Linkage**

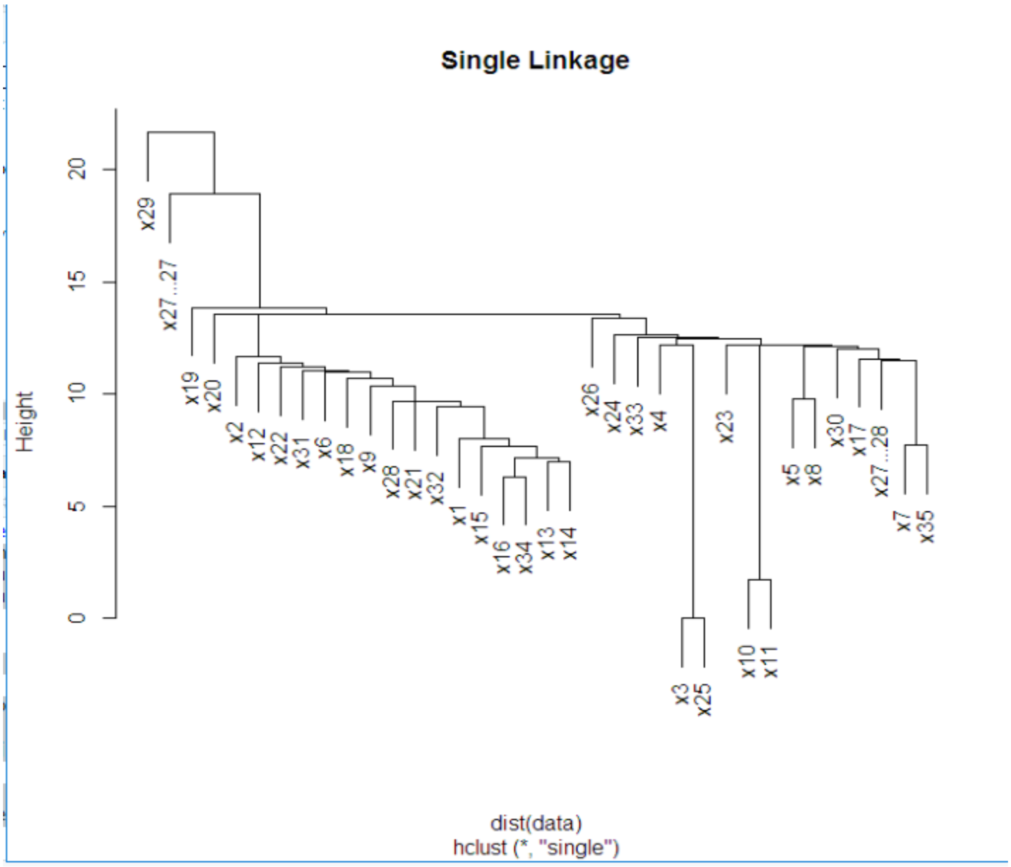


From the above dendrogram we can see that from complete linkage method gives grouping number that is 3. From these clustering techniques here we can find three main clusters for total 36 variables. Were in the first cluster X_4, X_3, X_{25}, X_{17}, X_7, \ X_{35}, X_{24}, X_{10}, X_{11}, X_{19}, X_{27}, X_5, X_8, X_{33}, X_{23}, and X_{30}. Second cluster contains X_{26}, X_6, X_{31}, X_{32}, X_{20}, X_{12}, X_{21}, X_2, X_{18}, X_9, X_{28}, X_{15}, X_{13}, X_{14}, X_1, X_{16}, and X_{34}. Third cluster contains few attributes that are X_{29}, X_{22} and X_{27}.

4.6.2 Single Linkage:

```
> # Perform hierarchical clustering with single linkage
>single_hclust<- hclust(dist(data), method = "single")
>single_hclust
Call:
hclust(d = dist(data), method = "single")
Cluster method   : single
Distance         : euclidean
Number of objects: 36
> # Plot for single linkage
> plot(single_hclust, main = "Single Linkage", sub = NULL)
```

Figure 4.27: **Single Linkage**



From the above dendrogram we can see that from single linkage method gives grouping number that is 2. From these clustering techniques here we can find two main clusters for total 36 variables. Were in the first cluster X_{29}, X_{27}, X_{19}, X_{20}, X_{2}, X_{12}, X_{22} , X_{31}, X_{6}, X_{18}, X_{9}, X_{28}, X_{9}, X_{28}, X_{21}, X_{32}, X_{1}, X_{15}, X_{16}, X_{34}, X_{13}, and X_{14} and cluster two contains X_{26}, X_{24}, X_{33}, X_{4}, X_{3}, X_{25}, X_{23}, X_{7}, X_{10}, X_{11}, X_{5}, X_{8}, X_{30}, X_{17}, X_{28}, X_{7}, and X_{35}.

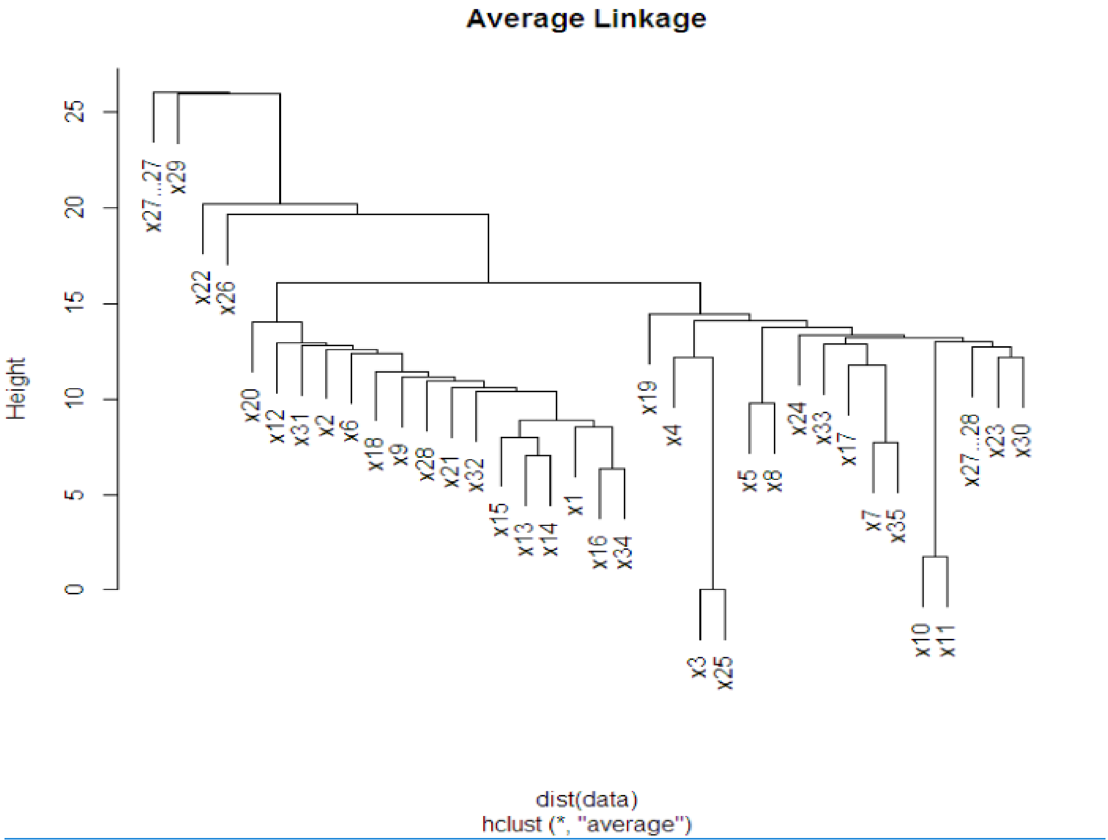
4.6.3 Avearage Linkage:

```
> # Perform hierarchical clustering with average linkage
>average_hclust<- hclust(dist(data), method = "average");
>average_hclust
Call:
hclust(d = dist(data), method = "average")
Cluster method   : average
Distance         : euclidean
Number of objects: 36
> # Plot for average linkage
> plot(average_hclust, main = "Average Linkage", sub = NULL)
```

4.7 Comparative View of all Clustering Techniques

From each of the four different clustering methods, including Chernoff faces, single linkage, full linkage, and average linkage, here it was found that the Chernoff faces and complete linkage algorithm shows similar results. Whereas average linkage and single linkage clustering shows similar results.

Figure 4.28: **Average Linkage**



From the above dendrogram we can see that from average linkage method gives same grouping number that is 2. From these clustering techniques here we can find two main clusters for total 36 variables. Were in the first cluster X_{27}, X_{29}, X_{26}, X_{20}, X_{12}, X_{31}, X_{2}, X_{6}, X_{18}, X_{9}, X_{28}, X_{21}, X_{32}, X_{15}, X_{13},X_{14},X_{1},X_{16}, and X_{34} and cluster two contains X_{19}, X_{4}, X_{3}, X_{5},X_{8}, X_{24}, X_{33}, X_{7}, X_{17}, X_{35}, X_{10}, X_{11}, X_{27}, X_{23}, X_{30}.

In closing, the exploratory data analysis conducted in this chapter has equipped us with a foundational understanding of the dataset. It has not only revealed key characteristics of our study population but also initiated the process of uncovering potential clusters within the data. This chapter sets the stage for the subsequent phases of our research, which will delve deeper into the components that have effect on awareness of care during journey of pregnancy among reproductive female in Baramati. The insights gained from this analysis will guide us in formulating hypotheses and research questions that will be explored in the following chapters. In the end, the purpose of our research is to make a contribution to the improvement of Maternal and Child Well-being outcomes in the area. The findings of our study will be given in later chapters.

CHAPTER-5

FACTORS AFFECTING AWARENESS OF ANC AMONG REPRODUCTIVE WOMEN

5.1 Introduction

Numerous factors that affect both mothers' and newborns' well-being are included in maternal health care. The type of delivery and its possible effect on the baby's weight are an important consideration. The association between the style of delivery and the weight of the newborn infant among reproductive women in Baramati is statistically analyzed in this chapter. To optimize maternal and newborn outcomes, healthcare practices and treatments must be guided by an understanding of this connection.

In this chapter, data collected from 430 women in reproductive age group from Baramati region is analysed and explained. This chapter focuses on the interpretation and analysis of the data obtained to evaluate the maternal health add new born outcome among reproductive women's in Baramati initially data was collected from 430 mothers with the help of structured questionnaire which contains social economic and demographic variables, question related to recent pregnancy and earlier pregnancy, awareness related to antenatal care, pathological information etc.

In the present investigation, the intention was to determine the factors that have a significant impact on the provision of maternal health care in Baramati, especially the style of delivery and the weight of newborns. Pregnancy, birth, and postpartum care are all included in the broad subject of maternal health care. The method of birth and baby's weight among reproductive women in Baramati are two crucial aspects of maternal health care that we explore statistically in this chapter. Let's first visualize the distribution of these crucial elements prior to going into the analytical specifics.

In order to comprehend the respondents' backgrounds, this chapter looks at the socioeconomic and demographic characteristics of the respondents. Demographic and socioeconomic factors are quite important in determining how women's health turns out. Demographic and socioeconomic factors significantly affect the maternal health of women. The quality of maternal healthcare that women get throughout pregnancy and delivery is significantly influenced by resource accessibility, access to healthcare services, and social factors. For the purpose of creating healthcare policies and treatments that effectively meet the unique demands and difficulties experienced by women, it is crucial to comprehend these variables. The following are some important impacts of socioeconomic and demographic factors on women's maternal health:

5.1.1. Healthcare Services Accessibility

The capacity of a woman to get healthcare treatments during pregnancy may depend on her socioeconomic situation. Financial obstacles may impede women from lower socioeconomic backgrounds from receiving early and consistent prenatal care. Inadequate maternal health outcomes may result from the delayed recognition of possible health hazards and consequences.

5.1.2 Social and Economic Status:

The socioeconomic situation of women frequently has an impact on that health. Access to high-quality healthcare services, such as preventative care and routine checkups, may be difficult for low-income women. Financial limitations may make it difficult for them to pay for drugs and treatments, which might result in health inequities.

5.1.3 Education and Health Literacy:

Better health outcomes are highly correlated with education. Higher educated women often have better health literacy, which increases their propensity to adopt healthy habits and make wise health-related decisions. Women who have received education are better equipped to recognize the value of early medical treatment and preventative health practices.

5.1.4 Healthcare Access and Infrastructure:

Women's health can be strongly impacted by the availability of medical facilities and their accessibility when needed, especially in rural regions. Delay in diagnosis and treatment of different health disorders can be brought on by difficulty in gaining access to medical facilities and skilled medical personnel.

5.1.5 Reproductive Health Services:

It is necessary for women to have access to services related to reproductive health, such as family planning, maternity care, and safe abortion services, in order to ensure their general well-being. Informed decisions regarding reproductive health may be made by women with the help of adequate family planning tools, which leads to better pregnancies and lower rates of maternal death.

5.1.6 Marital and Family Status:

Marital status and family situation might have an impact on a woman's health. Women who are married may have better access to healthcare services and social networks, whereas women who are divorced or alone may experience particular difficulties in finding healthcare and maintaining their health.

5.1.7 Age and Life Stage:

Women's health needs differ during several life phases, including adolescence, adulthood, and menopause, among others. To guarantee a woman's wellbeing at every stage of her life, understanding age-related health risks and taking preventive action is crucial.

5.1.8 Geographical Location:

Depending on the region in which they reside women's health might vary greatly. For example, rural women may experience difficulties getting access to healthcare and nutritious food, which can negatively affect their maternal health.

5.1.9 Health Insurance Coverage:

Access to healthcare services can be significantly influenced by health insurance coverage. Women who have full health insurance are more likely to go for routine check-ups and receive prompt medical care.

5.2 STATISTICAL ANALYSIS USING TESTING OF HYPOHESIS

Hypothesis

A hypothesis is a claim or informed guess that aims to explain phenomena, forecast outcomes, or serve as a starting point for more study and research. A hypothesis is a proposed explanation for observed phenomena in the context of scientific study and the scientific method. An assumption or concept is given as a hypothesis for the purpose of evaluating it and testing if it could be true.

Types of Hypotheses:

- **Null Hypothesis(H_0)**

The assertion makes a suggestion that there is no discernible difference or association among the variables. It is often used as the basic assumption to be checked against.

- **Alternative Hypothesis (Ha or H_1):**

This is the claim that challenges the null hypothesis and suggests a substantial distinction or connection between the variables.

e. g. **Null Hypothesis:** "There is no significant difference in maternal mortality rates between urban and rural areas."

Alternative Hypothesis: "Maternal mortality rates are significantly different between urban and rural areas."

One and Two tailed Hypothesis:

Hypotheses in statistical testing can be classified into one-tailed (one-sided) and two-tailed (two-sided) hypotheses, depending on the direction of the expected effect or relationship being tested.

One Tailed Hypothesis: When a researcher has a predetermined expectation regarding the direction of the impact or relationship under investigation, they utilize a one-tailed hypothesis, sometimes referred to as a one-sided hypothesis. When we wish to test if a parameter is larger than or less than a specific value, but not both, one-tailed tests are frequently utilized.

e. g. **Null Hypothesis (H_0)**: "Regular exercise has no significant effect on reducing the risk of heart disease in women."

Alternative Hypothesis (H_1): "Regular exercise significantly reduces the risk of heart disease in women."

Two Tailed Hypotheses: It is used to determine whether a parameter deviates from a given value without indicating the direction of the deviance. It is more circumspect and takes both sides into account.

e. g. **Null Hypothesis (H_0):** "There is no significant difference in the average BMI between women who follow a vegetarian diet and women who follow a non-vegetarian diet."

Alternative Hypothesis (H_1): "There is a significant difference in the average BMI between women who follow a vegetarian diet and women who follow a non-vegetarian diet."

We do not state the direction of the difference in this two-tailed hypothesis. Instead, we are determining if there is a discernible difference in average BMI between vegetarian and non-vegetarian women. The alternative hypothesis (H_1), assuming data and analysis are consistent with it, would imply that there is a statistically significant difference in BMI between these two groups, but it would not say whether vegetarians had a higher or lower BMI.

Choice of Null Hypothesis:

The selection of the null hypothesis is a fundamental and crucial step in the problem of hypothesis testing. One of the two hypotheses is chosen as the alternative hypothesis, while the other is chosen as the null hypothesis. The null hypothesis is typically used to refer to a hypothesis whose incorrect rejection would be more detrimental.

Type I error and Type II error:

These two types of errors are occurring in hypothesis testing and statistical decision-making. They are important concepts in the field of statistics and have implications for the accuracy and reliability of research findings.

Type I Error

First type of error happens when the statistical analysis failing to accept a null hypothesis that is actually true. In other words, the null hypothesis was rejected when it shouldn't have been. The significance level, often known as the α, represents the likelihood of making a Type I mistake. The likelihood of making a mistake is represented by the significance levels of 0.05 or 0.01, respectively. Because they lead to the conclusion that there is a substantial impact or difference when there isn't, type I mistakes are often referred to as "false positives."

e. g. The type I error related to this study is if a pregnant woman without the medical condition receives a positive test result, indicating that she has the condition when she does not.

Type II Error

A Type II mistake happens when a statistical analysis fails to reject a null hypothesis that is genuinely untrue. In other words, the null hypothesis that should have been rejected was not rejected. The sign (β) stands for the likelihood of making a Type II mistake. Due to their tendency to miss actual effects or differences, type II mistakes are frequently referred to as "false negatives".

e.g. A missed opportunity to provide early intervention and care to a pregnant woman who does have the condition, potentially leading to negative impact on maternal health outcomes.

Test Statistics:

A function of sample observations which is used to test Ho is called as test statistics

Level of Significance:

A key idea in statistical analysis and hypothesis testing is the degree of significance, which is frequently represented by the symbol (alpha). It stands for the point at which we are prepared to conduct a statistical test with a Type I mistake (false positive). In other words, it establishes the likelihood that a null hypothesis will be wrongly rejected when it is actually true. We can fix level of significance in advance as 1%, 2% or 5%. Most of the time researcher would like it fix it 5%.

P- Value or Observed level of Significance:

Under the null hypothesis, the p-value indicates the likelihood of receiving the observed data or even more extreme data. When the p value is lower than the threshold of significance, we conclude that the null hypothesis is not true otherwise accepting it.

Assumptions of Testing of Hypothesis:

The characteristics that the population from which we are sampling should ideally possess in order for us to draw appropriate conclusions are known as assumptions.When doing analysis for hypothesis testing, there are three underlying assumptions.

Random Sampling: It is recommended that there is a good representation of the population in the sample of significant interest; the data should be gathered using a random sampling procedure. Non-random sampling can cause bias and compromise the reliability of the findings.

Independence: The observations in the sample need to be unrelated to one another. This implies that the results of any observations should be independent of one another. When this assumption is broken, hypothesis testing may yield false findings.

Normality: ANOVA and certain hypothesis tests, such t-tests, take into consideration the possibility that the data follows a normal distribution. The accuracy of the results can be impacted by variations from a normal distribution even though these tests are generally resistant to breaches of normality. Non-parametric tests could be more suited when the data is not regularly distributed.

Homogeneity of Variance: In certain tests, it is presumed (homoscedasticity) that the variances of various groups or samples being compared are similar. The outcomes of tests like ANOVA and t-tests may be impacted by violating this premise. Levene's test and Bartlett's test are two methods that may be used to investigate the equality of variances.

Measurement Scale: For the selected statistical test, the scale of measurement (such as nominal, ordinal, interval, or ratio) should be adequate. The inappropriate test might result in inaccurate findings since different tests are suitable for various types of data.

To ensure that the findings of hypothesis testing are valid and insightful, it is essential to carefully take into account these presumptions. Inaccurate conclusions and inaccurate data interpretations may result from failure to fulfil these assumptions**.**

Small Sample Test: It's crucial to pick statistical tests and procedures that take into consideration limited information when working with small sample sizes in hypothesis testing. Because small sample sizes sometimes have lower statistical power, it might be difficult to identify significant effects. Here are a few typical statistical procedures and methods for testing small samples. Following are some small sample test:

- t-Tests for Small Samples:
- Wilcoxon Signed-Rank Test:
- Wilcoxon-Mann-Whitney Test:
- Kruskal-Wallis Test

Large Sample Test: Here are some typical statistical procedures and methods for testing with big samples.

Z-Tests: When comparing sample statistics to population parameters, especially when the population standard deviation is known, Z-tests are acceptable for large sample sizes.

t- Tests: Large samples can benefit from the basic t-test, and we are able to routinely assume that the data is normal. The student t-distribution resembles the normal distribution if the sample size is large enough.

Chi-Square Tests: When we need to analyse categorical data, such as in the case of goodness-of-fit tests, tests of independence, or tests of homogeneity, chi-square tests are helpful for large sample sizes.

5.3 Analysis of Variance (ANOVA)

When comparing means across several groups with significant sample sizes, ANOVA is effective. It can aid in spotting mean differences and taking into consideration variation within and across groups.

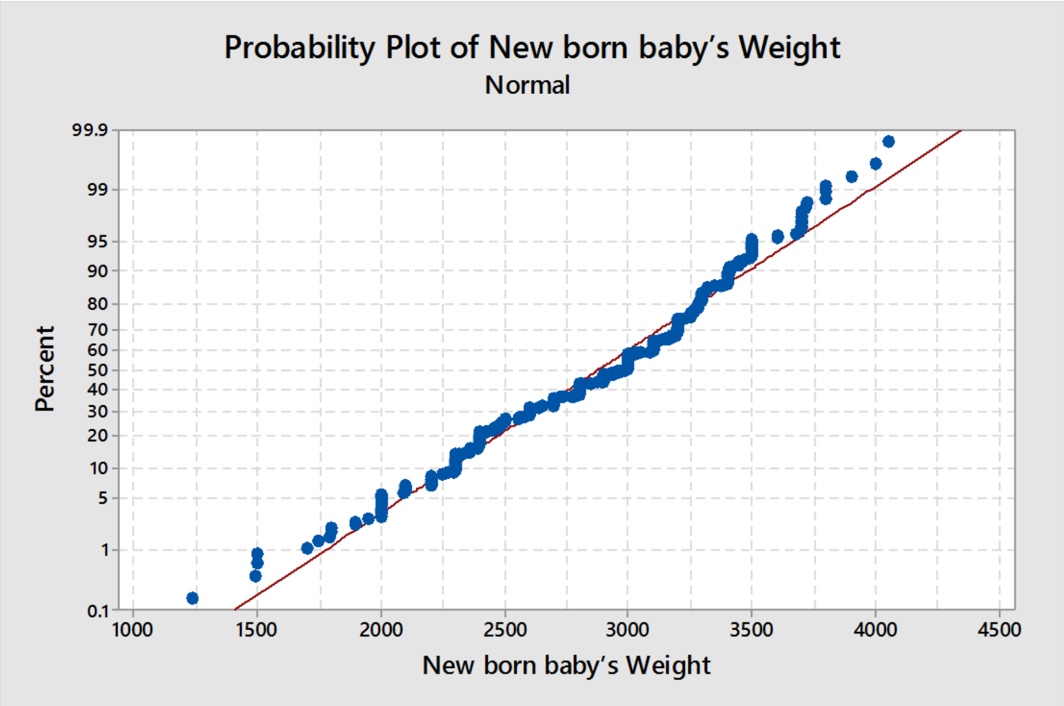
Researchers should consider both the statistical significance of their results as well as its practical importance when dealing with large sample sizes. To give a more thorough picture of the outcomes, effect sizes, confidence intervals, and measures of accuracy should also be presented. Furthermore, because of the high sample size, researchers should exercise caution when reading too much significance into seemingly insignificant variations. In this study, a large sample size has been employed, thus necessitating the use of t test for extensive data analysis.

What is t-Test?

When comparing the means of two groups, a t-test is used to assess whether there is a significant difference that may be connected to certain characteristics. A t-test is a method for evaluating hypotheses that may be used to assess a population-based assumption.

To evaluate statistical significance, a t-test considers the values of the t-distribution, the degrees of freedom, and the t-statistic. We may assess if the two data sets' average values originated from the same population by contrasting them using a t-test. A t-test presupposes that the measuring scale used to analyse the data be continuous or ordinal, like the results of an IQ test. In this we consider study variable new born baby’s weight and it is continuous variable, also population variance is unknown. Observation was collected randomly in this study. Following figure shows the normality assumption of data. We can check normality of data by using normal probability plot on Minitab software.

Figure 5.1.Normal Probability Plot of New Born Baby’s Weight



The above graph shows that all points closely follow a straight line, it suggests that the data may follows a normal distribution. It concludes that weight of new born baby's are normally distributed. So here in this study we can use t test for equality of two populations mean.

5.4 Statistical Analysis Using T-Test

It is essential to determine if the variances of the two samples are approximately equivalent before doing a two-sample t-test. A statistical test called the F-test is used to assess variances between two or more groups or samples. We use the F-test to examine whether or not the variances of two samples are statistically similar when comparing two groups, such as in a two-sample t-test.

Hypotheses to be tested in F test

For the F-test to determine whether or not the variances are identical, the following are the null and alternative hypotheses involved:

Null- Hypothesis (H_0): The variances of the two samples are equal.

Alternative Hypothesis (H_1): The variances of the two samples are not equal.

Test Statistics:

The test statistics for F test is F = $\frac{s_1^2}{s_2^2}$ has F distribution with (n_1-1) and (n_2-1) d.f , if $s_1^2 > s_2^2$ where s_1^2 is mean square of first sample can be calculated as

s_1^2 = $\frac{\sum_{i=1}^{n}(x_i - \overline{x})^2}{n_1 - 1}$ and s_2^2 is mean square of second sample can be find by using

s_2^2 = $\frac{\sum_{i=1}^{n}(y_i - \overline{y})^2}{n_2 - 1}$ on the other hand if $s_1^2 < s_2^2$ then under H0 the test statistic is

F = $\frac{s_2^2}{s_1^2}$ follows F distribution with (n_2-1) and (n_1-1) degrees of freedom.

In this study we use R studio software for the analysis, so we use R code to test the corresponding hypothesis. We use the var.test function to perform the F-test.

Decision criteria: we used p value for taking decision about rejecting or accepting null hypothesis. It is possible that we will not be able to reject the null hypothesis if the p-value is greater than the significance threshold that we have established as 0.05. It would seem from this that there is not sufficient information to support the result that variances between the two samples are distinct from one another. So we proceed with a -test with two samples assuming same variances. We are able to reject the null hypothesis if the p-value is lower than the significance threshold alpha, which is set at 0.05. This indicates that the variances are statistically different from one another. In this case, we should not assume equal variances in this subsequent t-test. We can perform two sample t-tests assuming unequal variance.

Test whether variances in weight of new born babies from both areas are equal

Hypothesis:

H_0: The variances of weight of babies in two living area are equal.

H_1: The variances of weight of babies in two living area are not equal.

View(bw_rural)

> data=bw_rural

> x=data$Rural

> y=data$Urban

> var.test(x,y,alternative = "two.sided")

F test to compare two variances

data: x and y

F = 1.3142, num df = 298, denom df = 130, p-value = 0.07479

alternative hypothesis: true ratio of variances is not equal to 1

95 percent confidence interval:

0.972733 1.745578

sample estimates:

ratio of variances

1.314176

From output p-value = 0.07479 which is greater than α = 0.05, therefore We are able to accepting the null hypothesis (H_0) at 5 % level of significance. Hence it concludes that variances of weight of babies in rural area and in urban area may be equal.

Equality of mean by two-sample t-test: A statistical test used to evaluate if there is a significant difference between the means of two independent groups is the two-sample t-test, sometimes referred to as an independent samples t-test. The alternative hypothesis (H_1) contends that neither of the two groups' population means are comparable to one another, contrary to the null hypothesis (H_0), which believes that they are. In this study our aim is to check is there any significant difference in new born baby’s weight between two or more groups.

1. **Test whether mean weight of babies from rural and urban area are same**

Let μ_1 and μ_2 be a average weight of new born babies in rural and urban area respectively.

Therefore hypothesis to be tested under study is,

H_0: $\mu_1 = \mu_2$ Against H_1: $\mu_1 \neq \mu_2$

R-Studio Output is

View(bw_rural)

> data=bw_rural

> x=data$Rural

> y=data$Urban

> t.test(x, y, alternative = "two.sided", mu = 0, paired = FALSE, var.equal = TRUE, conf.level = 0.95)

Two Sample t-test

data: x and y

t = -4.8057, df = 428, p-value = 2.137e-06

alternative hypothesis: true difference in means is not equal to 0

95 percent confidence interval:

-328.5067 -137.7929

sample estimates:

mean of x mean of y

2807.682 3040.832

Here p value is 3.061e-08which is less than $\alpha = 0.05$ level of significance. Therefore we may reject H_0 at 5 % level of significance. The alternative hypothesis suggests that there is a substantial disparity between the means of the two groups of the paired data. The confidence interval for the difference between means, calculated at a level of 95 percent precision is from -424.7267 to -211.2428. The confidence interval offers a range where the actual difference in means may be located with 95% certainty. The confidence interval in this instance ranges from -328.5067 to -137.7929. We can thus say that the genuine difference in means resides within this range with a 95% confidence level. The sample means of x and y are provided. The average for x is around 2807.682 while the average for y is roughly 3040.832. We forward to one tailed t test.

Hypothesis:

$H_0: \mu_1 = \mu_2$ Against $H_1: \mu_1 < \mu_2$

t.test(x, y, alternative = "less", mu = 0, paired = FALSE, var.equal = TRUE, conf.level = 0.95)

Two Sample t-test

data: x and y

t = -4.8057, df = 428, p-value = 1.069e-06

alternative hypothesis: true difference in means is less than 0

95 percent confidence interval:

-Inf -153.1769

sample estimates:

mean of x mean of y

2807.682 3040.832

The test's p-value is negligible; at 1.069×10^{-6}.This extremely low p-value suggests that the true difference in means is actually smaller than zero, providing strong evidence against the null hypothesis. The 95% confidence interval for the difference between the means is reported as (-Inf, -153.1769). The left endpoint (-Inf) implies that the lower bound of the confidence interval extends to negative infinity, indicating that we are highly confident the true difference in means is less than 0. The sample estimate for the mean in rural area is approximately 2807.682. The sample estimate for the mean in urban area is approximately 3040.832.Similarly we can perform test for other factors in following table:

Table 5.1: Equality of Variance test for factors from two samples

Factors	***Category***	F_{Cal}	**p-value**	**Decision**
Family Type	Joint Nuclear	0.88873	0.3982	Accept H_0
Monthly Income	Less than 10,000/- More than 10,000/-	1.2857	0.07055	Accept H_0
Working Status of Mother	Working Non Working	1.1888	0.2627	Accept H_0
Detecting Abnormality in USE	Yes	0.70915	0.119	Accept H_0

	No			
Days Iron Supplement Taken by Mother	> 3 Months	1.2194	0.1718	Accept H_0
	< 3 Months			
Awareness about ANC	Yes	1.0407	0.7891	Accept H_0
	No			
Mothers HB	<= 11g/dl	0.91782	0.5474	Accept H_0
	>11g/dl			
Sex of Baby	Male	0.78325	0.07397	Accept H_0
	Female			
Type of Delivery	Normal	0.9578	0.7004	Accept H_0
	Caesarean			

The result reveals that the p value is 0.3982, which is higher than 0.05; hence, we are able to accept the null hypothesis at a significance level of 5%. This indicates that the variances of weight of babies from joint family and nuclear family are equal. Similarly for next all category p value is greater than 0.05, so we may accept that variance. Now we can check equality of sample mean by assuming equal variance in each category with help of two sample t test.

Table 5.2: Equality of Mean test for factors from two samples (Two-sided)

Factors	***Category***	t_{Cal}	**p-value**	**Decision**
Family Type	Joint	-2.4985	0.01285	Reject H_o
	Nuclear			
Monthly Income	Less than 10,000/-	-4.8568	1.676e-06	Reject H_o
	More than 10,000/-			
Working Status of Mother	Working	-3.0528	0.00120	Reject H_o
	Non Working			
	No			
Days Iron Supplement Taken by Mother	> 3 Months	-3.5089	0.00049	Reject H_o
	< 3 Months			
	No			
Mothers HB	<= 11g/dl	-	0.9374	Accept H_o

	>11g/dl	0.0785		
Sex of Baby	Male	-2.4988	0.01283	Reject H_o
	Female			
Type of Delivery	Normal	-1.5781	0.115	Accept H_o
	Caesarean			

Here p-value = 0.0002809 < 0.05 therefore we may reject null hypothesis at 5 % l.o.s. The alternative hypothesis suggests that there is a significant difference between the means of the paired data. The 95 percent confidence interval for the difference between means ranges from -329.9645 -100.9774. The confidence interval offers a range where the genuine difference in means may be located with 95% certainty. The confidence interval in this instance extends from -211.59617 to -25.26342. This indicates that we can determine the genuine difference in means with a 95% confidence interval, and it does not contain 0. This strengthens the argument made in favour of the null hypothesis.

It offers sample values for "Joint" and "Nuclear." The average value for "Joint" is around 2836.022, whereas the average value for "Nuclear" is roughly 2954.452. In summary, the results of this t-test suggest that there is some evidence that the means of "Joint" and "Nuclear" are different. The p-value of 0.01285 is smaller than 0.05, indicating statistical significance. However, the strength of evidence is not extremely strong, as the p-value is not very close to zero. The confidence interval further supports the conclusion that the means are different, as it does not include 0.

Here p-value = $1.676\times10^{-6} < 0.05$ therefore we may reject null hypothesis at 5 % l.o.s. The alternative hypothesis suggests that there is a significant difference between the means of the paired data. The 95 percent confidence interval for the difference between means ranges from -313.8272 -132.9988. The confidence interval offers a range that, with 95% certainty, contains the genuine difference in means. The confidence interval in this instance extends from -313.8272 to -132.9988. This indicates that we can determine the genuine difference in means with a 95% confidence interval, and it does not contain 0. This strengthens the argument made in favour of the null hypothesis. The sample means for "Less than 10K" and "More than

10K" are provided. More than 10K has a mean of roughly 2963.401 while "Less than 10K" has a mean of approximately 2739.988. In summary, the results of this t-test suggest that there is very strong evidence to reject the null hypothesis. The means of "Less than 10K" and "< More than 10K" are significantly different from each other. The small p-value and the confidence interval not including 0 support this conclusion.

The p-value is 0.002408, which is smaller than the typical significance level of 0.05. This suggests that there is evidence against the null hypothesis. The small p-value indicates that the difference between the means of "Non Working" and "Working" is statistically significant. The alternative hypothesis states that the "true difference in means is not equal to 0," meaning we are testing whether the means of "Non Working" and "Working" are different. The confidence interval provides a range within which Because of this, we have a confidence level of 95% that the real difference in means lies. In this case, the confidence interval ranges from -248.90327 to -53.92796. This means that, with 95% confidence, we can estimate that the true difference in means falls within this interval, and it does not include 0. The evidence that runs counter to the null hypothesis is supported by this. It provides the sample means of "Non Working" and "Working." The mean of "Non Working" is approximately 2833.639, and the mean of "Working" is approximately 2985.055.In summary, the results of this t-test suggest that there is evidence to reject the null hypothesis. The means of "Non Working" and "Working" are statistically different, with "Working" having a higher mean. The small p-value and the confidence interval not including 0 support this conclusion.

The p-value is 0.0004977, which is much smaller than the typical significance level of 0.05. This indicates very strong evidence against the null hypothesis. The small p-value suggests that the difference between the means of "<3 month" and ">3 month" is statistically significant. There is a statement in the alternate hypothesis that the "true difference in means is not equal to 0," indicating that we are testing whether the means of "<3 month" and ">3 month" are different. The confidence interval provides a range within which we can be 95% confident that the real difference in means lies. In this case, the confidence interval ranges from -269.40456 to -75.95185. This means that, with 95% confidence, we can estimate that the true difference in means falls within this interval, and it does not include 0. This supports the evidence against the null hypothesis.

Here p-value = 0.9374 is greater than 0.05, so we may accept H_0. It means that there is no difference between birth weights of infant according to mother's HB.

We can see that p-value is 0.01283 which is less than 0.05. Hence we may reject null hypothesis. It means that there is considerable difference between birth weight between male babies and female babies. Sample mean of female babies is 2822.102 which is less than sample mean of male babies 2935.321.

Table 5.3: Equality of Mean test for factors from two samples (One-sided)

Factors	***Category***	t_{Cal}	**p-value**	**Decision**
Family Type	Joint	-2.4985	0.00642	Reject Ho
	Nuclear			
Monthly Income	Less than 10,000/-	-4.8568	8.38e-07	Reject Ho
	More than 10,000/-			
Working Status of Mother	Working	-3.0528,	0.00120	Reject Ho
	Non Working			
	No			
Days Iron Supplement Taken by Mother	> 3 Months	-3.5089	0.00024	Reject Ho
	< 3 Months			
Sex of Baby	Male	-2.4988	0.00641	Reject Ho
	Female			

The test's p-value is extremely small, at 0.006423. This extremely low p-value suggests that the real difference in means is actually smaller than zero, providing strong evidence against the null hypothesis. The 95% confidence interval for the difference between the means is reported as (-Inf -40.29408). The left endpoint (-Inf) implies that inside the confidence interval, the lowest limit of the range extends to negative infinity, indicating that we are highly confident the true difference in means is less than 0. The sample estimate for the mean in joint family area is approximately 2836.022. The sample estimate for the mean in nuclear family is approximately 2954.452.

The test's p-value is extremely small, at 8. 8.38×10^{-7}. This extremely low p-value suggests that the true difference in means is actually smaller than zero, providing strong evidence against the null hypothesis. The 95% confidence interval for the difference between the means is reported a -Inf -147.5855The left endpoint (-Inf) implies that the lower limit of the confidence interval extends to negative infinity, indicating that we are highly confident the true difference in means is less than 0. The sample estimate for the mean in income less than Rs.10, 000 families is approximately 2739.988. The sample estimate for the mean in income of family more than 10,000 is approximately 2963.401.

The p-value is 0.001204, which is smaller than the significance level of 0.05.This indicates strong evidence against the null hypothesis. The small p-value suggests that the mean of birth weight of non working mother is significantly less than the mean of birth weight of working mother. It provides the sample means of "x" and "y." The mean of "x" is approximately 2833.639, and the mean of "y" is approximately 2985.055.

The p-value is 0.0002488, which is much smaller than the typical significance level of 0.05. This indicates very strong evidence against the null hypothesis. The small p-value suggests that the mean of "x" is significantly less than the mean of "y."The alternative hypothesis states that the "true difference in means is less than 0," indicating that we are specifically testing whether the mean of "x" is less than the mean of "y."In this case, the confidence interval is one-sided and ranges from negative infinity (-Inf) to -91.55685. This interval suggests that with 95% confidence, we can estimate that the true difference in means is less than -91.55685.The sample means of "x" and "y." The mean of "x" is approximately 2758.238, and the mean of "y" is approximately 2930.917.

Output reveals that p-value = 0.006416 < 0.05, so we may reject H_0. It is strong evidence that male infant have more weight than female infant.

5.5 Chi- Square Test

As an inferential statistical test, the chi-square test of independence enables us to infer information about a population from a sample. It enables us to determine whether two variables have a relationship within the population. A non-parametric tool for determining if there are significant variations in group frequencies is the Chi-square test. When working with data, we frequently don't always receive it in continuous data format. Data may be presented as frequencies. Consider the number of men and women employed in a workplace. There are considerably more men than women employed in a job or workplace if they significantly differ from one another.

The chi-square test has several forms, but the tests of independence and goodness-of-fit are the two most used forms. In the present study it is used to check whether there is significant association between categorical variable.

Chi-Square Test of Independence:

The chi-square test of independence is used within the context of determining whether or not there exists a link that may be considered statistically significant between two category variables. This test responds to queries such as, "Are two variables independent, or is there an association between them?" In contingency tables, it is often used for cross-tabulated data.

Key Elements:

Observed Frequencies (Oi): The actual counts or frequencies observed in the data.

Expected Frequencies (Ei): The counts expected if the variables are independent. These are calculated based on the null hypothesis.

Justification for Using Chi-Square Test:

The test is a suitable statistical tool for analyzing categorical data and testing the independence of variables. If there are significant connections between categorical variables, it is utilised to determine whether or not such relationships exist. An investigation of the parameters that are connected with the method of delivery and the weight of a newborn infant is the purpose of this research. So that we categorized this variables as: baby’s weight as 1 for greater than 2.5 kg and less than or equal to 2.5 as 0.wheras type of delivery categorized as 0 for normal delivery and 1 denote delivery by caesarean.

Hypotheses to Be Tested

Null Hypothesis (H_0): There is no association between the variables i.e. variables are independent.

Against

Alternative Hypothesis (H_1): There is an association between the variables i.e. variables are dependent.

Test Statistic: This is the sum of the squared discrepancies between the frequencies that were observed and those that were expected, normalized by the expected frequencies, yields the chi-square test statistic. The procedure of chi-square is used in order to disperse it. The test statistic's formula is as follows:

$$\chi^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i}$$

Decision Criteria: When the observed and expected frequencies differ significantly, as seen by a high chi-square test score, the variables may be related. The variables may be independent if the chi-square statistic is low.

In the forms of the chi-square test, the significance level α is chosen to determine whether the results are statistically significant. If the p-value is less than α, reject the null hypothesis, indicating an association between two variables. If the p-value is higher than the alpha, then we are unable to reject the null hypothesis, which states that the two variables do not depend on one another in any way for their existence.

5.6 Odds Ratio

The odds ratio (OR) is a statistical tool that may be used to evaluate the degree of a connection or link between two categorical variables, as well as the direction of such association or link. It is frequently used to compare the probabilities of an occurrence or consequence happening in two groups in epidemiology, medical research, and social sciences. The odds ratio is especially helpful for examining how one variable affects the likelihood of an occurrence or result in a different group.

If the OR is 1, it means there is no correlation and both groups have the same probabilities of the event occurring. In the case that the odds ratio (OR) is less than one, this signifies a negative link, which implies that the group that was exposed to the event is a greater likelihood to experience it than the group that served as the comparison. There may be a positive association if the odds ratio (OR) is greater than one, which indicates that the group that was exposed to the event is a greater probability to experience the occurrence than the group that served as the comparison.

5.6.1 Implementation in the Awareness Study of Antenatal Care:

In our thesis, we might use an odds ratio to evaluate the relationship between knowledge of prenatal care and a variety of parameters, including socio-demographic traits, education level, economic position, or any other variables that are pertinent to the topic at hand. As an example, we might compute odds ratios in order to provide answers to problems such as:

1. When compared to women with lower levels of education, what are the chances that women with greater levels of education are aware of the importance of prenatal care?
2. What are the ways in which the likelihood of awareness varies across various age groups?
3. Is there a difference in the likelihood of awareness between women who are working and those who are unemployed?

5.7 Proportion Test

The research on current topic found a relation between the type of delivery and different variables like mother’s age, living area, number of earlier pregnancy etc. The rationale and methodology for conducting a proportion test will be discussed to further understand this relationship.

There is a statistical test that is used to assess whether or not there is a significant differences in proportions between two or more categories within a categorical variable is called a proportion test, sometimes referred to as a chi-squared test for proportions. Investigating how prenatal care knowledge differs among various levels of mother's education and delivery styles is a useful tool for this study.

Hypotheses:

Null Hypothesis (H_0): There is not any significant variation in the percentage of different variables and methods of delivery, the weight of the infant, or the knowledge of prenatal care.

Alternative Hypothesis (H_1): There is significant difference in the proportion of various variable and types of delivery, baby’s weight and awareness of antenatal care.
Based on the results of the proportion test, we will be able to conclude whether there is a significant variation in the awareness of antenatal care based on different categories and types of delivery, baby’s weight. This information can contribute valuable insights to in this study on antenatal care awareness in Baramati.

By including a proportion test in thesis, we will enhance the statistical rigor of research and supply a more extensive and detailed analysis of the relationships between these categorical variables. It will also help in making evidence-based recommendations for improving awareness of antenatal care among reproductive women in Baramati.

A) Chi Square Test For Type Of Delivery

1. Aim is to test is there relation between Type of Delivery and Mother's age ?

Null Hypothesis (H_0): No association between the type of delivery and mother's age

Alternative Hypothesis (H_1): There is association between the type of delivery and mother's age.

Output of R

```
data <- matrix(c(31,26,159,191,8,15), nrow =3,ncol=2,byrow=T)
> result <- chisq.test(data)
> print(result)
     Pearson's Chi-squared test
data:  data
X-squared = 2.824, df = 2, p-value = 0.2437
```

Decision Criteria: If p-value > 0.05, we may accept $H_{0.}$ Otherwise reject H_o.

Here, p-value =0.2437 greater than l.o.s., so we may accept null hypothesis. The study's p-value of 0.2437 shows that there is no significant association between the type of delivery and the mother's age. A p-value greater than 0.05 (in this case, 0.2437) suggests that there is not enough evidence to conclude a statistically significant association between type of delivery and mother's education. The variables appear to be relatively independent based on the given data and statistical analysis.

2. Aim Is To Test Is There Relation between Type Of Delivery And Mother's Education?

Null Hypothesis (H_0): There is no association between the type of delivery and mother's education

Alternative Hypothesis (H_1): There is association between the type of delivery and mother's education

Output of R

```
data <- matrix(c(26,23,126,130,46,79), nrow =3,ncol=2,byrow=T)
> result <- chisq.test(data)
> print(result)
 Pearson's Chi-squared test
data:  data
```

X-squared = 6.3092, df = 2, p-value = 0.04265

The p-value is 0.04265. This p-value indicates the likelihood of an observation a chi-squared statistic as extreme as 6.3092 if there were no real association between the type of delivery and mother's education. A p-value less than 0.05 (in this case, 0.04265) suggests that there is enough evidence to conclude that there is a statistically significant association between these variables.

In this case, the p-value is less than 0.05, which means we can reject the null hypothesis. The Chi-squared test suggests that there is a statistically significant association between the type of delivery and mother's education. This implies that these two variables are not independent, and there is likely a relationship or association between the type of delivery and the level of education of the mothers in this dataset. As a result, we have decided to conduct a percentage test in order to determine whether or not there is a discernible disparity in the proportions of three distinct categories of education, namely no education, up to senior secondary, and up to post graduate.

Table 5.4:Chi-Square Tests Of Independence For Type Of Delivery

	Type of Delivery			χ^2 Cal	p-value
Selected Variables	Category	Normal	Caesarean		
Living Area	Rural	153	146	7.9592	0.004784
	Urban	47	84		
Family Type	Joint	139	136	4.5501	0.03292
	Nuclear	61	94		
Mother's Working Type	Mental	11	16	0.83472	0.6588
	Physical	44	56		
	House wife	45	158		
Marriage Month	< = 36 Month	135	132	4.2247	0.03984
	> 36	65	98		

Vegetarian Only	No	161	172	1.6878	0.1939
	Yes	39	58		
Type of earlier delivery	Normal	68	13	112.73	2.2e-16
	Caesarean	6	98		
ANC Service Provider	NA	29	11	10.849	0.0009886
	Doctor or Health Professional	171	219		
Month of First ANC Visit	First Trimester	142	183	3.8009	0.05122
	Second and Third trimester	58	47		
Advice of Nutrition	No	74	126	12.892	0.00033
	Yes	126	104		
Prgnancy period	<= 38 weeks	131	178	6.9042	0.008599
	>38 weeks	69	52		
Media Exposure	Yes	39	30	2.8484	0.09147
	No	161	200		
Mothers HB	< 11	148	148	4.207	0.04026
	>=11	52	82		
Mothers Weight Before Delivery	< 50	29	18	4.2328	0.03965
	>=50	171	212		
Child Order	0	107	114	1.05	0.5915
	1	62	82		
	2 and more	31	34		

New Born Baby Weight	< 3 kg	138	112	17.297	3.197e-05
	>= 3 kg	62	118		

The result is regarded as statistically significant at the 0.05 level since the p-value of 0.004784 is smaller than the often used significance threshold of 0.05. In other words, there is substantial evidence to reject the null hypothesis. This shows that the type of delivery and living location have a statistically significant link. In particular, data suggests that residing in rural v/s urban locations may greatly affect the risk of a Caesarean or Normal birth. It shows how living in an area, regardless of whether it is rural or urban, might be a significant role in deciding the kind of delivery, which in turn could have an impact on access to healthcare, the results of maternal health, and the distribution of healthcare resources. The p-value indicates a significant relationship, but it doesn't indicate its strength or practical importance. To understand the effect size or magnitude, one might use odds ratios or relative risk, depending on the data's nature. By using following command we can find odds ratio,

```
> odds_ratio <- (a / b) / (c / d)
> odds_ratio
[1] 1.872923
```

OR = 1.872923: This indicates that the odds of caesarean delivery are approximately 87.29% higher in the group associated with "Rural" living area compared to the group associated with "Urban" living area.

For family type p-value = 0.03292 indicates that we should generally reject the null hypothesis. This shows that the method of delivery and family type have a statistically significant link or relationship. More specifically, it suggests that between joint and nuclear family types, there may be a considerable difference in the chance of a Caesarean or Normal birth. In other words, if the OR is greater than 1(1.540984), as in this case, it is suggested that caesarean deliveries are occur more in the "Joint" family type group compared to the "Nuclear" family type group based on the data we have analyzed. Compared to the significance level of 0.05, a p-value of 0.6588 is higher than the threshold. The fact that this is the case shows that there is no statistically significant link or relationship between the kind of delivery and the working type of the mother. For marriage month p value is 0.03984. The statistically significant result implies that the duration of marriage in months is associated with the type of delivery. After finding OR = 1.541958 we can conclude that it suggests that caesarean deliveries are more likely to occur in the group with a longer marriage duration compared to the group with a shorter marriage duration based on the current data. On the basis of p- value = 0.1939 being a vegetarian-only does not appear to significantly influence the likelihood of caesarean or Normal delivery. A strong rejection of the null hypothesis is shown by the p-value of 2.2e-16, which is much lower than the significance threshold of 0.05. This indicates that there is a strong correlation between the kind of delivery that occurred earlier and the type of delivery that is now being performed. This suggests that the type of earlier delivery is a strong predictor of the current type of delivery. The OR is 85.4359, this indicates that the odds of having a caesarean delivery in the current pregnancy are 85.4359 times higher for women who had a caesarean delivery in their earlier pregnancy compared to those who had a normal delivery in their earlier pregnancy. It strongly suggests that having a previous caesarean delivery is a very strong predictor of having a caesarean delivery in the current pregnancy. The study's p-value of 0.0009886, which is significantly lower than the commonly used 0.05 significance level, strongly rejects the null hypothesis, indicating a strong association between the type of delivery and the ANC service provider. This implies that the choice of ANC service provider has a considerable effect on the kind of delivery, independent of whether or not the delivery is carried out by a health professional. The p-value of 0.05122, slightly above 0.05, suggests evidence against the null hypothesis but does not meet the standard threshold for statistical significance, making it potentially considered marginally significant. We may easily draw the conclusion that the method of delivery is related to the supply of dietary advice because of the low p-value, which shows a highly significant association between the two. Practically speaking, an OR of 0.4847569 indicates that obtaining nutrition advice is linked to a lower chance of having a caesarean birth. Although being somewhat higher than 0.05, a p-value of 0.09147 is still rather near. The conventional threshold for significance at the 0.05 level is not met by this, despite the fact that it does give some evidence that the null hypothesis is not true. A p-value of 0.04026 is just below the usual significance threshold of 0.05. This shows that the outcome is deemed statistically significant at the level of 0.05. In other words, there is substantial evidence to accept alternative hypothesis. P value for mother’s weight before delivery is 0.03965 < alpha (0.05). We may reject null hypothesis at 5% l.o.s. OR of 1.997401 implies that having a weight greater than 50 kg before delivery is associated with an increased likelihood of having a caesarean delivery. For child order p value is 0.5915 which is more than 0.05, we may accept H_0. OR = 2.345046: This indicates that the odds of Caesarean delivery are approximately 134.50% higher for newborn babies with a weight greater than 3 kg compared to newborn babies with a weight less than 3 kg, based on this specific data.

<u>Proportion Tests For Type of Delivery</u>

Further study test whether the proportion of caesarean deliveries differs significantly between different categories using a proportion test.

Hypothesis to be tested:

H_0: Proportion of delivery by caesarean section is the same in both areas.

H_1: Proportion of caesarean delivery in rural area and urban area are not same

```
x=c(146,84);n=c(299,131)
> prop.test(x,n)
   2-sample test for equality of proportions with continuity correction
data:  x out of n
X-squared = 7.9592, df = 1, p-value = 0.004784
alternative hypothesis: two.sided
95 percent confidence interval:
 -0.25819768 -0.04765644
sample estimates:
   prop 1    prop 2
0.4882943 0.6412214
```

The p-value of 0.004784 is less than the common significance level of 0.05. Therefore, we would typically conclude that there is a significant difference in the proportions of the type of delivery between rural and urban living areas. We can go towards on sided test.

Hypothesis to be tested:

H_0: Proportion of caesarean delivery in area wise

H_1: Proportion of caesarean delivery in rural area less than urban area.

```
x=c(146,84);n=c(299,131)
> prop.test(x,n,alternative="l")
            2-sample test for equality of proportions with continuity correction
        data:  x out of n
```

X-squared = 7.9592, df = 1, p-value = 0.002392

alternative hypothesis: less

95 percent confidence interval:

-1.00000000 -0.06369868

sample estimates:

prop 1 prop 2

0.4882943 0.6412214

The p-value of 0.002392 is less than the common significance level of 0.05, indicating that there is a statistically significant difference. Specifically, the proportion of the Caesarean delivery in the rural area is significantly less than the proportion in the urban area.

Table 5.5 : Proportion Tests For Type of Delivery

	Type of Delivery			**P-value**	**P-value**
Selected Variables	**Category**	**Normal**	**Caesarean**	**Two tailed**	**One tailed**
Family Type	Joint	139	136	0.03292	0.01646
	Nuclear	61	94		
Marriage Month	< = 36 Month	135	132	0.03984	0.01992
	> 36	65	98		
Type of earlier delivery	Normal	68	13	2.2e-16	2.2×10^{-16}
	Caesarean	6	98		
Advice of Nutrition	No	74	126	0.00033	0.000165 (right tailed)
	Yes	126	104		
Mothers Weight Before Delivery	< 50	29	18	0.03965	0.01983
	>=50	171	212		
Pregnancy period	<= 38 weeks	131	178	0.008599	0.0043 (right

	>38 weeks	69	52		tailed)
New Born Baby Weight	< 3 kg	138	112	3.197e-05	1.599×10^{-5}
	>= 3 kg	62	118		

Table shows that from p values of all categories, less than level of significance 0.05. The analysis reveals that a higher proportion of Caesarean deliveries are observed between female livings in nuclear families compared to those in joint family households. It indicates that there are a higher proportion of caesarean deliveries among women whose marriage duration exceeds 3 years, while the proportion is notably lower for women with marriage duration of less than 3 years. A notable proportion of caesarean deliveries are observed among mothers who have previously undergone a caesarean section. Pregnant women who receive comprehensive advice on nutritional diets during their antenatal care (ANC) visits exhibit a lower proportion of caesarean deliveries compared to those who do not receive sufficient information regarding nutritional diets. High weight of mother's may be significant factor of caesarean delivery. Proportion of c- section is large in pregnancy period before is 38 weeks. Babies weighing more than 3 kg at birth have a significantly higher proportion of caesarean deliveries when compared to babies with a birth weight less than 3 kg.

B) Chi Square Test For New Born Baby Weight

Null Hypothesis (H_0): No association between the new born baby weight and different categories.

Alternative Hypothesis (H_1): Association between the new born baby weight and different categories.

Table 5.6: CHI-SQUARE TESTS OF INDEPENDENCE FOR BABY'S WEIGHT

	New Born Baby's Weight			**χ^2 Cal**	**p-value**
Selected Variables	Category	< = 2.5 kg	>2.5 kg		
Living Area	Rural	89	210	10.484	0.001204
	Urban	19	112		

Family Type	Joint	75	200	1.5816	0.2085
	Nuclear	33	122		
Gross Monthly Income	Below 5000	32	27	29.065	7×10^{-8}
	Greater than 5000	76	295		
Mother's Working Status	Non-Working	86	216	5.5063	0.01895
	Working	22	106		
Mother's Age at the marriage	<=18 years	57	108	11.856	0.0005748
	>18 years	51	204		
Vegetarian Only	No	87	246	0.58008	0.4463
	Yes	21	76		
Aware about ANC	No	35	50	13.484	0.0002406
	Yes	73	272		
Go For ANC	No	22	22	14.697	0.0001263
	Yes	86	300		
Media Exposure	No	36	47	17.045	3.65×10^{-5}
	Yes	72	275		
Pregnancy period	40 weeks	54	278	58.632	1.901×10^{-14}
	Before 37 weeks	54	44		
Mothers Weight Before Delivery	< 50	23	24	14.528	0.03965
	>=50	85	298		
Iron Supplement	<6 Month	62	220	3.7992	0.05128
	>= 6 Month	46	110		

Eating Vegetable and Milk	Daily and 2 times in Week	90	305	10.975	0.0009237
	Rarely	17	17		
Child Order	1	33	188	23.304	1.383×10^{-6}
	2 and more	74	134		

The statistically significant value of 0.001204 is lower than the standard level of significance, which is currently set at 0.05. The study found a correlation between newborn baby weight and living area, suggesting a difference in distribution between rural and urban areas. The p-value is 0.2085. It represents the probability of obtaining the observed results under the null hypothesis that there is no association between family type and the baby's weight. A p-value of 0.00000007 is much higher than the typical significance threshold of 0.05, which indicates a significant difference. As a result, we would draw the conclusion that there is a very strong statistical correlation between gross monthly income and infant weight. The p-value of 0.01895 is less than the usual 0.05 criterion of significance. Consequently, we would typically come to the conclusion that there is a link that is statistically significant between the work position of an individual and the weight of a newborn. When compared to the standard threshold of significance, which is 0.05, the probability value of 0.0005748 is much lower. Therefore, we would conclude that baby's weight is a highly statistically significant with mother's age. The p-value of 0.4463 is much greater than the common significance level of 0.05. Therefore, we would typically conclude that there is no statistically significant association between dietary choices (both vegetarian non-vegetarian and vegetarian only) and the outcome being studied. P-value for awareness about ANC indicates that there is a strong and significant association between a women's awareness about ANC and the weight of baby. The test suggests that there is a significant connection between ANC taken and baby weight. Similarly media exposure, pregnancy period, mother's weight before delivery, Iron supplement taken, frequently eating vegetable and milk, child order are all have significantly associated with new born baby's weight.

Table 5.7 : Proportion Tests For New Born Baby Weight

	New Born Baby's Weight			p-value	p-value
Selected Variables	Category	< = 2.5 kg	>2.5 kg	For two tailed	One tailed
Living Area	Rural	89	210	0.001204	0.0006019
	Urban	19	112		
Gross Monthly Income	Below 5000	32	27	7e-08	3.5×10^{-8}
	Greater than 5000	76	295		
Mother's Working Status	Non-Working	86	216	0.01895	0.009474
	Working	22	106		
Mother's age at the marriage	<=18 years	57	108	0.0005748	0.0002874
	>18 years	51	204		
Aware about ANC	No	35	50	0.0002406	0.0001203
	Yes	73	272		
Go For ANC	No	22	22	0.0001263	6.313×10^{-5}
	Yes	86	300		
Pregnancy period	40 weeks	54	278	1.901e-14	9.503×10^{-6} (right tailed)
	Before 37 weeks	54	44		
Mothers Weight Before Delivery	< 50	23	24	0.0001381	6.903×10^{-5}
	>=50	85	298		
Eating Vegetable and Milk	Daily and 2 times in Week	90	305	0.0009237	0.0004619 (right tailed)

	Rarely	17	17		
Child Order	1	33	188	2.243e-06	1.121×10^{-6} (right tailed)
	2 and more	74	134		

After statistical analysis it concludes that p value for living area, gross monthly income, mother's age at the marriage, awareness about ANC, go for ANC, pregnancy period, mothers weight Before delivery, frequency of eating vegetable and milk, child order all have proportional to baby's weight. It is more common for neonates born in urban regions to have a greater birth weight compared to babies born in rural areas. This is because metropolitan areas have a bigger population of newborns. A smaller proportion of birth weight is observed in the group with a monthly income of less than 5000, while a larger proportion is found in the group with an income greater than 5000. Mothers who are aware of and receive ANC (Antenatal Care) contribute to a significantly larger proportion of healthy birth weights for newborn babies compared to mothers who lack awareness and do not receive ANC. In comparison to moms who have preterm births, those who have an optimal pregnancy period have a higher percentage of birth weight. This is in contrast to the group of mothers who born prematurely. Indeed, if a mother's weight is higher, it often corresponds to a larger proportion of birth weight, as indicated by the data. Mothers who regularly consume fresh foods, vegetables, and fruits during the week tend to have a larger proportion of their baby's weight compared to mothers who infrequently consume these items. Babies born to primigravida mothers typically have a higher birth weight than those born to mothers who are experiencing their second or third delivery.

c) Chi-Square tests of Independence for ANC visits

In order to determine is there is a link between two or more category variables, a statistical method known as the Chi-Square test for Independence is used. The test enables us to determine if the frequency distribution of ANC visits is dependent on various categorical characteristics in the context of ANC visits and various factors. This test is especially helpful for examining the associations between ANC usage and variables including age, socioeconomic position, educational attainment, husband's occupation, media exposure, gross monthly income and many more. The Chi-Square test is primarily used to examine whether there is a statistically significant relationship between two category variables. The test enables us to determine if there is a significant correlation between ANC utilization and each of the many characteristics in the case of ANC visits. We may determine which factors are statistically associated with ANC use by applying the Chi-Square test for each category component. This knowledge is important for comprehending the variables that could affect whether or not people use ANC services.

Healthcare practitioners may better manage resources if they are aware of the variables that affect ANC use. Targeted services can be offered to particular age groups or socioeconomic groups, for instance, if they are less susceptible to use ANC. Overall, the test is a powerful tool for analyzing the relationship between ANC visits and various categorical factors, providing actionable insights to improve healthcare services and interventions.

Null Hypothesis (H_0): There is no association between the attending ANC visits and different categories.

Alternative Hypothesis (H_1): There is association between the attending ANC visits and different categories.

Table 5.8 : Chi-Square Tests Of Independence For ANC Visits

	ANC Visits			χ^2 Cal	p-value
Selected Variables	Category	<=8	> 8		
Living Area	Rural	153	146	0.0099657	0.9205
	Urban	47	84		
Mother's Education	No Education	47	2	25.584	4.236×10^{-7}
	Educated	219	62		
Family Type	Joint	168	107	0.1117	0.7382
	Nuclear	98	57		
Monthly Income	< 10,000	117	46	10.28	0.001345
	> 10,000	149	118		
Husband's	Employed	141	109	7.0048	0.008129

occupation	Unemployed	125	55		
Awareness about ANC	No	67	19	10.777	0.001028
	Yes	200	145		
Distance from ANC center	<=20 km	164	126	9.9599	0.0016
	>20 km	102	38		
Iron Supplement	<6 Month	226	56	113.82	2.2×10^{-16}
	>= 6 Month	40	108		
Knowledge about danger sign	Better	187	134	6.3857	0.0115
	Poor	79	30		
Mothers Occupation	Service	87	38	4.0237	0.04486
	Housewife	179	126		

From above table it shows that living area, mother's education, monthly income, husband's occupation, awareness about ANC, and distance from ANC center, iron supplement, knowledge about danger sign, mother's occupation all are significant variable at 5% level of significance. At a significance level of 5%, this indicates that the statistical tests that we carried out have shown that these factors have a substantial influence on the degree of awareness of prenatal care among women who are pregnant in Baramati.

Analysis in this chapter we were able to evaluate the significance of differences in newborn health outcomes based on different variables. The results have provided valuable insights into the factors influencing the health of newborns in our study. We examined the relationship between the type of delivery (e.g., Normal or caesarean) and different socio-economic, demographic, and obstetric variables. The chi-square test of independence helped us understand how these variables may be associated with the mode of delivery and the potential implications for maternal and child health. We also employed chi-square tests to investigate the relationship between the number of ANC visits (less than 8 visits and more than 8 ANC meets) and various socio-economic, demographic, and awareness-related variables. This analysis allowed us to explore the determinants of adequate ANC attendance and the potential barriers to accessing antenatal care. The results of this chapter form a crucial foundation for the subsequent sections of our thesis, where we will delve deeper into the implications of these findings, explore potential causal relationships, and propose recommendations for enhancing the awareness and the use of prenatal care female who are pregnant or who are pregnant in Baramati. In the forthcoming chapter, we will continue our analysis by constructing logistic regression model and Decision tree model towards a comprehensive understanding of awareness regarding ANC visits, vital aspect of healthcare and its impact on maternal and child well-being in the region.

CHAPTER-6

AWARENESS OF ANTENATAL CARE: A COMPARATIVE STUDY OF LOGISTIC REGRESSION AND DECISION TREES

6.1 Introduction

In Baramati, the level of awareness of prenatal care (ANC) among women who may become pregnant was examined in Chapter 5 of this thesis, along with its associations with three key outcome variables: the type of birth, the weight of the infant, and the frequency of ANC visits. In order to determine the relationships and dependencies between ANC awareness and these outcome variables, Chapter 5's study used both proportion tests and chi-square testing. In order to have a deeper understanding of the factors impacting these outcome variables, we expand on this research in Chapter 6 by utilizing advanced statistical techniques, particularly decision trees and logistic regression. Our goal is to develop prediction models that provide insightful information about the factors influencing ANC results.

The prenatal care that is provided is an essential component of maternal health, since it has been shown to have a positive impact on the health of both the mother and the infant. Uncertainties exist about the complex interactions that exist between ANC awareness and the mode of delivery, infant weight, and frequency of ANC visits. Strong techniques for separating this complexity and identifying the interactions between different factors and the three main outcome variables are decision trees and logistic regression.

An introduction to decision trees and logistic regression is given at the beginning of this chapter, emphasising their applicability to our investigation. We describe in detail the data and the technique that went into building these models, and then we show the outcomes. While the decision tree models provide a visual depiction of the elements affecting these outcomes, the logistic regression analysis will shed light on the probability of particular outcomes depending on a range of predictor variables.

The information provided in this chapter adds to our understanding of ANC awareness and outcomes and provides healthcare providers, policymakers, and other stakeholders with useful information for enhancing mother and child health in Baramati. In this chapter, we explore the complex network of variables that influence ANC results and provide the groundwork for evidence-based decision-making in maternal healthcare.

6.2 Regression Analysis

A statistical method for examining and modelling the relationship between variables is regression analysis. Regression has many uses in practically all fields, including engineering, economics, management, and the social sciences, the physical and chemical sciences, and life and biological sciences. Regression analysis is a fundamental method in data science and analytics and is widely used in data mining. Perhaps the most popular statistical method is regression analysis due to its broad application to a variety of issues. A statistical technique called regression gives us the ability to investigate and measure the relationships between variables, giving us important information for making predictions, comprehending causation, and making decisions. We'll start by giving a general review of regression analysis.

6.3 Statistical Model

A statistical model is a mathematical depiction of a process, system, or occurrence that occurs in the real world that uses probabilistic and statistical concepts to explain, evaluate, and draw conclusions or predictions about the data. The data or observations gathered from the actual process, which are used as the model's input. Numerous disciplines, including science, engineering, economics, the social sciences, and machine learning, heavily rely on statistical models. These models aid analysts and researchers in comprehending the connections and patterns found in data. Generally speaking, a model is viewed of as a simplified version of a more complicated scenario. A model's main goal is to extract the salient characteristics from the subject matter in order to help us comprehend the modelled scenario or grasp how it connects to other real-world elements. Though there are many distinct kinds of models, all of them are still an approximation or simplification of a more intricate object. Data, the subject of statistics, can be infamously complex and messy. Whether the data are about the weather, health outcomes, or the quantity of frogs killed on a roadway over the course of a year, a statistical model is a simplification of any data scenario. Data may be about almost anything that is testable or measurable. However, data must be described quantitatively in order to be measured; in other words, a statistical model is a way to make numbers easier to understand or less confusing. The foundation of parametric statistical models is the probability distribution function, or PDF. They are employed in the modelling of data produced by a taken from the whole population and selected at random. The distribution of the random sample and the mean, position, and scale of the PDF are defined by parameters. The correlation between the parameters of the underlying PDF and the analyst's estimations is known as a statistical model. Statistical models frequently assume certain things about the underlying process of creating data, such as that mistakes have a normal distribution, that correlations are linear, or that observations are independent. These suppositions aid in streamlining and tractability of the modelling procedure. Statistical models come in a variety of shapes and sizes, contingent on the data and problem. Time series models, logistic regression, linear regression, and more sophisticated models like neural networks in machine learning or hierarchical models are a few popular types of statistical models. The model used will rely on the particular objectives of the study or analysis as well as the type of data being examined. A key component of data analysis and scientific research, statistical modelling is a crucial tool for forecasting, drawing conclusions, and comprehending the connections between variables in a variety of fields. One of the most popular methods for objectively assessing the true parameters is regression. In other words, regression is commonly employed to create a precise model based on population data. Nearly every stage of the computations might introduce measurement error, and the random sample we are evaluating could not accurately reflect the underlying population of data or its real properties. The technique of regression modelling is a tool for comprehending and managing the uncertainty involved in determining the actual parameters of the distribution that describe the population data. This is significant because it influences the predictions we derive from models, which are predicated on this population.

6.4 Linear Regression

An effective statistical method for simulating and n investigation of the connection that exists between a dependent variable (Y) and one or more independent variables (X) is linear regression. The linear regression technique is one of the most straightforward and often used approaches to machine learning. It's a statistical technique for forecasting analysis. For continuous/real or numerical variables like sales of particular commodity, salary of a person, age, product price, etc., linear regression generates predictions. The situation in which we assume there is a linear or roughly linear connection between the variables is one in which it works very effectively. This method of analysis involves determining the coefficients of the linear equation by making use of one or more independent variables that are able to provide the most accurate prediction of the value of the dependent variable. Linear-regression is used to fit a straight line or surface that minimises the discrepancies between the predicted and actual output values. This is accomplished by predicting the output values. The "least squares" approach is used by certain basic linear regression calculators to get the line that provides the greatest fit for a collection of paired data. Next, using Y as the independent variable, we estimate the value of X, the dependent variable.

The result or response variable that we are attempting to forecast or explain is known as the dependent variable. Usually, it is a continuous numerical variable, like test results, temperature, or sales income. The result or response variable that we are attempting to forecast or explain is known as the dependent variable. Usually, it is a continuous numerical variable, like test results, temperature, or sales income. The premise of linear regression is that the explanatory variables and the outcome variables have a linear relationship. This demonstrates that there is a proportional link between changes in the free variable or variables and a change in the variable that is being studied (the dependent variable). The equation $Y = \beta_0 + \beta_1 X + \varepsilon$ represents the model based on a linear regression approach. In this instance, X is the explanatory variable, β_0 represents the point that intercepts of the line and β_1 is the coefficient (slope) of the straight line, and ε is the random residual term. If the variable of interest is continuous and the connection between the independent factors and the dependent variables is considered to be linear, then linear regression is the appropriate statistical method to utilise. In this thesis data set contains three main outcome variables like type of delivery, new born babies weight and frequency of ANC visits which have binary response so we proceed to logistic regression analysis.

6.5 Logistic Regression

At this point in time, regression techniques are required to be included into every data analysis that seeks to explain there is a connection between the outcome variable and one or more factors that contribute to the response. The result variable is frequently discrete, with two or more potential values. For the purpose of analysing this data, the LR model is the most of the time used regression model. Prior to delving into a comprehensive examination of the LR model, It is of the highest priority to have a clear understanding that the objective of an analysis that makes use of this model is the same as that of any other regression model that is used in statistics.: to identify the most appropriate, economical, and model that is interpretable for clinical purposes that characterizes the correlation between a group of independent explanatory variables and an outcome response variable. The independent variables are often called covariates. A model of logistic analysis differs from a model of linear regression analysis because the outcome variable in the former may be either binary or dichotomous, and the variable under interest in the latter is continuous. This is the principal distinction between the two types of models. Both the model's structure and underlying presumptions reflect this distinction between logistic and linear regression. After this discrepancy is taken into consideration, the techniques utilized in a logistic regression study essentially adhere to the same broad principles as those in linear regression. Thus, our approach to LR is motivated by the methods employed in linear regression research.

The logistic model, which is sometimes referred to as the logit model, is a statistical model that is used in the field of statistics to simulate the probability of an event happening. This is accomplished by considering the event's log-odds as a linear combination of one or more independent variables. Logit regression is often commonly referred to as logistic regression, is a method of doing regression analysis. It is for the purpose of estimating the parameters of a model of logistics, or the coefficients in the linear combination. Logit regression, commonly known as the logit model, is a statistical technique that involves fitting data to a logistic curve, determines the chance of an event happening by evaluating the link between a number of independent variables and a categorical dependent variable. Among the several forms of regression models, the two most common types are LR with binary variables and multinomial logistic regression. When the independent variables are either continuous or categorical and the outcome variable is dichotomous, binary logistic regression is commonly employed. A multinomial logistic regression can be used when the dependent variable is not dichotomous and consists of more than two labels. Formally, in binary logistic regression, the explanatory variables can each be either a continuous variable or a binary variable. The one binary dependent variable is represented by an indicator variable with the two values labelled "0" and "1." In other words, the variable that is binary can be either continuous or binary. The labelling is necessary because the equivalent probability of the value designated "1" might range from 0 to 1. Based on the provided dataset of independent characteristics, the logistic regression model determines the likelihood that an event like voting or not, would take place. The logistic model has been the most generally used model for binary regression since about 1970. Binary variables are widely used in statistics to describe the likelihood of a given class or event taking place, such as the chance of a team winning, of a patient being healthy, etc. When there are more than two potential values, binary variables may be generalized to categorical variables, and binary logistic regression can be generalized to multinomial logistic regression. The ordinal LR can be used if the numerous categories are sorted. This type of logit model, which is a machine learning regression model, is widely used in predictive analytics and classification. Since the outcome represents the likelihood that an event will occur, the dependent feature's range is 0 to 1.As we discussed in earlier chapter in this study type of delivery considered as normal or caesarean, baby's weight considered as less than or equal to 2.5 kg or more than 2.5 kg and frequency of ANC visits less than or equal to 8 or more than 8 ANC visits coded as 0 and 1 respectively in each case. Since outcome variable of data set contains dichotomous response variable, we can use logistic regression model for prediction. Consider how the amount of different factors may be used to forecast the weight of a newborn infant as an example. The likelihood that a newborn weighs more increases as nutrient consumption increases. One way to conceptualise the connection is as an "S" curve. Since the logistic function, In addition to providing estimates in the range of 0 to 1 and an attractive S-shaped description of the combined influence of several risk variables on the chance for an occurrence, the logistic model, which serves as the basis for the LR model, is used by a significant number of individuals. The first area of difference is the type of the link that exists between the explanatory variables and the outcome. When dealing with any kind of regression problem, the most significant figure to consider is the average value of the variable of response, given the value of the input variable. This number, known as the conditional mean, is written as "$E(Y|X=x)$," where x represents a particular value of the independent variable and Y represents the outcome variable. "The expected value of Y, given the value x" is what is written in the quantity $E(Y|X=x)$. Assuming that this mean may be expressed as a linear equation in x, examples of such equations include: $E(Y|X=x) = \beta_0 + \beta_1 x$, in linear regression. This formula suggests that $E(Y|x)$ can take on any value as long as x is in the range of $(-\infty, +\infty)$.When the logistic distribution is utilized, conditional mean of the data of Y given x is represented by the number $\pi(x) = E(Y|X=x)$ to simplify notation. The particular version of the logistic regression model that we used is:

$$\pi(x) = \frac{e^{\beta_0+\beta_1 x}}{1+e^{\beta_0+\beta_1 x}} \quad \text{or} \quad Y = \frac{e^{\beta_0+\beta_1 x}}{1+e^{\beta_0+\beta_1 x}} + \epsilon$$

Where β_0 and β_1 are regression coefficients.

The logit transformation is a important transformation of $\pi(x)$ in our investigation of logistic regression. In terms of $\pi(x)$, this transformation is defined as follows:

$$h(x) = \log\left[\frac{\pi(x)}{1-\pi(x)}\right] = \beta_0 + \beta_1 x$$

Note that the parameters of h(x) are linear and it may be continuous over the range $-\infty$ to ∞. One of the most significant distinctions between the LR model and the linear regression model is the conditional probability distribution of the outcome variable. This distinction is a significant one. We suppose that an observation of the outcome variable in the linear regression model may be written as follows: $y = E(Y|x) + \varepsilon$. The error, shown by the number ε, indicates how far an observation deviates with respect to the conditional mean. Most people assume that ε has a normal distribution with zero mean and a constant variance throughout the independent variable's values. As a result, given x, the conditional distribution of the outcome variable has a normal mean ($E(Y|x)$) and constant variance. With a dichotomous result variable, this is not the case. In this case, we may write $y = \pi(x) + \varepsilon$ to represent the value of the outcome variable given x. In this case, there are two alternative values for the quantity ε. With probability $\pi(x)$, $\varepsilon = 1 - \pi(x)$ for $y = 1$, and with probability $1 - \pi(x)$ for $y = 0$. Consequently, the distribution of ε has a mean of zero and a variance of $\pi(x)[1 - \pi(x)]$. In other words, the probability of the conditional mean, $\pi(x)$, identifies the conditional distribution of the variable that represents the consequences, which is a binomial distribution.

6.5.1 Assumptions of Logistic Regression

Logistic regression does not need many of the basic assumption that are required by linear regression models that are based on the ordinary least squares method. These presumptions include the linearity of the dependent-independent connection, the normality of the error distribution, the uniformity of the errors, and the measurement level of the dependent variable. Because logistic regression performs a non-linear log transformation of the linear regression, it can handle non-linear correlations between the independent and dependent variables. Multivariate normality offers a more stable solution, although error components need not be normally distributed. For every level of the independent variables, there is a possibility of heteroscedastic variation in the errors. Both discrete and continuous data can be handled as independent variables in logistic regression. Independent observations are crucial for logistic regression, with minimal multicollinearity. Dependent variables should have a linear relationship with log probabilities, avoiding linear relationships between independent and dependent factors. Because maximum likelihood estimates are not as reliable as simple least squares, which are used to estimate the unknown parameters in a linear regression model, logistic regression necessitates high sample sizes.

Linearity of the Logit: The logistic regression model makes the assumption that the log-odds of the output variable (the logit), which is a mixture of the predictor variables, are linear. In other words, the correlation between the log-odds and the predictors should be linear. The model might not accurately represent the data if the connection is not linear.

Independence of Observations: The dataset's observations (or "data points") ought to be independent of one another. According to this presumption, the results of one observation shouldn't be affected by the results of another observation. When observations are associated in time series data or clustered data, violations of independence might happen.

No or Little Multicollinearity: The term "multicollinearity" refers to a situation in which, among the predictor variables, there is a high degree of correlation. Multicollinearity can make it challenging to separate the distinct effects of associated predictors on the response in logistic regression. It is crucial to check for multicollinearity and, if it is, think about using variable selection or transformation to remedy it.

Large Sample Size: For stable parameter estimates and precise inference, logistic regression presupposes a sizeable sample. Although there is no clear definition of what is meant by a "large" sample size, having too few observations might result in estimates that are erroneous and confidence intervals that are too broad.

Binary Dependent Variable: For dependent variables that are binary or dichotomous, logistic regression is the best option. Although multinomial logistic regression can be used to handle greater than two lables, the fundamental version of regression only considers outcomes that fall into one of two categories. For LR to work, the dependent variable must mostly be dichotomous and discrete. Furthermore, since logistic regression calculates the event's probability (P(Y=1)), the dependant variable must be coded appropriately. The intended result should be coded as 1, ensuring a proper fit for the model without excessively packed variables or under fitting.

Linearity of Independent Variables and Log Odds: Each predictor variable should have a roughly linear connection with the dependent variable's log chances. For the coefficients to be interpreted, this premise is crucial. Binary dependent variables, such as 0 or 1, yes or no, true or false, are modelled statistically using the technique of logistic regression. The logistic regression model has several assumptions, much as any statistical model. Results that are biased or unreliable can emerge from breaking these assumptions. The following assumptions define logistic regression.

Absence of Outliers: In logistic regression, outliers can significantly skew parameter estimates, producing inaccurate findings. It's critical to locate and deal with outliers in the dataset.

No Perfect Separation: When a set of predictor variables can accurately forecast an event, complete separation occurs, leading to an endless number of parameter estimations. In such circumstances, the model might not converge or the parameter estimations might be inaccurate.

Analysing these assumptions is crucial while undertaking logistic regression analysis. If breaches are found, the proper action should be taken to rectify them, which may involve pre-processing data, data transformation, or different modelling approaches. The selection of predictors should also be logically supported and guided by domain expertise.

6.5.2 Fitting of Logistic Regression Model

In order to fit a logistic regression model, for univariate or multivariate must be used to train the model to predict binary or categorical outcomes. One statistical technique used for categorization tasks is logistic regression. The general stages for fitting a model are as follows:

Suppose for the moment that There are n separate sample of the pair (xi, yi), where i may range from 1 to n, and xi is the value of the independent variable. A sample consisting of n separate observations is available to us for the i^{th} subject and yi represents value of a dichotomous outcome component in a given situation. Additionally, let's assume that the outcome variable has been assigned a code of 0 or

1, which corresponds to the characteristic's presence or absence. Throughout the book, this dichotomous outcome coding is employed. It is necessary to make an estimation of the values of the unknown parameters, namely β0 and β1, in order to successfully fit the logit -regression model in equation to a given set of data. Least squares principle is the most used approach in linear regression for estimating unknown parameters. Using that strategy, we select β0 and β1 values that minimise the deviations based on sum of squares between the observed values of Y and the model-predicted values. Within the standard assumptions of linear regression, the least squares approach produces estimators possessing several desirable statistical features. Sadly, the estimators lose these characteristics when the least squares approach is used on a model having a binary result.

When the error components in a linear regression model are normally distributed, maximum likelihood is the name given to the common estimation method that results in the least squares function. This technique serves as the basis for our method of estimate used throughout this article utilising the logistic regression model. In general, the maximum likelihood approach is used to produce values for the unknown parameters in such a way as to maximise the probability of receiving the data collection that has been observed. The greatest likelihood strategy is the name given to this method. To utilise this approach, we must first create a function known as the probability function. The chances that the data is what was expressed by this function as a function of the unknown factors. The values that maximise this function are the parameters' maximum likelihood estimators. As a consequence of this, the estimators that emerge are the ones that are in the closest agreement with the data that has been seen. We now describe how to find these values for the logistic regression model.

When the error components in a linear- regression model are normally distributed, the general estimating technique that yields the least squares function is known as maximum likelihood. This technique serves as the basis for our method of estimate used throughout this article utilising the LR model. Generally speaking, the maximum likelihood strategy generates values for the unknown parameters that maximise the probability of recovering the data collection that has been seen. To utilise this approach, we must first create a function known as the probability function. The values that maximise this function are the parameters' maximum likelihood estimators. The estimators that come out as a consequence are those that most closely match the data that has been seen. The process for determining these parameters for the logistic regression model is now explained.

It is provided the assumption that the observations are independent of one another, the probability function may be constructed by multiplying the terms that are provided in the equation in the following manner:

$$L(\beta_0, \beta_1) = \prod_{i=1}^{n} \left\{ \pi(x_i)^{y_i} (1-\pi(x_i))^{1-y_i} \right\}$$

The log likelihood can be written as

$$\text{Log } L(\beta_0, \beta_1) = \sum_{i=1}^{n} y_i \ln[\pi(x_i)] + (1-y_i)\ln[1-\pi(x_i)]$$

To find values of regression coefficient β_0 and β_1 that maximizes L (β_0, β_1), we differentiate log L (β_0, β_1) with respect to β_0 and β_1 and equate it zero. After finding regression coefficients we can compare it with p value for checking significance of corresponding regressors. We can evaluate logistic regression model by using following methods.

6.5.3 Evaluation of a Logistic Regression Model

The assessment of the logistic regression model consists of many components. It is necessary to evaluate the model as a whole first. Second, each independent variable's significance must be evaluated. Third, the model's discriminating power or forecast accuracy must be assessed. Eventually, validation of the model is required.

Overall Model Evaluation

The Likelihood Ratio Test (LRT)

A model's overall fit is an indication of the strength of the model as well as the link between the dependent variable and all of the input variables combined. By contrasting the two models' fits with and without the independent variables, it may be evaluated. If a LR approach with k regressors performs better than a model that does not include any independent variables, then the performance of the former model is deemed to be superior to that of the latter. LRT, which verifies the null hypothesis, may be used to assess how well the model with k coefficients fits the data overall.

$$H_0: \underline{\beta} = 0 \qquad \text{against} \qquad H_1: \underline{\beta} \neq 0$$

This is accomplished by comparing the deviation with the addition of the k independent variables (-2 log probability of the supplied model) to the deviation with only the intercept (-2 log likelihood of the null model). The likelihood that the observation would be obtained in the event that the regressor variables had no influence on the outcome is referred to as the null model's probability. The probability of getting the observations with all independent variables included in the model is known as the likelihood of the given model. A goodness of fit index G, or $\chi 2$ statistic with k degrees of freedom, is produced by dividing these two. This is a measure of how well each independent variable influences the dependent variable, or result. G = $\chi 2$ = (-2 log probability of the provided model) – (-2 log likelihood of the null model). Reject H0 with the finding that there is evidence that at least one of the independent variables contributes to the result prediction if the p-value for the overall model fit statistic is less than the level of significance 0.05.

6.6 Logistic Regression in Machine Learning

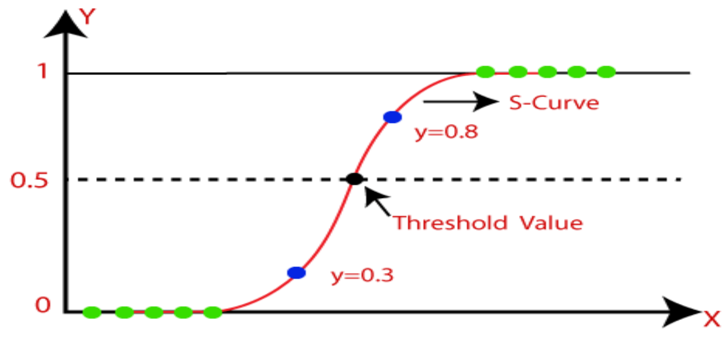
Among the many machine learning algorithms that fall under the area of supervised learning, logistic regression is among the most commonly used applications. For the purpose of making a prediction about the categorical dependent variable, it is used with a particular collection of independent components. It is possible to make a prediction about the outcome of a classification of the dependent variable by the use of LR. A discrete or category value is required to be the outcome as a consequence of this. It does not supply the exact values, which are 0 and 1, but rather it provides the probabilistic values, which are probabilities that lie somewhere between 0 and 1. Both Yes and No, 0 and 1, true and false, and so on are all possible responses. Logistic regression and linear regression are fairly similar to one another, with the exception being the manner in which they are applied. In order to solve issues with classification, logistic regression is used, whilst linear regression is utilised to handle problems with regression. Rather of fitting a regression line (0 or 1), logistic regression uses a "S"-shaped logistic function to predict two maximum values. This is in contrast to the traditional method of fitting a regression line. The curve that represents the logistic function illustrates the potential of a number of different things, such as whether or not the cells involved are cancerous, whether or not a mouse is overweight based on its weight, and so on.

The logistic regression method is a strong machine learning methodology that can create probabilities and categorise fresh data. It may be used to both continuous and discrete datasets. Different forms of data may be utilised to categorise observations using logistic regression, which also makes it simple to identify the factors that work well for the classification. The logistic function is seen in the picture below.

6.6.1 Logistic Function (Sigmoid Function)

Specifically for the goal of acquiring predicted values into probabilities, a mathematical formula known as the sigmoid function is utilised. This function takes any real integer between 0 and 1 and turns it into a different value. The outcome of the model must be between 0 and 1, and since it cannot be higher than this, it becomes a "S" curve. This is because the result cannot be bigger than 1. A different term for the S-form curve is the logistic function, often known as the sigmoid function. In logistic model, the concept of the threshold value is used. This value represents the probability of either 0 or 1, depending on the situation. For example, numbers above the threshold tend towards one, whereas those below the threshold tend towards zero.

Figure 6.1 Graph of Sigmoid Function



6.7 Type of Logistic Regression:

Based on the classifications of the categories, there are three distinct types of logistic regression that may be separated.

Binomial: There are just two possible kinds of dependent variables that may be used in a binomial logistic regression: either 0 or 1, Pass or Fail, etc.

Multinomial: Within the framework of multinomial logistic regression, the dependent variable, which may include "cat," "dogs," or "sheep," may be one or more of three possible sorts that are not ordered.

Ordinal: Ordinal logistic regression offers the possibility of having three or more ordered dependent variable categories, such as "low," "medium," or "high," among others.

6.8 Advantages of Logistic Regression

A logistic regression model is a statistical approach that is used for binary classification, which implies that it is suited for estimating the chance of an occurrence belonging to either of two classes. The following are some of the benefits of using logistic regression:

1. The implementation of logistic-regression is less complicated than other methods, and it does not call for any complicated calculations. Additionally, the findings are simple to comprehend, which is another reason why it is a well-liked option for binary classification issues.
2. Even when there are just a few observations, it can still carry out its functions well. The fact that it does not need a huge dataset to deliver solid findings makes it suited for situations in which there is a limited amount of data.
3. In comparison to other classification methods, it requires much less computer effort to perform efficiently. Because of this, it can be trained more quickly and is well suited for circumstances in which you have limited access to computing resources.
4. It is a statistical technique that may be used in decision-making processes since it offers probability for the events that are anticipated. The probabilities that have been forecasted may be threshold in order to produce binary forecasts that are tailored to the particular requirements of the application.
5. It is able to handle non-linear correlations between the characteristics and the log-odds of the outcome, despite the fact that the name "regression" may imply a linear relationship. Techniques such as polynomial characteristics are used in order to accomplish this goal.
6. The process of regularising it is simple and may be used to avoid over fitting. It is possible to use L1 (Lasso) and L2 (Ridge) regularisation approaches in order to penalise big factors while stopping them from dominating the model.

Although there are many benefits associated with logistic regression, it is essential to keep in mind that it also has certain drawbacks. In situations when the connection between the characteristics and the log-odds of the result is substantially non-linear, for instance, it may not perform as well as it could. Models that are more complicated, such as decision trees or neural networks could be taken into consideration in situations like these.

6.9 Logistic regression Model for Type of Delivery

As we discussed in earlier chapters thesis contain three main outcome variables namely type of delivery which is binary response variable coded as 0 and 1. For normal delivery coded as 0 and for caesarean delivery ceded as 1. For model we consider independent variables mother's age coded as 0 for the mother's whose age is less than 20 years and greater than 30 years and 1 for mothers whose age is between to 21 to 30 years, mother's education considered in three levels 0 for no education, 1 for education up to Senior secondary and 2 for education up to post graduate, living area defines as 0 = rural , 1 = urban, marriage period in month coded as 0 for less than or equal to 36 month and 1 coded as greater than 36 month. Husband's occupation set as 0 for unemployed and 1 for employed, number of earlier pregnancies is the continuous variable, type of earlier delivery coded as 0 for normal delivery and 1 for caesarean delivery, pregnancy period till the delivery coded as 0 for less than or equal to 38 weeks and 1 for greater than 38 weeks, new born baby's weight fix as 0 for less than 2.5 kg weight and greater than or equal to 2.5 kg set as 1, USE code as 0 for those women whose USE during pregnancy is less than or 3 and code as those women whose USE has greater than 3 , place for ANC coded as 0 for both public as well as private, 1 for public centres, 2 for private hospitals and 3 for no ANC whereas ANC Visit as per WHO guidelines we coded as 0 for less than 8 ANC visits and 1 for greater than or equal to 8 ANC visits. Our logistic model is constructing to predict the "Type of earlier delivery" based on various predictor variables. A sample size of 430 was chosen for fitting a logistic regression model; eighty percent of the data will be used for training, while the remaining twenty percent will be set aside for testing. The R software produced the output for a logistic regression model with a binary response variable. The model is implemented using the glmnet library in R.

```
> library(glmnet)
> data <- read.csv("C:/Users/Shree/Desktop/TODNew.csv",header=T)
> data
>  formula <- Y ~ .
> model <- glm(formula, data = train_data, family = binomial)
> model
Call:  glm(formula = formula, family = binomial, data = train_data)
Coefficients:
                (Intercept)                Mother's Age
```

-2.95332	0.24847
Mother’s education	Living area
-0.28278	0.57815
Marriage month	Husband’s Occupation
0.90244	-0.22249
No. of earlier pregnancies	Type of earlier delivery
0.87857	1.42783
Go for ANC	Mother’s Weight before delivery
-0.27077	0.49062
Pregnancy period till the delivery	New born baby’s Weight
-0.69450	0.49567
USE	Place for ANC
0.27294	-0.06299
ANC Visit	
-0.09942	

Degrees of Freedom: 343 Total (i.e. Null); 329 Residual

Null Deviance: 474.6

Residual Deviance: 416.8 AIC: 446.8

> summary(model)

Call:

glm(formula = formula, family = binomial, data = train_data)

Deviance Residuals:

Min	1Q	Median	3Q	Max
-2.2042	-1.0701	0.5204	1.0167	2.0917

Coefficients:

	Estimate	Std. Error	z value	Pr(>|z|)	
(Intercept)	-2.95332	0.99624	-2.964	0.00303	**
Mother’s .Age	0.24847	0.32911	0.755	0.45026	
Mother’s education	-0.28278	0.23522	-1.202	0.22930	
Living area	0.57815	0.29528	1.958	0.0500	*
Marriage month	0.90244	0.39205	2.302	0.02134	*
Husband’s Occupation	-0.22249	0.26765	-0.831	0.40582	
No. of earlier pregnancies	0.87857	0.29213	3.007	0.00263	**
Type of earlier delivery	1.42783	0.31006	4.605	4.13e-06	***

Go for ANC	-0.27077	0.55210	-0.490	0.62382
Mother's Weight before delivery	0.49062	0.42274	1.161	0.24582
Pregnancy period till the delivery	-0.69450	0.26951	-2.577	0.00997 **
New born baby's Weight	0.49567	0.27329	1.814	0.04972*
USE	0.27294	0.31584	0.864	0.38750
Place for ANC	-0.06299	0.17217	-0.366	0.71449
ANC Visit	-0.09942	0.26912	-0.369	0.71181

Null deviance: 474.60 on 343 degrees of freedom

Residual deviance: 416.78 on 329 degrees of freedom

AIC: 446.78

Number of Fisher Scoring iterations: 4

```
> predictions <- predict(model, newdata = test_data, type = "response")
> predictions
         1          3          6          9         12         15         17         18
0.62401389 0.53380506 0.64141591 0.58620919 0.91632583 0.48031447
0.57032037 0.59989295
        37         38         44         46         47         56         58         59
0.53881807 0.89308748 0.63182482 0.31795912 0.60219080 0.64409927
0.44433659 0.35240720
        60         62         65         68         70         71         75         79
0.47175766 0.47824825 0.39764799 0.33443010 0.69325526 0.74028023
0.79170170 0.36474540
        88         95         97         99        100        103        108        123
0.22526558 0.55724269 0.50622256 0.51882700 0.20076811 0.09875622
0.73363876 0.61977881
       124        131        132        138        139        140        142        144
0.23792391 0.62447687 0.70598845 0.25927236 0.31398276 0.52195515
0.50323148 0.05369781
       147        149        156        172        181        187        189        193
0.56261913 0.46439307 0.59046008 0.51239719 0.58154191 0.18810815
0.51882700 0.30114432
       202        207        219        222        228        231        233        239
0.29256760 0.17124819 0.31987947 0.42900875 0.50917692 0.34149604
0.67171847 0.35642304
```

241 247 248 260 265 270 274 292
0.56081311 0.65066921 0.79688509 0.47835881 0.68154853 0.46562030
0.39338521 0.53994823
296 300 304 311 320 322 325 333
0.42813029 0.64476883 0.50308947 0.30321880 0.86989756 0.41501193
0.80307377 0.63899660
349 356 357 362 363 367 382 385
0.81832458 0.66112334 0.80762224 0.57994310 0.74578924 0.53452727
0.39338521 0.15527617
396 403 414 419 422 430
0.54305216 0.53452727 0.87131579 0.76976295 0.49042214 0.44465831
> predicted_classes <- ifelse(predictions > 0.5, 1, 0)
> accuracy <- sum(predicted_classes == test_data$Y) / length(test_data$Y)
> print(paste("Accuracy:", accuracy))
[1] "Accuracy: 0.709302325581395"

6.9.1 To test the significance of regression:

We wish to test H_0: $\underline{\beta} = 0$ against H_1: $\underline{\beta} \neq 0$ at least on β

From the output, we observe that Null deviance = 474.6 and Residual deviance = 416.78

Therefore G = Null deviance - Residual deviance = 57.82, and table value is $\chi^2_{14,0.05}$ = 23.68479. Since value of g exceeds, we are rejecting null hypothesis at 5% level of significance. Hence it concludes that model is significant and it shows at least one variable is significant.

From the p value obtained if output we conclude that, it has been shown that there is a correlation between a one-unit increment in the mother's age and a 0.24847 increase in the log-odds of having a caesarean type of birth, but this effect is not statistically significant as the p-value (0.45026) is greater than 0.05. Living in urban area is connected with a 0.57815 increase in the log-odds of having a caesarean type of delivery. This effect is significant with a p-value of 0.05. Marriage periods exceeding three years among women are significantly important with a 0.90244 increase in the log-odds of having a caesarean type of delivery, as indicated by a statistically significant p-value of 0.05. The number of prior pregnancies was shown to have a substantial link with the risk of having a caesarean birth, according to the findings of a statistical analysis. As the number of pregnancies increases, the likelihood of having a caesarean section increases by 0.87857. This suggests a positive shift in the likelihood of having a caesarean delivery. The low p-value of 0.00263 suggests this relationship is highly unlikely to be random variation. Understanding this relationship is crucial in maternal healthcare, as it helps healthcare providers and expectant mothers make informed decisions about delivery. Further research could improve maternal care and childbirth practices.

The coefficient for "Type of earlier delivery" in the logistic regression analysis is of particular significance. It has a positive value of 1.42783, which is notably high. This coefficient pertains to the variable itself and represents the baseline effect, essentially capturing the inherent impact of this specific variable on the likelihood of experiencing a caesarean delivery. The fact that the coefficient is not only positive but also statistically significant (with a p-value of less than 0.001) emphasizes the substantial influence of the "Type of earlier delivery" variable on the probability of having a caesarean delivery. In other words, this variable is a strong predictor of the outcome, indicating that the previous delivery method has a profound effect on the likelihood of undergoing a caesarean section in subsequent pregnancies. Historical information about a woman's earlier delivery method can guide medical professionals and expectant mothers in making informed choices about delivery methods in subsequent pregnancies. Understanding the underlying factors contributing to this association can lead to improvements in maternal care and childbirth practices, benefiting both mothers and their infants' well-being.

The residual deviance and AIC values in the summary output are indicators of model fit. A lower AIC suggests a better fit, and the difference between the null and residual deviances can provide insights into how well the model explains the variance in the data.

6.9.2 Interpretation by using odds ratio for significant variables

A key idea in logistic regression is the odds ratio, which is used to measure the correlation between predictor factors and the likelihood that an event will occur. It is a measurement of how likely an event is to occur in one group as opposed to another group. When referring to logistic regression:

Log-odds: Logistic regression may be used to model the log-odds of the event probability, which is also known as the "logit." The predictor variables are combined linearly to create the log-odds. Odds: The odds are determined by taking the log-odds and exponentialing it. The definition of the odds (O) in mathematics is O = e^(log-odds), where "e" is the natural logarithm's base (about 2.71828). The odds ratio, or OR, is the ratio of one group's chances of an event occurring to those of another group. The odds ratio in logistic regression is used to evaluate how a one-unit change in a predictor variable affects the likelihood that the event will occur. The comparable probabilities of A happening in relation to B occurring for two occurrences, A and B, are

Odds ratio {A against B} = $\frac{odds\{A\}}{odds\{B\}}$

The odds ratio (OR) shows how likely an event (illness or disorder) is to occur given a certain exposure (healthy behaviour, medical history), as opposed to how likely it would occur to the extent that the exposure was not present. The coefficient of regression, denoted by the symbol $\beta 1$, is the predicted increase in the logged chances of the result for every unit increase in the value of the independent variable, when calculating a logistic regression. Put otherwise, the OR linked to a per-unit increase in the independent variable is the exponential function of the regression parameter ($e^{\beta 1}$). Another possible use of the OR is to evaluate the comparison of the relative significance of several risk variables for a given outcome and to ascertain if a given risk factors is exposure for that outcome. The odds ratio denoted by notation $\hat{\psi}$. OR=1 shows that exposure has no effect on the likelihood of a result. OR>1 denotes exposure linked to increased outcome probabilities. Exposure is linked to decreased odds of outcome when the OR is less than 1. For instance, the odds ratio for the variable smoking is and it is coded as 0 (=no smoking) and 1 (=smoking).Then, compared to non-smoking patients, the likelihood of a favourable outcome in smoking cases is 3.2 times greater.

From the above output we observe that estimates of regression coefficients are $\hat{\beta}_0$= -2.95332, $\hat{\beta}_1$= 0.24847, $\hat{\beta}_2$= -0.28278, $\hat{\beta}_3$= 0.57815, $\hat{\beta}_4$= 0.90244, $\hat{\beta}_5$= -0.22249, $\hat{\beta}_6$= 0.87857, $\hat{\beta}_7$= 1.42783, $\hat{\beta}_8$= -0.27077, $\hat{\beta}_9$= 0.49062, $\hat{\beta}_{10}$= -0.69450, $\hat{\beta}_{11}$= 0.49567, $\hat{\beta}_{12}$= 0.27294, $\hat{\beta}_{13}$= -0.06299, $\hat{\beta}_{14}$= -0.09942.

Logistic regression model with "type of delivery" as the response variable and "living area" as the predictor variable. The odds ratio for living area is $\hat{\psi} = e^{\hat{\beta}_3} =$ 1.7827 >1. It indicates that the odds of having a caesarean delivery for individuals living in an urban area are approximately 1.7827 times higher compared to individuals living in rural areas, holding all other factors constant. Additionally, since the odds ratio for "Living area" is greater than 1 and statistically significant, it indicates that the predictor variable "Living area" has a meaningful and positive influence on the risk of having a caesarean birth is much higher as compared to living in a rural region. This information can be important for healthcare decision-making and policy planning, especially in terms of understanding regional variations in childbirth practices.

The odds ratio for marriage month is $\hat{\psi} = e^{\hat{\beta}_4} = 2.465612 > 1$. "Marriage month" is the predictor variable the odds of having a caesarean delivery are approximately 2.465612 times higher for individuals who were married for more than 3 years compared to those who were married for less than or equal to 3 years. An odds ratio of 2.465612 indicates that, while holding all other factors constant, individuals with a marriage period greater than 3 years have significantly higher odds of experiencing a caesarean delivery compared to those with a shorter marriage period of 3 years or less. An odds ratio greater than 1 suggests that a longer marriage period is positive connection with an increased probability of undergoing a caesarean section labour and delivery, indicating that the timing and duration of marriage could influence the mode of childbirth. The statistical significance of the odds ratio would reinforce the notion that this variable has a meaningful and significant impact on the probability of having a caesarean delivery.

The odds ratio for number of earlier pregnancies is $\hat{\psi} = e^{\hat{\beta}_6} = 2.407455 > 1$. "Number of earlier pregnancies" is a continuous predictor variable (taking values 0, 1, and 2 in this data), the odds of having a caesarean delivery increase by a factor of approximately 2.4074 for each unit increase in earlier number of pregnancy by keeping all other factors held constant. The odds ratio of a pregnancy is a significant predictor of the type of delivery, particularly in favour of caesarean deliveries. A higher odds ratio indicates a positive relation between the number of earlier pregnancies and the likelihood of having a caesarean delivery. As the number of earlier pregnancies increases, the odds of having a caesarean delivery also increase. This relationship is crucial in maternal healthcare and childbirth practices, as healthcare providers should consider the impact of the number of earlier pregnancies when making decisions about delivery, especially when there is a history of multiple pregnancies. This information can aid in personalized and informed childbirth decisions.

The odds ratio for type of earlier pregnancies is $\hat{\psi}$ = $e^{\hat{\beta}_6}$ = 4.169641 > 1. "Type of earlier pregnancies" is a predictor variable, the odds of having a caesarean delivery are approximately 4.169641 times higher for individuals with a particular type of earlier pregnancies compared to those with a different type of earlier pregnancies. It is indicated by an odds ratio that is bigger than one that the specific type of earlier pregnancies has a positive association with an increased likelihood of having a caesarean delivery. In this case, the caesarean type of earlier pregnancies is a strong predictor of caesarean deliveries. The odds ratio being significantly greater than 1 (assuming it is statistically significant) suggests that the type of earlier pregnancies is a substantial and meaningful factor influencing the mode of delivery. It implies that certain characteristics or conditions related to the type of earlier pregnancies are with a greater likelihood of having a caesarean section. The odds ratio of 4.169641 means that individuals with the specific type of earlier pregnancies have approximately 4.16964 times higher odds of having a caesarean delivery compared to those with a normal delivery.

The odds ratio for pregnancy period till the delivery is $\hat{\psi}$ = $e^{\hat{\beta}_{10}}$ = 0.499324 < 1. In logistic regression model, where "Pregnancy period till the delivery" is the predictor variable (coded as 0 for less than or equal to 38 weeks and 1 for greater than 38 weeks), the odds of having a caesarean delivery are approximately 0.499324 times lower for individuals with a longer pregnancy period (greater than 38 weeks) compared to those with a shorter pregnancy period (less than or equal to 38 weeks). An odds ratio less than 1 implies that a longer pregnancy period (greater than 38 weeks) is associated with a reduced likelihood of having a caesarean delivery compared to a shorter pregnancy period (less than or equal to 38 weeks).The odds ratio being significantly less than 1 (assuming it is statistically significant) suggests that the length of the pregnancy period plays a significant role in determining the mode of delivery. The odds ratio of 0.499324 means that individuals with a longer pregnancy period have approximately half the odds of having a caesarean delivery compared to those with a shorter pregnancy period. . It indicates that a longer pregnancy period is associated with a decreased likelihood of caesarean delivery, which may have implications for decision-making during childbirth and maternal healthcare practices.

The odds ratio for new born baby's weight is $\hat{\psi} = e^{\hat{\beta}_{11}} = 1.641598$ >1."Newborn baby's weight" is the predictor variable (coded as 0 for newborns with a weight less than 2.5 kg and 1 for newborns with a weight greater than 2.5 kg), the odds of having a caesarean delivery are approximately 1.641598 times higher for newborns with a weight greater than 2.5 kg with comparison of weight less than 2.5 kg. An odds ratio greater than 1 implies that newborns with a weight greater than 2.5 kg are linked with a maximum likelihood of having a caesarean delivery in comparison to babies who weigh less than 2.5 kg on average. The odds ratio being significantly greater than 1 (assuming it is statistically significant) suggests that the weight of the newborn baby makes a big contribution in determining the mode of delivery.

The odds ratio of 1.641598 means that newborns with a weight greater than 2.5 kg have approximately 1.641598 times higher odds of having a caesarean delivery compared to those with a weight less than 2.5 kg. Understanding this relationship is important for healthcare providers, as it indicates that weight of the infant that has just been born can influence the choice of delivery method.

The accuracy of above model on the test data is approximately 70.93%, indicating how well the model is able to correctly classify the type of earlier delivery based on the given predictors. Overall, analysis suggests that certain predictor variables like living area, marriage month, number of earlier pregnancy, type of earlier delivery, pregnancy period till the delivery, new born baby's weight are statistically significant in influencing the type of earlier delivery, while others are not for this data set.

6.10 Logistic regression Model for New Born Baby's Weight

```
library(glmnet)
data <- read.csv("C:/Users/Shree/Desktop/Baby-copy.csv", header=T)
data
formula <- Y ~ .

model <- glm(formula, data = train_data, family = binomial)

model
```

Call: glm(formula = formula, family = binomial, data = train_data)

Coefficients:

(Intercept)	Living area
0.1068	0.9429
Gross monthly household income	Mothers working status
0.3267	15.2279
Mothers working type	Mother’s age at the marriage
-14.0472	0.5550
Are you aware about ANC	Have you go for ANC
-0.8513	1.3208
Media exposure	Mother’s weight before delivery
0.2161	0.5548
Pregnancy period till the delivery	ANC Code
-1.9452	-0.6574
Vegetable and Milk	New born baby’s sex
-0.6126	0.3526

Degrees of Freedom: 343 Total (i.e. Null); 330 Residual

Null Deviance:	389.1

Residual Deviance: 294.4	AIC: 322.4

predictions <- predict(model, newdata = test_data, type = "response")

predictions

1	3	6	9	12	15	17
0.8122142	0.4947321	0.1092496	0.3317311	0.5268531	0.4742995	0.5788834
18	37	38	44	46	47	56
0.4672488	0.8278582	0.6171959	0.5603348	0.2770936	0.8316605	0.9666176
58	59	60	62	65	68	70
0.8484459	0.7393126	0.4071059	0.8236296	0.8692026	0.7393529	0.6659260
71	75	79	88	95	97	99

0.9249906	0.9269211	0.2296360	0.6132503	0.1255686	0.8701517	0.9375600
100	103	108	123	124	131	132
0.6529993	0.5376666	0.8454547	0.9275591	0.9281951	0.6659260	0.7357926
138	139	140	142	144	147	149
0.7429502	0.7229136	0.9296676	0.8999980	1.0000000	0.7764087	0.7229136
156	172	181	187	189	193	202
0.6195327	0.7478600	0.7280660	0.9269211	0.8316605	0.7950247	0.9275591
207	219	222	228	231	233	239
0.1406088	0.9098829	0.5996285	0.7342956	0.8764922	0.8999980	0.7418547
241	247	248	260	265	270	274
0.9251491	0.7972363	0.9694608	0.9828375	1.0000000	0.9757581	0.7764087
292	296	300	304	311	320	322
0.6659260	0.9446221	0.8029097	0.8280073	0.8280073	0.7877712	0.7229136
325	333	349	356	357	362	363
0.9757581	0.5192921	0.9828375	0.8999980	0.6385859	0.9116298	0.7393126
367	382	385	396	403	414	419
0.2217653	0.8726008	0.6058234	0.9275591	0.9400400	0.9461928	0.9400400

422 430

0.9251491 0.7950247

predicted_classes <- ifelse(predictions > 0.5, 1, 0)

accuracy <- sum(predicted_classes == test_data$Y) / length(test_data$Y)

"Accuracy: 0.837209302325581"

print(paste("Accuracy:", accuracy))

summary(model)

Call:

glm(formula = formula, family = binomial, data = train_data)

Deviance Residuals:

Min	1Q	Median	3Q	Max
-2.8513	-0.2925	0.4346	0.6499	1.8581

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	0.1068	0.6233	0.171	0.86391
Living area	0.9429	0.3811	2.474	0.01335*
Gross Monthly household income	0.3267	0.3182	1.027	0.30461
Mothers working status	15.2279	882.7436	0.017	0.98624
Mother’s Working type	-14.0472	882.7436	-0.016	0.98730
Mother’s age at the marriage	0.5550	0.3059	1.814	0.06963
Are you aware about ANC	-0.8513	0.4809	-1.770	0.07671
Have you go for ANC	1.3208	0.6728	1.963	0.04961*
Media exposure	0.2161	0.4127	0.524	0.60054
Mother’s weight before delivery	0.5548	0.4566	1.215	0.22434
Pregnancy period till the delivery	-1.9452	0.3473	-5.601	2.13e-08***
ANC Code	-0.6574	0.5100	-1.289	0.19733
Vegetable and Milk	-0.6126	0.2355	-2.601	0.00929**
New born baby’s sex	0.3526	0.3012	1.171	0.24173

Null deviance: 389.07 on 343 degrees of freedom

Residual deviance: 294.40 on 330 degrees of freedom

AIC: 322.4

Number of Fisher Scoring iterations: 13

To Test The Significance of Regression:

We would want to conduct a test H_0: $\underline{\beta} = 0$ against H_1: $\underline{\beta} \neq 0$ at least on β

From the output, we observe that Null deviance = 389.07and Residual deviance = 294.40

Therefore G = Null deviance - Residual deviance = 94.67, and table value is $\chi^2_{13,0.05}$= 22.36203. Since value of g exceeds, Ho is failing to accept at 5% level of significance. Hence it concludes that model is significant and it shows at least one variable is significant.

From the above output we observe that estimates of regression coefficients are

$\hat{\beta}_0$= 0.1068, $\hat{\beta}_1$= 0.9429, $\hat{\beta}_2$= 0.3267, $\hat{\beta}_3$= 15.2279, $\hat{\beta}_4$= -14.0472, $\hat{\beta}_5$= 0.5550, $\hat{\beta}_6$ = -0.8513, $\hat{\beta}_7$= 1.3208, $\hat{\beta}_8$= 0.2161, $\hat{\beta}_9$= 0.5548, $\hat{\beta}_{10}$= -1.9452, $\hat{\beta}_{11}$= -0.6574, $\hat{\beta}_{12}$ = -0.6126 , $\hat{\beta}_{13}$= 0.3526.

The provided logistic regression output is for a model where the probability of a newborn baby's weight being greater than 2.5 kg (coded as 1) or minimum than 2.5 kg (coded as 0). The model aims to predict this probability based on various predictor variables. All of the predictor variables in the model have their predicted coefficients, which are shown below. They represent a shift in the log-odds that occurred for newborn baby having a weight greater than 2.5 kg for a one-unit change in the predictor variable, holding all other variables constant. The intercept term are the estimated log-odds of a newborn baby's weight being greater than 2.5 kg when all predictor variables are zero. In this case, it is not significantly different from zero (p-value > 0.05), indicating it may not be a significant predictor. There is a correlation between an increase of one unit in the living space variable and an estimated rise of 0.9429 in the log-odds of a newborn baby's weight being larger than 2.5 kg with this connection. This effect is statistically significant (p-value < 0.05), suggesting that living area is a significant predictor. Babies in a certain living area are more likely to have higher birth weights. This variable does not appear to be a significant predictor, as the coefficient is not significantly different from zero (p-value > 0.05). These variables also do not appear to be significant predictors, as their coefficients have very high standard errors, making them statistically insignificant. An estimated 0.5550 percent increase in the log-odds of the newborn baby's weight being larger than 2.5 kg is connected with a one-unit increase in the age of the mother at the day of the wedding. This is the case when the mother's age is increased by one unit. However, it is marginally significant (p-value = 0.06963). Changes in log-odds are connected with these factors, and the latter it is associated with a p-value less than 0.05 being the threshold for significance. Mothers who have gone for ANC have higher odds of having babies with a weight greater than 2.5 kg. Media exposure, Mother's weight before delivery, ANC Code, and newborn baby's sex, none of these variables appear to be significant predictors, as their coefficients there is not a difference between them and zero (p-value > 0.05).

6.9.2 Odds Ratio for Significant Variable and Its Interpretation

The odds ratio for living area is $\hat{\psi} = e^{\hat{\beta}_6} =$ 2.5674>1. The odds ratio for "Living area" in the LR model with "Weight of newborn baby" as the dependent variable (coded as 0 for < 2.5 kg weight and 1 for >2.5 kg weight) and "Living area" as the predictor variable (coded as 0 for rural area and 1 for urban area) is approximately 2.5674, which is significantly greater than 1. The odds ratio greater than 1 indicates a positive effect of living in an urban area on newborn baby weight in this context. An odds ratio greater than 1 indicates a positive association between living in an urban area and the likelihood of having a newborn baby with a weight greater than 2.5 kg when compared to living in a rural area. If "Living area" is associated with an odds ratio of approximately 2.5674, it suggests that mothers living in urban areas have a higher likelihood (approximately 2.57 times higher) of having a newborn baby with a weight greater than 2.5 kg compared to mothers living in rural areas. This implies that the area of residence (urban or rural) has an impact on newborn baby weight, with urban living associated with a higher likelihood of having babies with a weight greater than 2.5 kg.

Logistic regression model with "Weight of new born baby" as the dependent variable and "attending ANC visits coded as 0 for no ANC visits and 1 for attending ANC visits" as the predictor variable. The odds ratio for living area is $\hat{\psi} = e^{\hat{\beta}_6} =$ 3.746417 >1. The odds ratio for "Attending ANC visits" in the logistic regression model with "Weight of newborn baby" as the dependent variable (coded as 0 for <2.5 kg weight and 1 for >2.5 kg weight) and "Attending ANC visits" as the predictor variable (coded as 0 for no ANC visits and 1 for attending ANC visits) is 3.746417, which is greater than 1. An odds ratio greater than 1 indicates that there is a positive association between attending ANC visits and the likelihood of having a newborn baby with a weight greater than 2.5 kg when compared to a baby with a weight less than 2.5 kg. If "Attending ANC visits" is associated with an odds ratio of 3.746417, it suggests that mothers who attend ANC visits have 3.746417 times higher odds of having a newborn baby with a weight greater than 2.5 kg. It is in contrast to women who do not go to their ANC appointments this implies that attending ANC visits is a significant predictor of newborn baby weight, and mothers who attend these visits are more likely to have babies with a weight greater than 2.5 kg. The odds ratio greater than 1 indicates a positive effect, and the result is statistically significant. It emphasizes the importance of ANC visits in promoting the health of newborn babies.

The odds ratio for "Pregnancy period till the delivery" in the logit regression model with "Weight of newborn baby" as the dependent variable (coded as 0 for <2.5 kg weight and 1 for >2.5 kg weight) and "Pregnancy period till the delivery" as the predictor variable (coded as 0 for greater than 36 weeks pregnancy period and 1 for less than or equal to 36 weeks pregnancy period) is approximately 0.142958629, which is less than 1. An odds ratio less than 1 indicates an inverse or negative association between the pregnancy period of less than or equal to 36 weeks and the likelihood of having a newborn baby with a weight greater than 2.5 kg when compared to a pregnancy period greater than 36 weeks. If "Pregnancy period till the delivery" is associated with an odds ratio of approximately 0.142958629, it suggests that mothers with a pregnancy period less than or equal to 36 weeks have a lower likelihood (approximately 0.14 times lower) of having a newborn baby with a weight greater than 2.5 kg compared to mothers with a pregnancy period greater than 36 weeks. This implies that a shorter pregnancy period (less than or equal to 36 weeks) is decrease likelihood of having newborn babies with a weight greater than 2.5 kg. The odds ratio less than 1 indicates a negative effect of a shorter pregnancy period on newborn baby weight in this context.

The "predictions" refer to the model's estimated likelihood of producing a baby that weighs more than 2.5 kg based on the test data. These probabilities are categorized using a threshold of 0.5 to create the "predicted classes". An illustration of how well the model performs on the test data is shown as "Accuracy: 0.8372," meaning that in about 83.72% of the cases, the outcome was accurately predicted by the model. The LR model evaluates the connection that exists between several characteristics and the likelihood of having a baby who weighs more than 2.5 kg. The results seem to be significantly influenced by a few characteristics, including living in an urban region, having a working mother, being married at a young age, and receiving ANC visits. The impact of other elements, such media exposure, is less noticeable.

6.11 Logistic regression Model ANC Visits

```
library(glmnet)
> data <- read.csv("C:/Users/Shree/Desktop/ANCModelFinal8NCHI.csv",header=T)
> data
>  formula <- Y ~ .
> model <- glm(formula, data = train_data, family = binomial)
> model
Call:  glm(formula = formula, family = binomial, data = train_data)
Coefficients:
                     (Intercept)                      Mother's education
                        -4.04934                                 1.75087
    Gross Monthly household income                  Husband's Occupation
                         0.62349                                 0.04900
  Distance from home to ANC centre    Days antenatal iron supplement taken
                         0.02458                                 2.23300
Knowledge on danger signs of pregnancy                 Mothers Occupation
                        -0.18925                                 0.32071
                       Aware ANC                  aware of 108 services
                         0.19741                                -0.04888
                  aware102.service
                         1.07149
Degrees of Freedom: 343 Total (i.e. Null);  333 Residual
Null Deviance:              456.2
Residual Deviance: 330.9       AIC: 352.9
> predictions <- predict(model, newdata = test_data, type = "response")
> predictions
         1          3          6          9         12         15         17         18
0.18579588 0.89078357 0.27785435 0.81385910 0.09833367 0.07848300 0.37264233 0.32988120
        37         38         44         46         47         56         58         59
0.45483770 0.87548515 0.59959785 0.51652356 0.29454723 0.19731883 0.51649390 0.61130120
```

```
       60         62         65         68         70         71         75         79 
0.11898819 0.51652356 0.52871707 0.82116767 0.82116767 0.11643585 
0.59959785 0.14733731 
       88         95         97         99        100        103        108        123 
0.14426180 0.01529195 0.14426180 0.20707455 0.56550395 0.51652356 
0.74576527 0.67505510 
      124        131        132        138        139        140        142        144 
0.24374214 0.61127298 0.24374214 0.23045840 0.89773816 0.23484583 
0.18214793 0.18581385 
      147        149        156        172        181        187        189        193 
0.62860529 0.24376403 0.61127298 0.34631669 0.82116767 0.59959785 
0.56550395 0.73638753 
      202        207        219        222        228        231        233        239 
0.62651796 0.81385910 0.73638753 0.75041901 0.89078357 0.23924047 
0.18581385 0.01856739 
      241        247        248        260        265        270        274        292 
0.23045840 0.23926209 0.21273280 0.46649254 0.25380287 0.85545662 
0.31914199 0.15041632 
      296        300        304        311        320        322        325        333 
0.29791254 0.73638753 0.24376403 0.23924047 0.05299899 0.23926209 
0.38818562 0.14733731 
      349        356        357        362        363        367        382        385 
0.17851531 0.03902516 0.23045840 0.19718363 0.02843716 0.14733731 
0.74576527 0.12779533 
      396        403        414        419        422        430 
0.04090001 0.19718363 0.47870395 0.03902516 0.23484583 0.04530467 
> predicted_classes <- ifelse(predictions > 0.5, 1, 0)
> accuracy <- sum(predicted_classes == test_data$Y) / length(test_data$Y)
> print(paste("Accuracy:", accuracy))
[1] "Accuracy: 0.790697674418605"
> summary(model)
Call:
glm(formula = formula, family = binomial, data = train_data)
Deviance Residuals:
```

Min	1Q	Median	3Q	Max
-2.1045	-0.7258	-0.4531	0.7680	2.1848

Coefficients:

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-4.04934	1.03692	-3.905 9	42e-05 ***
Mother's education	1.75087	0.82458	2.123	0.033724 *
Gross Monthly household income	0.62349	0.31776	1.962	0.049749 *
Husband's Occupation	0.04900	0.30179	0.162	0.871030
Distance from home to ANC centre	0.02458	0.32128	0.076	0.939025
Days antenatal iron supplement taken	2.23300	0.29049	7.687	1.51e-14 ***
Knowledge on danger signs of pregnancy	-0.18925	0.38449	-0.492	0.622560
Mothers Occupation	0.32071	0.32395	0.990	0.322161
Aware about ANC	0.19741	0.43970	0.449	0.653454
Aware of 108 service	-0.04888	0.29862	-0.164	0.869989
Aware about 102 service	1.07149	0.31025	3.454	0.000553 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 456.16 on 343 degrees of freedom

Residual deviance: 330.94 on 333 degrees of freedom

AIC: 352.94

Number of Fisher Scoring iterations: 5

To Test The Significance of Regression:

We wish to test H_0: $\underline{\beta} = 0$ against H_1: $\underline{\beta} \neq 0$ at least on β

From the output, we observe that Null deviance = 456.16 and Residual deviance = 330.94

Therefore G = Null deviance - Residual deviance = 125.22, and table value is $\chi^2_{10,0.05}$ =18.30704. Since value of g exceeds, null hypothesis is rejected at 5% level of significance. Hence it concludes that model is significant and it shows at least one variable is significant.

From the above output we observe that estimates of regression coefficients are $\hat{\beta}_0$= -4.04934, $\hat{\beta}_1$= 1.75087, $\hat{\beta}_2$= 0.62349, $\hat{\beta}_3$= 0.04900, $\hat{\beta}_4$= 0.02458, $\hat{\beta}_5$= 2.23300, $\hat{\beta}_6$= -0.1892, $\hat{\beta}_7$= 0.32071, $\hat{\beta}_8$= 0.19741, $\hat{\beta}_9$= -0.04888, $\hat{\beta}_{10}$ = 1.07149.

In logistic regression model, the predicted variable is "ANC visits," that is coded as 0 for less than 8 ANC visits and 1 for greater than 8 ANC visits. We have several predictor variables to predict the likelihood of having more than 8 ANC visits. Here's an interpretation of the output. The intercept represents the log-odds of the outcome (more than 8 ANC visits) when all predictor variables are zero. In this case, the coefficient is -4.04934. This means that the log-odds for having more than eight trips to the ANC rise by 1.75087 for every unit that is added to the "Mother's education" variable. The p-value for this variable is 0.033724, which indicates that it is highly significant. A unit increase in household income leads to a 0.62349 increase in the log-odds of having more than 8 ANC visits. It has a probability value of 0.049749. This indicates that it is of statistical significance. The coefficient for this variable is 0.04900, but it is not statistically significant (p-value is high at 0.871030). The variable has a coefficient of 0.02458, and it's not statistically significant (p-value is high at 0.939025). For each unit increase in the number of days antenatal iron supplement is taken, the log-odds of having more than 8 ANC visits increase by 2.23300. This variable is highly statistically significant (p-value is very close to zero). This variable has a coefficient of -0.18925, which indicates that a lower log-odds of having more than eight ANC visits is connected with those who have a greater level of awareness about the warning indications of pregnancy. However, it is not statistically significant (p-value is 0.622560. This variable has a log-odds of more than eight ANC visits that increases by 0.32071 for every unit that is increased in this variable. It's not statistically significant (p-value is 0.322161). Being aware of ANC is associated with an increase of 0.19741 in the log-odds of more than 8 ANC visits. It's not statistically significant (p-value is 0.653454). This variable's coefficient is -0.04888, indicating that awareness of the 108 service is associated with a lower log-odds of more than 8 ANC visits. It's not statistically significant (p-value is 0.869989). Being aware of the 102 service increases the log-odds of more than 8 ANC visits by 1.07149. This variable is also with lower p-value of 0.000553. Based on the coefficients and their significance levels, several variables appear to have a statistically good impact on the likelihood of having more than 8 ANC visits. For example, "Mother's education," "Gross Monthly household income," and "Number of days antenatal iron supplement taken" are significant predictors. Acquiring knowledge of the early warning symptoms of pregnancy, husband's occupation, distance from home to the ANC center, and awareness of certain services (108service) do not appear to significantly influence the outcome.

6.11.1 Odds Ratio for Significant Variable and Its Interpretation

The odds ratio for mother's education is $\hat{\psi} = e^{\hat{\beta}_1} = 5.7596 > 1$. In the logistic regression model we provided, the dependent variable is "ANC Visits," which is coded as 0 for less than 8 ANC visits and 1 for greater than 8 ANC visits. The predictor variable is "Mother's education," which is coded as 0 for no education and 1 for educated. The odds ratio for "Mother's education" is approximately 5.7596, and it is greater than 1. An odds ratio of 5.7596 suggests that mothers with an education (coded as 1) have approximately 5.76 times higher odds of having greater than 8 ANC visits compared to mothers with no education (coded as 0). The odds ratio is more than one, which indicates that having a higher level of education is connected with a considerably increased risk of having more than eight visits to the antenatal care centre. What this shows is that education may be a major predictor of attendance at ANC, and that moms who have had a higher level of education are more probable to have a greater number of trips to ANC.

The odds ratio for gross monthly household income is $\hat{\psi} = e^{\hat{\beta}_1} = 1.865427 > 1$. The predictor variable is "Gross Monthly household income," which is coded as 0 for less than 10 thousand and 1 for greater than 10 thousand. The odds ratio for "Gross Monthly household income" is approximately 1.865427, and it is greater than 1. An odds ratio of 1.865427 suggests that individuals with a monthly household income greater than 10 thousand (coded as 1) have approximately 1.87 times higher odds of having greater than 8 ANC visits compared to individuals with a monthly household income less than 10 thousand (coded as 0). In other words, having a higher monthly household income (greater than 10 thousand) is associated with a significantly increased likelihood of having more than 8 ANC visits, as indicated by the OR greater than 1. This indicates that a higher income may be a predictor of increased attendance at the ANC, and those with higher earnings are more probable to have a larger number of trips to the ANC.

The predictor variable is "Days antenatal iron supplement taken," which is coded as 0 for less than 6 months and 1 for greater than 6 months. The odds ratio for "Days antenatal iron supplement taken" is approximately 9.3278, and it is greater than 1. An odds ratio of 9.3278 suggests that individuals who took antenatal iron supplements for more than 6 months (coded as 1) have approximately 9.33 times higher odds of having greater than 8 ANC visits compared to individuals who took iron supplements for less than 6 months (coded as 0). In other words, taking antenatal iron supplements for a longer duration (greater than 6 months) is strongly associated with a significantly increased likelihood of having more than 8 ANC visits, as indicated by the odds ratio greater than 1. This implies that individuals who adhere to a longer regimen of iron supplements during pregnancy are more likely to have a higher number of ANC visits.

In the logistic regression model we provided, the dependent variable is "ANC Visits," which is coded as 0 for less than 8 ANC visits and 1 for greater than 8 ANC visits. The predictor variable is "Aware about 102 service," which is coded as 0 for not aware of the 102 service and 1 for aware of the 102 service. The odds ratio for "Aware about 102 service" is approximately 2.919727, and it is greater than 1. An odds ratio of 2.919727 suggests that individuals who are aware of the 102 service (coded as 1) have approximately 2.92 times higher odds of having greater than 8 ANC visits compared to individuals who are not aware of the 102 service (coded as 0).In other words, being aware of the 102 service is associated with a significantly increased likelihood of having more than 8 ANC visits, as indicated by the odds ratio greater than 1. This implies that awareness of the 102 service is associated with better adherence to ANC visits during pregnancy.

Evaluation of the model's performance is a vital step to take once it has been fitted. The accuracy of the logistic model, when tested on the validation dataset, is approximately 79.07%. Furthermore, it may be inferred from this that the model is capable of making accurate predictions if the number of trips to the ANC is larger than eight in about 79.07% of instances.

6.12 Decision Tree Classification Algorithm

Among the most effective supervised learning techniques for classification and regression applications is the decision tree. It does this by generating a tree structure that is analogous to a flowchart, with each internal node representing a test on an attribute, each branch indicating a test result, and each leaf node (terminal node) containing a class name. In other words, it is a tree structure. When a stopping condition is fulfilled, the training data is recursively divided into subsets based on the values of the attributes. Other examples of stopping criterion include the greatest depth of the tree or the smallest amount of samples required for splitting a node.

Although decision trees are a supervised learning approach, we are mostly employed to solve classification issues. On the other hand, we may also be used to tackle issues involving regression. The structure of this classification system is arranged in the shape of a tree, with the core nodes reflecting the characteristics of the dataset, the branches representing the decision rules, and the leaf nodes indicating each conclusion. The Decision Tree approach makes use of a assesses the degree of unpredictability or impurity, such as entropy or Gini impurity, are examples of metrics that may be used in the subsets, in order to identify which feature is the most suitable for dividing the data while the training is being done. The goal is to determine the feature that maximises either the increase in information or the reduction in impurity that occurs as a result of the split. A decision tree is a form of tree structure that is similar to a flowchart. The core nodes of a decision tree contain characteristics, the branches of the tree indicate rules, and the leaf nodes provide the conclusion of the algorithm. The method is a versatile approach to supervised machine learning that may be is used for situations involving regression as well as classification. Furthermore, it is one of the most powerful algorithms. Also, Random Forest makes use of it to train on a variety of different subsets of training data, which is another reason why within the realm of machine learning algorithms, it is widely regarded as one of the most powerful algorithm.

6.12.1 Decision Tree Terminologies

Root Node: At the root node, the decision tree is said to have begun. After that, it presents the whole dataset, which is then divided into two or more groups of data that are comparable to one another.

Leaf Node: After obtaining a leaf node, the tree cannot be further divided; leaf nodes are the ultimate output nodes.

Splitting: The term "splitting" refers to sub-nodes are created by the process of separating the decision node, also known as the root node in line with the parameters that have been provided.

Branch: A tree created by slicing another tree into a branch or sub-tree.

Pruning: Removing undesirable limbs from a tree is the process of pruning.

Parent / Child Node: The root node of the tree is referred to as the parent node, while the other nodes are referred to as the child nodes.

Confusion Matrix

A table that makes it possible to see a machine learning model's performance is called a confusion matrix. It is particularly useful in classification jobs, in which the model's goal is to divide the data into several groups or classifications. An overview of the model's predictions in comparison to the real ground truth is given by the matrix itself.

Components:

True Positives (TP): Specific examples in which the model predicts a certain class, and the actual data also belongs to that class.

True Negatives (TN): Instances in which the model was correctly predicts the absence of a certain class.

False Positives (FP): Situations in which the model shows a class when it's not actually present.

False Negatives (FN): Instances where the model fails to predict a class that is actually present.

Application

One important method for assessing a classification model's performance is the confusion matrix. It aids in figuring out where the model may be falling short and where it is producing accurate predictions. This realisation is crucial for modifying the model, improving its characteristics, or comprehending how the model behaves in various situations. It is extensively used in many industries, including marketing, finance, healthcare, and consumer segmentation. It provides a clear picture of the model's accuracy and mistakes in predicting distinct classes within a dataset.

Advantages of decision tree algorithm

One of the most common types of machine learning algorithms, For the purpose of categorization, decision trees is implemented. The decision tree algorithm has a number of benefits, including the following:

Decision trees are simple to comprehend and interpret because of their visual orientation. The structure of the tree is easy to understand and can be simply described to stakeholders that are not technically oriented. Decision trees are not affected by the magnitude of the characteristics that are supplied as input. This indicates that scaling the features prior to training a decision tree model is not required in any way. There is no need for one-hot encoding when using decision trees since they are able to process both category and numerical input. Because of this, they are adaptable to a broad variety of files and databases. Within the context of decision trees, implicit feature selection is accomplished by picking the characteristics that are the most informative at each split. In a natural process, the tree will organically prune away features that are less pertinent to the job at hand. Modelling non-linear interactions between characteristics and the goal variable is possible with the help of decision trees. They are able to grasp the limits of complicated decisions.

Despite the existence of extreme values within the data, decision trees remain very resilient. When compared to the performance of other algorithms, the influence of outliers on the model's performance is much lower. Data preparation is not required to a significant degree when using decision trees. They are able to address the issue of missing values and need neither the normalisation nor the standardisation of the input characteristics themselves. In terms of the quantity of data points, complexity is essential. Transparency is maintained throughout the decision-making process of a decision tree. This makes it much simpler to comprehend the reasoning behind a particular prediction that was made by the model since each choice that it makes is based on a distinct set of rules.

Despite the fact that decision trees provide a number of benefits, it is essential to keep in mind that they also have certain drawbacks. These drawbacks include the fact that they are prone to over fitting that they are unstable when there are just little changes in the data, and that they have the potential to produce trees that are excessively complicated. Frequently, these constraints may be alleviated by the use of methods like as pruning and the utilisation of ensemble.

Accuracy of Model

Models employed in machine learning are noted for their accuracy when it comes to the validation process needed to assess categorization challenges. Its appeal stems mostly from the accuracy's relative simplicity. We can understand the accuracy very easily, and it is simple to implement. It is simple to assess the effectiveness of the model using accuracy.

When a model is considered accurate, it is measured by the proportion of correct predictions it generates throughout the whole dataset. It's a helpful indicator to assess a model's overall performance, particularly in datasets that are balanced and have around equal numbers of cases in each class. However, in datasets that are imbalanced—that is, where one class is significantly larger in comparison to the other—accuracy may not always be the ideal statistic. For example, a model that consistently predicts the majority class might still obtain a high accuracy but may not be useful in a situation when one class is rare.

However, when the distribution of the issues to a particular class is unbalanced, the overall accuracy of the machine learning classification models might be deceiving since it becomes extremely challenging to accurately anticipate the model's class at that point. In this case, the class with the highest incidence will be accurately predicted, earning a high accuracy score, whereas the class with the lowest occurrence will be incorrectly labelled. This kind of scenario in the model increases the likelihood that the anticipated accuracy will be inaccurate, and we are unable to accurately estimate the model's performance.

For instance, we are unable to overlook any cases of dangerous diseases in any health issue prediction model due to modifications made to patient data. In the event that any files are altered as a result of problems, the predictor will immediately forecast the state using the files or classes. Due to these modifications or incorrect class classifications, an individual with even a minor health concern must receive serious medical attention.

6.12.2. What is the Process of the Decision Tree Algorithm?

The method in a decision tree starts at the root node in order to make a prediction about the category of the dataset that is providing the information. Following the branch, by comparing the values of the root property with the record, this procedure goes on to the next node in the tree (real dataset). This allows the algorithm to take the next step. After that, the procedure moves on to the subsequent node and does another comparison of the attribute value of that node with the values of the other sub-nodes. Up to the point when it reaches the plant's leaf node, it continues to behave in this manner. The method that is shown below will assist in gaining a better understanding of the whole process:

Step 1: According to the recommendation made, the root node, which is the node that holds the whole dataset, ought to be the beginning point for the tree.

Step 2: To decide which of the attributes in the dataset is the most important, you may make use of the Attribute Selection Measure (ASM).

Step 3: Create subgroups inside the S that include possible values for the traits that are considered to be the most important.

Step 4: Construct the node of the decision tree that has the most appropriate attribute at its centre.

Step 5: Using the dataset subsets generated in step 3, recursively develop new decision trees. This process should be repeated until the nodes can no longer be categorised in any further manner; at this point, the node that is considered to be the last node can be described as a leaf node. The first problem that emerges while creating a decision tree is figuring out which attribute is ideal for the root node and its child nodes. A approach ASM for short, has been created in order to be able to handle these challenges. We can quickly choose the ideal attribute for the tree's nodes using this measurement. Two widely used ASM approaches are the Gini Index and Information Gain.

Gini Index: When building a decision tree using the CART (Classification and Regression Tree) technique, the Gini index is a measure of purity or impurity. It is better to choose a characteristic with a low Gini index than one with a high index. The CART algorithm only produces binary splits, and it does so by utilising the Gini index.

6.12.3 Information Gain

Information gain is the evaluation of changes in entropy that occur after a dataset is segmented according to a feature. This evaluation is carried out after the split of the dataset. It determines the amount of knowledge a feature gives us about a class. On the basis of the information gain value, we design the decision tree and partition the node into its constituent parts. In a decision tree method, which continually strives to maximise the value of knowledge gained, the node or attribute that has the greatest information gain is used as the starting point for the splitting process.

Entropy: Entropy is a metric that calculates the degree of impurity present in a certain property. The unpredictability of the data is specified by it. One way to compute entropy is as follows:

Entropy (s) = -P(yes = 1) log2 P(yes = 1) - P(no = 0) log2 P(no = 0)

6.13 Decision Tree Model for Type of Delivery

```
data<- read.csv("D:/Ph.D New/Logistic Models/Final Logistic Model in Thesis/TODNew.csv",header=T)
>formula<- Y ~ .
>model<- rpart(formula, data = train_data, method = "class")
>summary(model)
Call:
```

```
rpart(formula = formula, data = train_data, method = "class")
  n= 344
        CP nsplitrel error    xerrorxstd
1 0.28481013      0 1.0000000 1.0000000 0.05849904
2 0.08544304      1 0.7151899 0.7151899 0.05513265
3 0.02531646      3 0.5443038 0.5886076 0.05213652
4 0.01898734      5 0.4936709 0.5696203 0.05159431
5 0.01000000      6 0.4746835 0.4936709 0.04915320
```

6.13.1Variable Importance

Type of earlier delivery	No. Of earlier pregnancies	Marriage month
43	21	15
New born baby's Weight	Living area	Place for ANC
6	5	3
ANC Visit	Mother's education	USE
3	2	1
Husband's Occupation		
1		

6.13.2 Interpretation

These scores indicate how important each variable is in making predictions with the model. In a decision tree model, variable importance can be measured using different methods, but it typically quantifies how much a variable contributes to the efficacy of the whole of the model. It's important to note that these scores are relative to the model's performance, and variables with higher scores are more influential in making predictions, while those with lower scores have less influence. The importance values are often scaled to add up to 100 or 1, depending on the method used.

Type of earlier delivery this variable is the most important in model. It has an importance score of 43, indicating that it strongly influences the model's ability to differentiate between normal and caesarean deliveries. A higher score means it makes a big contribution to the predicting the response variable. Additionally, the number of pregnancies that occurred in the past is the second most significant element, with a score of 21 when it comes to relevance. It has a substantial impact on predicting the type of delivery. The month of the wedding is the third most essential characteristic, with a score of 15 for its respective relevance. It indicates that the month of marriage is a moderately important factor in predicting the type of delivery.Newborn baby's Weight this is variable which has an importance score of 6, suggesting that it contributes to the model's predictive power but to a lesser extent than the top three variables. The predictor variables " New born baby's weight", " living area", " place of ANC", " ANC visit", " mother's education", "use" and " Husband's occupation" have moderate importance with respect to prediction of the type of delivery.

Evaluating the performance of the model is the objective, which comes after the identification of major aspects related with the method of delivery. The following is a list of some of the factors that might be considered while evaluating the performance of a model:

To measure the model performance the confusion matrix was evaluated as follows:

```
> p=predict(model, newdata = test_data, type="class")
> cm=table(test_data$Y,p)
> cm
    p
    0  1
 0 35  7
 1 14 30
>accuracy=sum(diag(cm))/length(test_data$Y)
>accuracy
[1] 0.755814
>sensitivity=13/(13+8)
>sensitivity
[1] 0.6190476
```

Interpretation

Confusion Matrix

The performance of the model may be evaluated with the assistance of this matrix. In the context of predicting different kinds of deliveries, the model seems to have predicted Caesarean births with more accuracy than Normal deliveries. This is due to the fact that Normal deliveries have a greater number of erroneous predictions (both false positives and false negatives) than Caesarean deliveries do.

True Positives (TP): The following are the cases in which the model predicted a caesarean section (1), whereas the actual procedure was a caesarean section. In this particular instance, it is thirty.

True Negatives (TN): The model predicted Normal (0) and it was actually Normal. There are 35 instances in this category.

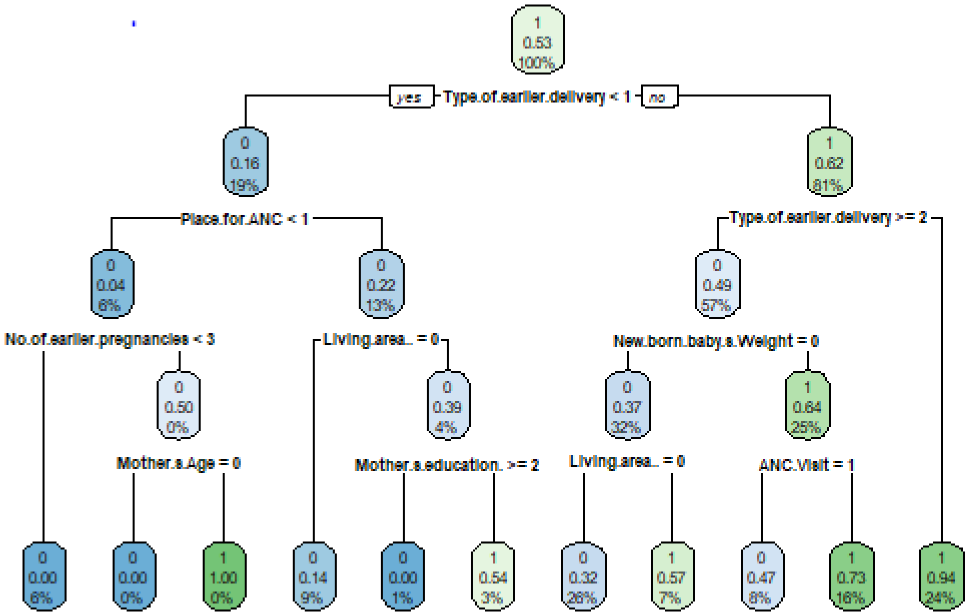
False Positives (FP): These are the instances where the model predicted caesarean (1) but the actual type was Normal (0). There were 7 instances in this category.

False Negatives (FN): Here, the model predicted Normal (0) but the actual type was Caesarean (1). This happened 14 times.

From the above measures we can make conclusion about the model performance: Decision tree model has an accuracy of approximately 75.58%. This means that our model correctly predicts the type of delivery for about 75.58% of the cases in our dataset. A higher degree of precision is typically believed to be preferable; nevertheless, it should be studied in combination with other metrics in order to provide a thorough knowledge of the performance of our model. A model's sensitivity, which is often referred to as the true positive rate or recall, is a measurement of the model's ability to accurately detect positive instances, which in this context refers to caesarean births. Model has a sensitivity of approximately 0.6190 or 61.90%. This means that it correctly identifies caesarean deliveries for about 61.90% of the actual caesarean cases. A higher sensitivity indicates that the model is better at capturing true positive cases.

```
>library(rpart.plot)
>rpart.plot(model)
```

Figure 6.2 Decision Tree for Type of Delivery



6.13.3 Interpretation:

From the above decision tree plot here we can make some conditional statements regarding the prediction of type of delivery on the basis of important predictors.

If the type of earlier delivery is normal then there is another two conditions such as place of ANC is both private as well as public health centre and number of earlier pregnancies less than 3 then 6% chance of type of delivery is normal. If women had normal delivery earlier and place of ANC is both private and public and living area is rural then 9% chance that she will have normal delivery otherwise another condition is applied that is mother's education, If a mother's education is either no education or education up to secondary, there is a 3% chance of women getting a C-section.

In the next branch of tree, if the type of earlier delivery is normal then there is 24% chance of women had C-section otherwise go to another conditions. If the type of earlier delivery is caesarean, newborn baby's weight is less than 2.5 kg and living area is rural then 26% chance of women getting normal delivery and on the same conditions but only living area is urban then 7% chance of women getting C-section. If the Type of earlier delivery is caesarean, newborn baby's weight is greater than 2.5 kg and greater 8 ANC visit then 8% chance of women have normal delivery otherwise 16% chance that the women have C-section.

6.14 Decision Tree Model for New Born Baby's Weight

```
>library(rpart)
>data<- read.csv("D:/Ph.D New/Logistic Models/Final Logistic Model in Thesis/Baby - Copy.csv",header=T)
>formula<- Y ~ .
>model<- rpart(formula, data = train_data, method = "class")
>summary(model)
Call:
rpart(formula = formula, data = train_data, method = "class")
  n= 344
          CP nsplitrel error    xerrorxstd
1 0.08620690      0 1.0000000 1.0000000 0.09266756
2 0.02873563      2 0.8275862 0.9655172 0.09158574
3 0.01724138      4 0.7701149 0.9770115 0.09195193
4 0.01149425      6 0.7356322 0.9425287 0.09083623
5 0.01000000      7 0.7241379 0.9655172 0.09158574
Variable importance
Pregnancy period till the delivery                Living area
         39                                            10
ANC Code                                   Mothers working Status
          8                                             7
Vegetable and Milk                         New born baby's sex
          7                                             7
Mothers working Type                       Have you go for ANC
          7                                             6
Gross Monthly household income             Mothers weight before delivery
          5                                             3
Media Exposure                             Are you aware about ANC
         2                                              1
```

6.14.1 Interpretation

Pregnancy period till the delivery this variable is the most important in model. It has an importance score of 39, indicating that it strongly influences the model's ability to differentiate between low birth weight and normal birth weight. Its strong contribution to the response variable's prediction is shown by a higher score. The model's predictions are influenced by several factors, including living area, ANC Code, and working status. Living area is the second most important variable, with a score of 10, suggesting a significant impact on the model's predictions. The ANC Code, crucial for assessing pregnant women's health, is also relevant in predicting newborn baby weight. Vegetable and Milk intake during pregnancy, newborn baby's sex, and mothers working type, attending ANC, gross monthly household income, mother's weight before delivery, media exposure, and awareness about ANC are not much important variables to predict weight of new born baby.

We may use these significance ratings as a reference to determine which characteristics in model are more important for predicting the kind of delivery. There is a possibility that factors with a higher contribution will play a more substantial influence in determining the outcome than variables with a lower importance.

Understanding the significance of these variables aids in prioritizing their importance in the model's predictions, variables with higher importance scores, like pregnancy period and living area, have a more substantial impact on predicting the newborn baby's weight. This knowledge helps in focusing attention on the more influential factors when considering interventions or understanding the weight prediction in newborns.

To measure the model performance the confusion matrix was evaluated as follows:

```
> p=predict(model, newdata = test_data, type="class")
> cm=table(test_data$Y,p)
> cm
p
     0    1
 0  10   11
 1   4   61
>accuracy=sum(diag(cm))/length(test_data$Y)
>accuracy
[1] 0.8255814
>sensitivity=13/(13+8)
>sensitivity
[1] 0.6190476
>precision=1
>predictions<- predict(model, newdata = test_data, type = "class")
```

```
>accuracy<- sum(predictions == test_data$Y) / length(test_data$Y)
>print(paste("Accuracy:", accuracy))
[1] "Accuracy: 0.825581395348837"
```

Interpretation

Confusion Matrix

True Positives (TP): Sixty-one cases were found in which the model accurately predicted a weight of more than 2.5 kg, and it was indeed more than 2.5 kg.

True Negatives (TN): 10 instances were predicted to be less than 2.5 kg and were actually less than 2.5 kg.

False Positives (FP): 11 instances were predicted to be more than 2.5 kg, but the actual weight was less than 2.5 kg.

False Negatives (FN): 4 instances were predicted to be less than 2.5 kg, but the actual weight was more than 2.5 kg.

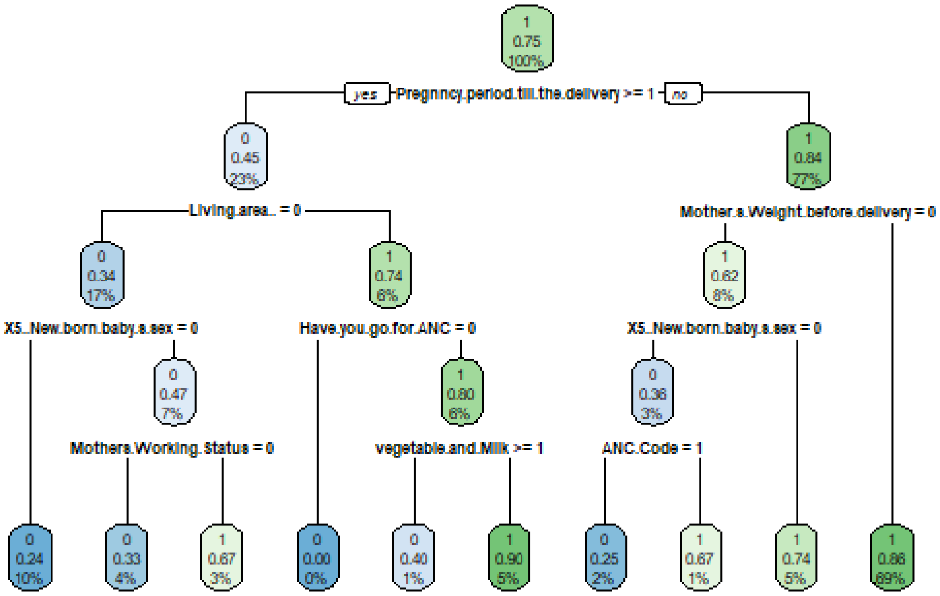
This confusion matrix helps in understanding how well the model is performing in predicting newborn baby weight categories. These measures may be used to comprehend how well the model predicts the weight category of newborns. Elevated accuracy and recall metrics suggest a more precise model for forecasting the weight of newborns.

Model has an accuracy of approximately 0.8256 or 82.56%. This means that model correctly predicts the outcomes for approximately 82.56% of the cases in this dataset. In a classification context, a higher accuracy is generally desirable, as it indicates that the model is making correct predictions for a large proportion of the data. Sensitivity, which is often referred to as the true positive rate or recall, is a measurement of the performance of the model in accurately identifying situations that are positive. In the context, it appears to be the ability to correctly identify a specific condition or event. Model has a sensitivity of approximately 0.6190 or 61.90%. This means that it correctly identifies the positive cases (in this case, the specific condition or event we're interested in) for about 61.90% of the actual positive cases.

```
>library(rpart.plot)
>rpart.plot(model)
>max_depth<- 4
>max_leaves<- 10
>control<- rpart.control(maxdepth = max_depth, maxsurrogate = 0, cp = 0, minsplit =
2,
```

```
+                        minbucket = 1, maxcompete = 4, maxnodes = max_leaves)
>model<- rpart(formula, data = data, method = "class", control = control)
>rpart.plot(model).
```

Figure 6.3 Decision Tree for Weight of New Born Baby



6.14.2 Interpretation:

From the above decision tree we can make statement regarding prediction of weight of newborn baby.

If the pregnancy period till the date of delivery is greater than 36 weeks and mother’s weight before delivery is less than 50 kg then 69% chance that baby’s weight will be less than 2.5 kg. If Mother’s weight before delivery is greater than 50 kg and sex of newborn baby is male then 5% chance that baby’s weight will be greater than2.5 kg otherwise go to another condition that is ANC code, if ANC visits is greater than 8 then 2% chance that the baby’s weight is less than 2.5 kg, otherwise only 1% chance that the baby’s weight will be greater than 2.5 kg..

If the pregnancy period till the date of delivery is less than or equal to 36 weeks, living area is rural and new born baby’s sex is female, then 10% chance that weight of newborn baby is less than 2.5 kg. If the pregnancy period till the date of delivery is less than 36 weeks, living area is urban and mother’s is not in working condition, then 4% chance that new born baby’s weight is less than 2.5 kg otherwise 3% chance that new born baby’s weight is greater than 2.5 kg. If the pregnancy period till the date of delivery is less than 36 weeks, living area is urban, mothers go for

ANC and also she take vegetable and milk intake during pregnancy then only 1% chance of baby’s weight will be less than 2.5 kg otherwise weight will be greater than 2.5 kg.

These conditions appear to weigh different factors in determining the likelihood of a newborn baby's weight being less than or greater than 2.5 kg. Factors such as pregnancy duration, mother's weight, ANC visits, living area, and dietary habits all contribute to these estimations.

It broadly suggests that various combinations of factors influence the likelihood of a baby's weight falling below or above the 2.5 kg threshold, with specific conditions contributing to these probabilities.

6.15 Decision Tree Model for ANC visits

```
library(rpart)
> data <- read.csv("D:/Ph.D New/Logistic Models/Final Logistic Model in
Thesis/ANCModelFinal8NCHI.csv",header=T)
> set.seed(123)
> train_indices <- sample(nrow(data), nrow(data) * 0.8)
> train_data <- data[train_indices, ]
> test_data <- data[-train_indices, ]
> formula <- Y ~ .
> model <- rpart(formula, data = train_data, method = "class")
> summary(model)
Call:
rpart(formula = formula, data = train_data, method = "class")
  n= 344
        CP nsplit rel error    xerror       xstd
1 0.41538462      0 1.0000000 1.0000000 0.06917609
2 0.01282051      1 0.5846154 0.5846154 0.05919045
3 0.01000000      4 0.5461538 0.6153846 0.06027322
Variable importance
Days antenatal iron supplement taken       Gross monthly household income
                        81                             8
 Aware 102 service                              Distance from home to ANC center
                         8                            3
           Aware ANC                     1
```

6.15.1 Interpretation

Confusion Matrix

True Positives (TP): 24 instances were predicted as more than 8 visits, and indeed, they were more than 8 visits.

True Negatives (TN): 42 instances were predicted as less than 8 visits and were actually less than 8 visits.

False Positives (FP): 10 instances were predicted as more than 8 visits, but the actual visits were less than 8.

False Negatives (FN): 10 instances were predicted as less than 8 visits, but the actual visits were more than 8.

By gaining an understanding of these indicators, one may get insight into the accuracy of the model in anticipating trips to the ANC. If the accuracy and recall values were higher, it would indicate that the model is more accurate in predicting whether the number of ANC visits is more than or fewer than 8.

Days antenatal iron supplement taken this variable has the highest importance score of 81, indicating that it is the most valuable factor in predicting the number of ANC trips. A higher score indicates that differences in the number of days pregnant women take iron supplements have a substantial impact on the capacity of the model to predict the frequency of visits to the nurse practitioner (ANC). Gross monthly household income is the second most important variable with an importance score of 8. It suggests that income has a significant influence on the model's predictions regarding the number of ANC visits. The awareness of the "102" service, with the same importance score as household income, is also a significant factor in predicting ANC visit frequency. The distance from home to the ANC centre and Awareness about Antenatal Care (ANC) is relatively less important, with an importance score of 3. It still plays a role in the model but has a smaller influence compared to the top three variables.

To measure the model performance the confusion matrix was evaluated as follows:

```
> p=predict(model, newdata = test_data, type="class")
> p
> cm=table(test_data$Y,p)
> cm
  p
    0  1
```

```
  0 42 10
  1 10 24
> accuracy=sum(diag(cm))/length(test_data$Y)
> accuracy
[1] 0.7674419
> sensitivity=13/(13+8)
> sensitivity
[1] 0.6190476
```

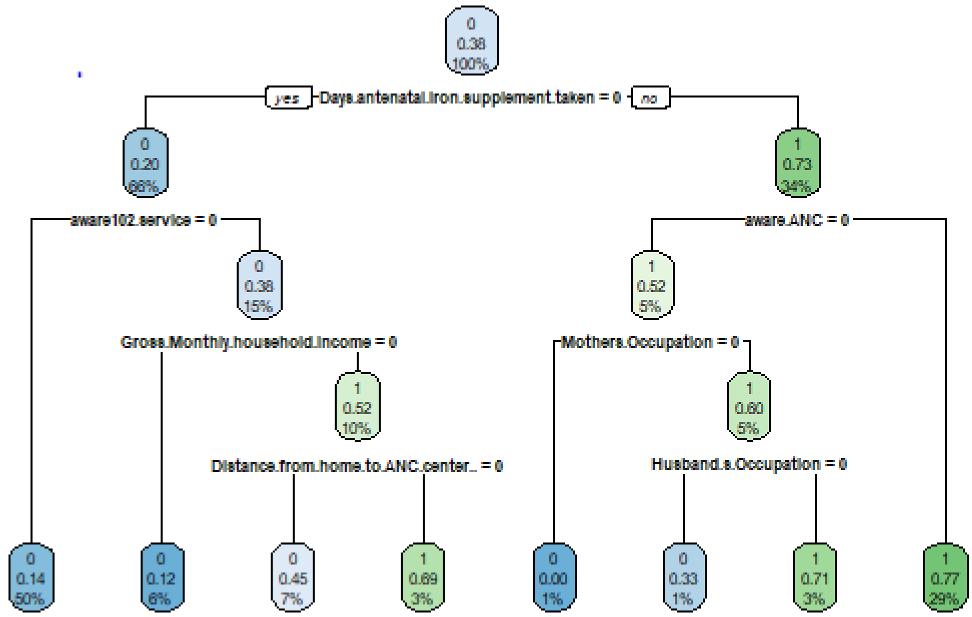
The fact that the model is able to accurately forecast the ANC visit categories while maintaining an accuracy of roughly 76.74% is indicative of its overall effectiveness. In this context, the model is correct in its predictions for about 76.74% of the cases. This means that it accurately classifies whether a pregnant woman is likely to have fewer than 8 ANC visits or more than 8 ANC visits in approximately 76.74% of the instances. The capacity of the model to accurately detect positive instances is monitored by the sensitivity metric. The purpose of this evaluation is to determine whether or not the model is capable of accurately identifying pregnant women who are likely to have more than eight antenatal care appointments. The sensitivity of approximately 61.90% indicates that the model correctly identifies women with more than 8 ANC visits for about 61.90% of the actual cases. In other words, it captures approximately 61.90% of the pregnant women who truly had more than 8 ANC visits.

```
library(rpart.plot)

> rpart.plot(model)

> max_depth <- 4
> max_leaves <- 10
> control <- rpart.control(maxdepth = max_depth, maxsurrogate = 0, cp = 0, minsplit
= 2,
+                        minbucket = 1, maxcompete = 4, maxnodes = max_leaves)
> model <- rpart(formula, data = data, method = "class", control = control)
> rpart.plot(model)
```

Figure 6.4 Decision Tree for ANC Visits



From the above decision tree the response variable ANC visits can be interpreted on the basis of some key factors. If the number of days antenatal iron supplement taken is less than six months and women's are not aware about 102 service then 50% chance that the response variable ANC visits will be less than 8. If the women's are aware about 102 service and gross monthly income is less than 10 thousand then 6% chance that ANC visits are less than 8.

If the number of days antenatal iron supplement taken is less than 6 month, if the women's area aware about 102 service and distance from home to ANC centre is less than 15 km then 3% chance that ANC visit will be greater than 8. Otherwise 7% chance that ANC visit will be less than 8.

According to next branch, if the number of days antenatal iron supplement taken is greater than six months and women's are aware ANC visit then 29% chance that ANC visits are greater than 8. If the number of days antenatal iron supplement taken is greater than six months, they are not aware ANC and mothers are non - working then only 1% chances that the ANC visit less than 8 visits. But if mother's is working and husband is employed then 3% chance that the ANC visits are greater than 8 visits otherwise it will be less than 8 visits.

Longer duration of taking antenatal iron supplements seems to generally increase the chances of having more ANC visits, especially when combined with awareness of ANC services. But the effect can vary based on other factors like the duration of iron supplement intake, employment status, and husband's employment status. These conditions suggest a set of rules that could potentially guide the likelihood of ANC visits, providing insights into how different factors or their combinations contribute to the frequency of ANC visits being more or less than 8.

6.16 Factor Analysis

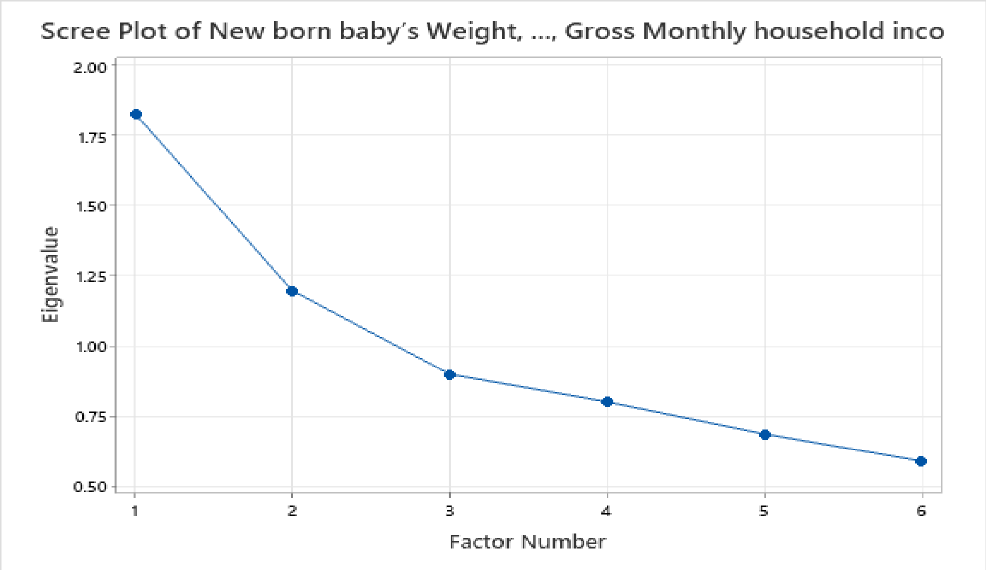
Factor analysis is a statistical method widely employed in social sciences and health research to explore the underlying structure of a set of variables and identify latent factors that explain their interrelationships. In the context of maternal and child health, factor analysis offers a valuable tool for investigating the complex array of factors influencing newborn weight at birth. Understanding these factors is critical for informing interventions aimed at promoting healthy birth outcomes and reducing the risk of adverse health outcomes for both mothers and newborns.

The primary objective of factor analysis is to identify underlying dimensions or factors that explain the correlations among observed variables. In this study, we aim to apply factor analysis to examine the factors associated with newborn weight at birth in the context of maternal and household characteristics, prenatal care behaviors, and socio-economic factors. Specifically, we will explore how variables such as maternal weight before delivery, maternal age, and timing of prenatal care visits, maternal education level, and household income are related to newborn weight. By identifying these factors, we seek to provide a comprehensive understanding of the determinants of newborn weight and inform strategies for improving maternal and child health outcomes.

To achieve this objective, we will conduct factor analysis on a dataset comprising relevant variables collected from a sample of mothers and newborns. We will analyze the factor loadings, communalities, and factor scores to elucidate the underlying factors influencing newborn weight. Additionally, we will utilize the scree plot and eigen values to determine the number of factors to retain for further analysis.

The findings of this study will have implications for clinical practice, public health policy, and future research endeavors aimed at promoting optimal birth outcomes and maternal-infant well-being.

Figure 6.5 Scree Plot



We determined the number of factors to consider by examining both the scree plot and eigen values. The scree plot indicated a clear break after the third factor, suggesting that the first three factors should be retained for further analysis. Additionally, we observed that the first three eigen values were greater than unity, indicating that these factors explain a significant amount of variance in the data. Therefore, we focused our analysis on these three factors as they are likely the most meaningful in understanding the factors influencing the weight of newborn babies.

6.16.1 Principal Component Factor Analysis of the Correlation Matrix

Unrotated Factor Loadings and Communalities

Variable	Factor1	Factor2	Factor3	Communality
New born baby's Weight	0.670	0.202	-0.459	0.700
Mother's Weight before delivery	0.646	0.365	-0.365	0.684
Mother's Age	0.456	0.416	0.624	0.770
At which Month do you	-0.542	0.537	-0.034	0.583

visit clinic first time				
Mother's education_	0.231	-0.732	-0.066	0.593
Gross Monthly household income	0.636	-0.159	0.402	0.591
Variance	1.8255	1.1961	0.8997	3.9213
% Var	0.304	0.199	0.150	0.654

6.16.2 Rotated Factor Loadings and Communalities

Varimax Rotation

Variable	Factor1	Factor2	Factor3	Communality
New born baby's Weight	0.825	-0.131	0.049	0.700
Mother's Weight before delivery	0.812	0.025	0.157	0.684
Mother's Age	0.099	0.153	0.858	0.770
At which Month do you visit clinic first time	-0.166	0.727	-0.163	0.583
Mother's education_	-0.066	-0.755	-0.138	0.593
Gross Monthly household income	0.148	-0.439	0.614	0.591
Variance	1.4031	1.3322	1.1861	3.9213
% Var	0.234	0.222	0.198	0.654

6.16.3 Factor Score Coefficients

Variable	Factor1	Factor2	Factor3
New born baby's Weight	0.629	-0.019	-0.163
Mother's Weight before delivery	0.607	0.108	-0.048
Mother's Age	-0.114	0.188	0.785
At which Month do you visit clinic first time	-0.022	0.536	-0.060
Mother's education	-0.091	-0.600	-0.165
Gross Monthly	-0.072	-0.282	0.504

household income

Based on the unrotated factor loadings, communalities, and factor score coefficients provided, we can interpret the relationships between the weight of the newborn baby and the other variables, as well as the identified factors:

6.16.4 Unrotated Factor Loadings and Communalities:

Factor 1: This factor is characterized by high loadings on variables such as "Mother's Weight before delivery," "Mother's Age," and "Gross Monthly household income." These variables represent maternal characteristics and socio-economic factors. The high communalities (>0.65) indicate that Factor 1 explains a substantial proportion of the variance in these variables. Therefore, Factor 1 can be interpreted as representing maternal and household characteristics associated with newborn weight.

Factor 2: Variables such as "At which Month do you visit clinic first time" and "Mother's education_" have high loadings on Factor 2. These variables are related to the timing of prenatal care visits and maternal education level. The relatively high communalities (>0.58) suggest that Factor 2 explains a significant portion of the variance in these variables. Thus, Factor 2 can be interpreted as representing prenatal care behaviors and maternal education level.

Factor 3: The variable "At which Month do you visit clinic first time" has a moderate loading on Factor 3, while other variables do not contribute significantly. However, the high communality (>0.58) suggests that Factor 3 still explains a substantial proportion of the variance in this variable. Factor 3 can be interpreted as representing the timing of the first prenatal care visit during pregnancy.

6.16.5 Rotated Factor Loadings and Communalities (Varimax Rotation):

After rotation, the factors become more interpretable and easier to understand.

Factor 1: The rotated loadings show that "Mother's Weight before delivery" and "Gross Monthly household income" has the highest loadings on Factor 1, indicating that this factor is primarily associated with maternal and household characteristics. The high communalities (>0.65) reinforce that Factor 1 explains a significant portion of the variance in these variables.

Factor 2: Variables such as "At which Month do you visit clinic first time" and "Mother's education" now have higher loadings on Factor 2 after rotation. This suggests that Factor 2 represents prenatal care behaviors and maternal education level more clearly. The high communalities (>0.58) indicate that Factor 2 explains a substantial proportion of the variance in these variables.

Factor 3: The rotated loadings show that "Mother's Age" has the highest loading on Factor 3, indicating that this factor is primarily associated with maternal age. The high communality (>0.77) reinforces that Factor 3 explains a significant portion of the variance in maternal age.

6.16.6 Factor Score Coefficients:

These coefficients represent the weights assigned to each variable for calculating factor scores.

For example, the positive coefficients for "Mother's Weight before delivery" and "Mother's Age" in Factor 1 suggest that these variables contribute positively to the Factor 1 score, indicating higher maternal weight and age are associated with higher scores on Factor 1, which, as previously interpreted, represents maternal and household characteristics associated with newborn weight.

In short, the factor analysis reveals three distinct factors associated with newborn weight: maternal and household characteristics, prenatal care behaviors and maternal education level, and maternal age. These findings provide valuable insights into the factors influencing newborn weight and can inform interventions aimed at improving maternal and child health outcomes.

CHAPTER-7
SUMMARY AND CONCLUSION

7.1 Introduction

The health of the pregnant lady and her unborn baby is dependent upon the provision of prenatal medical attention. Comprehensive prenatal treatment are essential for promoting healthy behaviours and understanding among women who are pregnant as well as for the detection of issues and treatment on it at early stage that are associated with pregnancy. The present chapter, headed "Summary and Conclusion," is the final section of a comprehensive analysis that examined the prenatal care knowledge of reproductive women in Baramati. This chapter summarises the main conclusions, revelations, and consequences that have come to light in an effort to connect the many strands of the research journey together. It gives us a thorough overview of the goals and technique of the study, enabling us to consider the research process. It also provides a succinct but comprehensive synopsis of the findings and their significance for the sake of the well-being of maternity and infant care in Baramati.

We have traversed the complex terrain of prenatal care throughout this thesis, delving into its importance, current practises, and women understand in this area. A thorough examination of the variables influencing prenatal care awareness, including socio-demographic traits, healthcare facility accessibility, cultural norms, and information sources, has served as the foundation for the inquiry.

This chapter is the intellectual conclusion of the search for a more thorough understanding of prenatal care knowledge among reproductive women in Baramati. Through an examination and synthesis of the research findings, we want to clarify the relevance of our findings for healthcare professionals and policymakers alike. In addition, we will discuss the prospects for further investigation and the means of improving knowledge and availability of prenatal care services, which will eventually benefit the health of pregnant women and the foetuses in this area. Thus, the chapter "Summary and Conclusion" not only signals the conclusion of our trip but also provides access to good opportunities and directions within the realm of maternal and infant health.

7.2 Summary and Concluding Remarks

We started our exploration of the complex terrain of maternity and child health in the setting of Baramati in Chapter 1. In order to do this, we looked at the important national and international frameworks, goals, and directives that serve as the general framework for healthcare interventions. We investigated the NHM, NRHM, and NUHM, realizing how important they are in determining access to healthcare, particularly for reproductive women in Baramati. We also looked at a number of government programmes that the Indian government has developed, drawing inspiration from WHO recommendations and that are especially designed to attend to the requirements of female health. The importance of prenatal care, safe pregnancies, and the health and happiness of infants is brought to light via these initiatives, which play a significant part in the overall improvement of women's health. The discussion focused on pregnancy, delivery types, and monitoring newborn babies' weight for a healthy start. It also touched on reproductive women's health concerns, highlighting factors influencing their well-being and health-seeking behaviors. The focus was on antenatal care awareness among reproductive women in Baramati, setting the stage for further investigation. We now have a comprehensive knowledge of the contextual background against which our study will be conducted due to the chapter 1. Our research has led us to identify the fundamental components, laws, and rules that have an impact on the health of pregnant women and children in Baramati. We provided a strong foundation for our investigation and analysis of prenatal care knowledge among reproductive women in this area by examining these aspects.

Chapter 2 of this thesis explores research on maternal health, antenatal care awareness among reproductive women, and the health of newborn babies. The review aims to provide a solid foundation for the study by examining various aspects of maternal health, antenatal care awareness, and newborn baby health. Studies from both the United States and other countries were included in the literature study. These studies were published in academic journals, reports, and peer-reviewed, user-generated content care list journals. The research articles highlight the importance of early and regular prenatal check-ups in identifying and managing pregnancy-related complications. Maternal awareness is crucial in accessing antenatal care services, as it significantly impacts the health and well-being of both mothers and their newborns. The literature also addresses newborn health, with a focus on birth weight and its implications for long-term health. A low birth weight has been related to an increased risk of various health issues, emphasizing the importance of prenatal care and treatment in ensuring healthy outcomes for newborns.

The study focuses on the importance of health, antenatal care awareness, and newborn baby health in the literature. Previous studies have shown that receiving quality prenatal care is not only essential for the health of both the mother and the infant, but it is also associated with better results for the pregnancy. Maternal awareness plays a significant role in accessing antenatal care services, suggesting interventions and awareness-raising efforts may improve healthcare utilization among reproductive women. The study aims to build upon the knowledge and insights gathered in this chapter to investigate the awareness of antenatal care among reproductive women in Baramati. The findings will serve as a reference point for the study, contributing to the existing body of knowledge and providing recommendations to enhance the well-being of mothers and newborns in the Baramati region. Factors such as mother's education, living area, economical status of women and distance from ANC centers, husband's occupation, and health-related variables are considered significant variables for utilizing maternal health care services.

The third chapter, "Methodology," provides the framework for our investigation of Baramati reproductive women's knowledge of prenatal care. . Any study must include a research technique as it establishes the framework for achieving the study's goals. We gave a thorough explanation of the techniques utilized in this chapter will focus on the gathering and analysis of facts. We explore the complexities of the study variables, the analytical tools used, inclusion and exclusion criteria, data collecting, sample techniques, and research design in this chapter that ensures the authenticity as well as reliability of our investigation into the awareness of antenatal care among reproductive women in Baramati. In this chapter, we discussed in detail the method of data collection, how to make a good questionnaire, study variables, and the statistical tools used to analyze the data. These methods will guide our analysis and contribute to the robustness of our findings and conclusions. The focus of this chapter is to offer an overview of the comprehensive framework that guides our research and ensures the validity and rigour of our results.

Chapter 4, "Exploratory Data Analysis," is a crucial phase in our research on antenatal care awareness among reproductive women in Baramati. Through summary statistics and data visualization techniques, we aim to uncover patterns, trends, and insights that will guide our analysis and interpretation of the data. This helps us identify potential areas of interest and focus on aspects that may significantly impact antenatal care awareness. The findings and visualizations presented in this chapter guide our subsequent analysis, helping us uncover meaningful associations and patterns that inform our understanding of factors influencing antenatal care awareness. This chapter facilitates the transition from raw data to actionable insights, setting the stage for further examination and interpretation of our research findings. . In conclusion, the interpretation of the diagram highlights the urgent need for educational interventions that may equip women with the information and resources necessary to facilitate access to basic prenatal care services, ultimately contributing to the overall improvement of the health of mothers and babies outcomes in Baramati. The distribution of respondents according to socio-economic demographic profile shows a diverse distribution of maternal age groups, with 13.26% under 20, 81.4% between 20-30, and 5.35% older than 30. The data also shows a range of education levels, with 11.4% illiterate, 2.09% completing primary, 29.3% having secondary, and 28.14% having senior secondary. This diversity highlights the need for tailored maternal healthcare and awareness programs to address the unique needs and perspectives of mothers across various educational backgrounds. The dataset shows a diverse range of incomes among participants, highlighting financial challenges and the need for tailored maternal healthcare programs. Women's working status also differs. The study reveals that 82.56% of mothers had a pre-pregnancy weight above 50 kg, indicating a healthier weight range. Around 77.91% of women reported no significant health issues, while 22.09% had some health problems, indicating the need for targeted support. It is essential for maternal healthcare to have a solid understanding of at the time of the first prenatal care appointment. This is because early and consistent attendance at ANC is related with improved outcomes. It is essential to analyze the different groups to identify potential barriers and interventions that may encourage early and consistent ANC utilization among pregnant women. In order to evaluate compliance with maternal healthcare guidelines, it is essential to know how long pregnant women have been taking iron supplements. Preventing anemia and protecting the health of both the mother and the growing foetus require enough iron consumption throughout pregnancy. These two groups may be analyzed to get insight into the variables affecting compliance with iron supplementation recommendations and to create methods to improve pregnant women's compliance with these recommendations. The "Distributions of Respondents According to Recent Pregnancy" section offers a comprehensive view of the pregnancy-related characteristics of the study participants. By examining factors such as pregnancy status, how many pregnancies there were, and gestation stages, the research has the capacity to enhance our comprehension of the situation of how various reproductive experiences may have an impact on the level of knowledge and use of prenatal care services in Baramati. This analysis is vital for tailoring maternal healthcare programs in order to satisfy the specific requirements and difficulties that women encounter at various stages of their reproductive journeys. In conclusion, it is evident that approximately 46.51% of the participants in our study opted for a normal delivery, which is the most common and less invasive mode of childbirth. On the other hand, about 53.49% of the participants underwent a caesarean section, comparatively which is high. In rural areas, a noteworthy 57.86% of women have acquired knowledge about the 108 emergency services. This awareness is crucial as it ensures access to immediate medical assistance in situations of emergencies, including those related to pregnancy and its complications.

31.10% of women from rural areas have poor knowledge about pregnancy danger signs whereas 12.21% of women from urban areas have poor knowledge about pregnancy danger signs: This data suggests that a significant number of rural women do not fully comprehend or are aware of the indicators of danger that come with being pregnant. These might include symptoms like intense stomach pain, heavy bleeding, a high temperature, or other indicators of concern that call for emergency medical treatment, all of which could point to possible pregnancy-related issues. Given the high proportion in rural regions, there may be a substantial information gap that affects these women's ability to identify and treat pregnancy-related problems early on.

There exists a association between a newborn baby's weight and the educational level of mothers, with educated mothers tending to have babies with higher mean birth weights in comparison to their less educated counterparts. The study reveals a significant disparity in birth weights between rural and urban areas, indicating a link between living environment and infant health. The mean birth weight of the baby is high, in the group that has a high family, mothers who are living in joint families, mother’s who are in working conditions, mothers who take iron-sufficient supplements during their pregnancy, women who take ANC services, mothers whose pregnancy period was idea, mother’s whose HB is greater than 11 g/dl, and mothers who take nutritional food daily during their pregnancy period.

In conclusion, the data from this study reveals that while a substantial portion of women in the dataset do engage in timely Antenatal Care (ANC), with 75% seeking care during the first trimester of their pregnancies, there is chance for improvement in early ANC utilization. It is of the highest priority to begin antenatal care (ANC) at the appropriate time to be able to ensure the health to maintain a healthy pregnancy. Therefore, the findings emphasize highlighting the value of ongoing efforts to improve participation and understanding to maternal healthcare services, particularly in encouraging more women to seek ANC services during the early stages of their pregnancies. Addressing the factors that may be influencing the timing of appointments of doctor and implementing targeted interventions can contribute to improve maternal and child health outcomes in the future.

In addition to the awareness and timing of Antenatal Care (ANC), our study also highlights an important concern related to iron supplementation during pregnancy. The data reveals that 65% of the women in the dataset take iron supplements for a duration of less than six months, which falls short of the recommended duration for iron supplementation during pregnancy. The consumption of an adequate amount of iron is necessary for the prevention of anaemia and for the maintenance of the health of both the pregnant woman and the growing foetus. This finding underscores the need for increased education and intervention strategies aimed at improving the adherence to iron supplementation guidelines among pregnant women. Ensuring that women receive the recommended duration of iron supplements during pregnancy is a critical aspect of maternal health that should be addressed to enhance overall pregnancy outcomes.

The study reveals that 61% of women receive fewer than the recommended 8 or more Antenatal Care (ANC) visits during their pregnancies. Adequate ANC visits allow monitoring of maternal and fetal health, addressing potential complications, and providing essential guidance and support. One of the most important things that can be done to improve the health of babies and their mothers is to encourage women to maintain the required number of antenatal care appointments. In the future, efforts should be concentrated on raising knowledge of the WHO's standards and encouraging pregnant women in the Baramati area to adhere to them.

Approximately 44% of the surveyed women said that they did not get any instruction on the recognise the meaning of giving birth to their child in a medical institution. The results emphasise the need for improving the substance and extent of prenatal counselling sessions. It is crucial to prioritise the emphasis on institutional delivery in order to provide expecting women with thorough information, enabling them to make well-informed choices about their birthing.

From rural area of Baramati 17.06% of women are unsure about the recommended number of TT injections to take while pregnant.

This suggests that a considerable proportion of pregnant women in the rural Baramati region are ignorant of the appropriate amount or quantity of TT injections to be given. Pregnancy-related TT immunisations are essential for tetanus prevention, and this proportion indicates that these women may not be aware of or knowledgeable about the necessary dosages. While 24.75% of women don't know how many iron-folic tablets to be taken during pregnancy. This finding demonstrates a comparable ignorance about the required iron-folic pill consumption during pregnancy. Supplementing with iron and folic acid is essential during pregnancy in order to avoid anaemia and promote the proper growth and development of the developing foetus. The figure suggests that a considerable proportion of women in this region may not be aware of the requirement to take these supplements.

In chapter 5 we used t test to check is there significant difference between mean birth weights of new born baby weight according to various groups. Study reveals that mean birth weight of baby in family with lower economic status is minimum as compare to high more economic income. The means of "Non Working" and "Working" are statistically different, with "Working" having a higher mean. Mean birth weight of baby is higher in the group of mother's who take iron supplement, HB level is > 11g/dl, caesarean type of delivery etc.

According to Chi- square test for independence and proportion test it is conclude that living area (rural) have significant for caesarean type of delivery. This OR indicates that the odds of caesarean delivery are approximately 87.29% higher in the group associated with "Rural" living area compared to the group associated with "Urban" living area. The analysis indicates a significant difference in the likelihood of caesarean or Normal births between joint and nuclear family types, with Caesarean deliveries more common in joint families. The length of time a couple has been married was shown to have a strong correlation with the kind of birth, with those who had been married for longer periods of time having a greater likelihood of having caesarean deliveries. The p-value of 2.2e-16 demonstrates a strong opposition to the null hypothesis, indicating a strong association between the type of earlier delivery and the current type of delivery. The odds of a caesarean delivery in the current pregnancy are 85.4359 times higher for women who had a previous Caesarean delivery in their earlier pregnancy. The study found a strong association between delivery type and ANC service provider, suggesting that the choice of provider significantly influences delivery methods. Nutrition advice was found to be linked to a lower chance of caesarean birth. A mother's weight before delivery was also found to be associated with an increased likelihood of caesarean delivery.

According to chi square test for independence for different variables with weight of new born baby, the study found there is a substantial connection with newborn baby weight and living area, suggesting a difference in distribution between rural and urban areas. There was a strong correlation between gross monthly income and infant weight, employment status and mother's age, and no statistically significant association between dietary choices and the outcome. Awareness about ANC was found to be strongly associated with baby weight. Other factors such as media exposure, pregnancy period, mother's weight before delivery, iron supplement intake, frequent vegetable and milk consumption, and child order were also found to be significantly associated with baby weight. The study found that factors such as living area, gross monthly income, mother's age at marriage, awareness about antenatal care (ANC), pregnancy period, weight before delivery, and frequency of eating vegetables and milk all contribute to baby's weight. Urban areas have a higher proportion of birth weight, while those with less than 5000 monthly incomes have a larger proportion. Mothers with ideal pregnancy periods have a larger proportion of healthy birth weights. The study discovered that prenatal care awareness among reproductive women in Baramati is greatly impacted by variables including dwelling area, mother's education, monthly income, husband's work, and understanding of antenatal care, distance from ANC centres, iron supplementation, and knowledge of warning indicators. The number of prenatal care visits and the socioeconomic, demographic, and obstetric characteristics were also analysed in connection to the manner of delivery.

In chapter 6, logistic-regression models are built in order to investigate the degree of probability associated with methods of delivery (normal or caesarean), newborn baby weight (low or normal), and the number of ANC visits (less than 8 or more than 8). Through logistic regression, we identified and quantified the influence of independent variables on these outcomes, determining which factors significantly impact the likelihood of a particular response. The accuracy of logistic regression model on the test data is around 70.93%, demonstrating how well the model can accurately determine the earlier delivery type based on the provided variables. Overall, the data points to a number of predictor variables that are statistically significant in affecting the type of earlier delivery, including dwelling location, marriage month, number of prior pregnancies, type of earlier delivery, pregnancy duration till delivery, and weight of the newborn. Whereas from decision tree algorithm type of earlier delivery, number of earlier pregnancies, marriage month, living area and new born baby's weight are more important variables. Decision tree model has an accuracy of approximately 75.58%.In conclusion, while the decision tree model outperforms the accuracy of the logistic-regression model in terms of correlation, it's essential to consider factors like model complexity, interpretability, robustness, and the nature of the problem when choosing between the two. If a simpler, more interpretable model is desired, logistic regression may be a better choice. However, if accuracy is the primary concern, the decision tree might be more suitable, provided over fitting can be controlled.

The logistic regression model accurately predicted 83.72% of cases of a baby weight over 2.5 kg, with urban location, working motherhood, young marriage, and ANC visits significantly influencing outcomes. The accuracy of the decision tree model, when tested on the validation dataset, is approximately 79.07%. This means that the model correctly predicts whether the number of ANC visits is greater than 8 in about 79.07% of cases. Logistic regression tends to be robust and less prone to over fitting, so for predicting weight of new born baby we may used logistic regression model.

When trying to predict the total number of visitors to the ANC, the decision tree model generates an accuracy rate of 76%. Specifically, when predicting whether the count of ANC visits is greater than 8, the model has an accuracy of approximately 79.07%. In practical terms, this suggests that if the primary goal is to accurately identify cases where the total number of visits to the health centre is higher than eight, the LR model is more effective in doing so compared to the decision tree model. It's important to consider the specific objectives of analysis and any consequences associated with false positives or false negatives when choosing the appropriate model.

The factor analysis unveils three distinct factors influencing newborn weight: maternal and household characteristics, prenatal care behaviours coupled with maternal education level, and maternal age.

7.3 Recommendations

Replicate the study on a larger and more diverse sample of reproductive women in Baramati. A bigger sample size has the potential to increase the generalizability of the results and give a more thorough knowledge of the awareness of prenatal care. Consider conducting separate analyses for mothers and newborn babies to gain insights into their unique healthcare needs and awareness levels. This separation can help tailor interventions and support services more effectively. Expand data collection to include private healthcare facilities in addition to public health centres. This will allow for a comparison of awareness and healthcare utilization between women accessing antenatal care services in different healthcare settings. Private facilities may have different practices and patient populations. Perform a comparative analysis between data collected from public and private healthcare centers to identify any variations in awareness and utilization of antenatal care services. This can shed light on the strengths and weaknesses of both sectors. Include healthcare providers in the study to understand their perspectives on antenatal care awareness and the challenges they face in delivering care. Their insights can help in devising strategies to improve maternal healthcare. Develop and implement tailored educational programs based on the study findings. These programs can address specific gaps in awareness and provide targeted information to women at different stages of their reproductive journey. Collaborate with local communities, organizations, and policymakers to advocate for improved maternal healthcare. Engage in community-driven initiatives to raise awareness and promote positive health-seeking behaviours. These results imply a need for focused educational initiatives, improved healthcare communication, and better access to information about pregnancy danger signs in both rural and urban settings. Enhancing awareness and knowledge among women about these warning indicators is crucial for early recognition and timely intervention in cases of potential complications during pregnancy. This could significantly contribute to better maternal health and the reduction of pregnancy-related risks in both urban and rural areas.

The text proposes a comprehensive a strategy for enhancing mother's health in remote regions areas of Baramati. It emphasizes the importance of early and regular antenatal care (ANC) visits, focusing on the health of both the mother and the child. The campaign also advocates for maternal education and the establishment of healthcare centres and mobile clinics to reach remote areas. Community health workers are trained to educate and support pregnant women; facilitating ANC visits. The plan also suggests identifying high-risk pregnancies based on factors like previous delivery complications, baby's weight, and maternal health conditions, ensuring they receive specialized care. Women who are empowered are able to put at the same time, their personal health of individual as well as the condition of their kids forefront of their priorities. Family planning and birth spacing programs can help women have healthier pregnancies and better birth outcomes. The text also emphasizes the importance of maintaining comprehensive health records for pregnant women, enabling healthcare providers to track pregnancy progress and detect issues early. Collaboration with NGOs and government agencies is crucial for allocating resources and funding for maternal health programs in rural Baramati. Regular evaluation and research will ensure the effectiveness of these initiatives. It is important that the proposals be adapted to the particular difficulties and requirements of the rural region, taking into consideration the cultural and social environment and circumstances. Further research can provide a more comprehensive understanding and guide policymakers in allocating resources and implementing interventions to bridge the birth weight gap between rural and urban areas. The results provide light on the factors that influence receiving appropriate prenatal care as well as possible obstacles to care access.

In order to evaluate compliance with maternal healthcare guidelines, it is essential to know how long pregnant women have been taking iron supplements. Preventing anaemia and protecting the health female, require enough iron consumption throughout pregnancy. These two groups may be analysed to get insight into the variables affecting compliance with iron supplementation recommendations and to create methods to improve pregnant women's compliance with these recommendations. In conclusion, the interpretation of the graphic highlights the need for educational interventions that may equip women with the information and resources necessary to facilitate access to basic prenatal care services, ultimately contributing to the overall improvement of the health of mothers and kids outcomes in Baramati. This highlights the need to understand the unique needs, time constraints, and economic contributions of working and non-working women in maternal healthcare and support programs. By examining factors such as pregnancy status, number of pregnancies, and gestation stages, the study can better understand how different reproductive experiences may affect the level of knowledge and use of prenatal care services in the Baramati District. This analysis is vital for tailoring maternal healthcare programs in order to find solutions to the specific problems and requirements that women face at various stages of their reproductive journeys. Having a clear understanding of the date of the appointment is essential for maternal healthcare. This is because early and consistent attendance at ANC is related with improved outcomes for both the mother and the foetus. It is essential to analyze the different groups to identify potential barriers and interventions that may encourage early and consistent ANC utilization among pregnant women. In order to close the birth weight disparity between rural and urban regions, governments may allocate resources and conduct initiatives more effectively and more comprehensively with the help of further research. The section titled "Distributions of Respondents According to Recent Pregnancy" provides an extensive overview of the research participants' pregnancy-related attributes.

Early ANC visits are crucial for identifying and addressing any potential risks or complications early in the pregnancy, which can significantly improve maternal and fetal health outcomes. Launch community awareness programs to educate women and their families about the importance of early ANC visits. Use various channels such as local radio, community gatherings, and door-to-door campaigns to spread the message. By implementing these recommendations, we can help ensure that more women in rural Baramati receive the early care they need to have healthy pregnancies.

The analysis highlights a specific concern within the rural segment of Baramati. Despite the overall satisfactory awareness, the rural region shows a notable gap or deficiency in knowledge about maternal health compared to the urban areas. This could pertain to understanding danger signs, recommended supplements, vaccination schedules, or access to prenatal care services.

7.4 Future Scope

The future scope of study, "Analytical study of awareness of antenatal care among reproductive women in Baramati," is promising and offers opportunities for further research, interventions, and policy development. Extend the study to compare awareness of antenatal care in Baramati with other regions or communities with similar characteristics. This comparative analysis can highlight regional disparities and best practices. Further we can extend study's findings and lessons to other global health contexts to contribute to improving maternal healthcare on a broader scale. Based on our findings, here are potential areas for future research and action: The study aims to improve maternal health in rural Baramati by developing targeted interventions and awareness programs. These programs should focus on raising awareness about the importance of maternal healthcare, especially among women with lower educational levels and limited access to healthcare facilities. Educational initiatives should emphasize antenatal care, family planning, and maternal health. Collaborating with local schools and communities is crucial to ensure women have access to education and information. Empowering women economically and socially through vocational training and financial literacy programs is also essential. Further research is needed to understand the underlying causes of health disparities in maternal health, explore the impact of socioeconomic factors on maternal health outcomes, and investigate the role of nutrition in maternal health. The study should also explore how maternal healthcare practices and early antenatal care impact childbirth outcomes, including delivery mode, maternal complications, and newborn health. We can increase the sample size for getting better results.

The interpretation implies that while the general awareness among women in Baramati about maternal health is promising, there's a distinct need for targeted interventions or educational campaigns specifically tailored for the rural areas. Focusing efforts on improving education, access to healthcare services, and spreading awareness about maternal health in rural Baramati could significantly enhance the overall awareness and understanding of maternal health, thereby bridging the existing gap between urban and rural segments.

7.5 Limitations of Research Work

Acknowledging these limitations in study is important as it demonstrates the rigor and honesty of research. The study may suffer from sampling bias if certain groups of reproductive women are underrepresented or overrepresented in the sample. This could affect the generalizability of the findings to the entire population of Baramati. A snapshot of knowledge and prenatal care practises at a certain period in time to be provided by the cross-sectional design of the research with which it was conducted. Over the course of time, it may not be able to record changes in awareness or utilisation. The study might rely on a limited number of data sources, such as public health centres. Data from other healthcare providers or private hospitals may not be included, potentially missing a large proportion of the total resident population. The study is focused on Baramati, which may not be representative of other regions in India or globally. Findings may not be generalizable to areas with different demographics and healthcare infrastructure. The study might not capture changes in awareness and antenatal care practices that may have occurred after the data collection period. "One limitation of this study is that during data collection, it was observed that some mothers who had recently given birth experienced discomfort or pain, mothers may feel physically uncomfortable, in pain, or exhausted, which may make it difficult for them to answer questions or take part in surveys.

Another limitation of this study is that some mothers, particularly those experiencing their first-time delivery, expressed discomfort or hesitation in responding to the study's questions. This discomfort may have been exacerbated by the presence of new responsibilities and the adjustment to caring for their newborns. Certain women may experience emotional exhaustion during their postnatal period. It could be difficult for them to concentrate on responding to questions because they are experiencing a variety of emotions, such as tension, worry, or tiredness.

The limited sample size and time span of the data restricted any generalisation of the findings. Study is limited to Baramati Taluka of Maharashtra. The study samples might not be fully honest in their questionnaire responses since the y are busy with other tasks.

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Appendix

Publications

Shri Jagdishprasad Jhabarmal Tibrewala University

Vidya Nagari, Chudela, Churu - Jhunjhunu Road, Jhunjhunu, Rajasthan - 333010

Ref. No. :- JJTU/CONF./LANG./2023/187

Online International Conference
(Multidisciplinary)

"G20 Issues : Employment, Gender, Education, Skill, Global Health and Social Policies"

Organized By
Institute of Languages

This is to certify that Dr. /Mr. /Ms . PRITI MANOHAR MOHITE has presented a paper titled " **Analysis of Factors Associated with Antenatal Care among Reproductive Women in Baramati.** " in the International Conference on " G20 Issues : Employment, Gender, Education, Skill, Global Health and Social Policies " held on 27th & 28th June , 2023 organized by Institute of Languages, Shri Jagdishprasad Jhabarmal Tibrewala University Vidyanagri, Chudela, Jhunjhunu, Rajasthan.

Er. Bal Kishan Tibrewala President	Dr. Madhu Gupta Registrar	Dr. Anshu Sharma Convener

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Shri Jagdishprasad Jhabarmal Tibrewala University

Vidya Nagari, Chudela, Churu - Jhunjhunu Road, Jhunjhunu, Rajasthan - 333010

Ref. No. JJTU/CONF./NUR/2023/094

ONLINE INTERNATIONAL CONFERENCE

(Multidisciplinary)

" Trends, Innovations and Technological Advancements in Nursing Education "

Organized By
Department Of Nursing

This is to certify that Dr. /Mr. /Ms . *PRITI MANOHAR MOHITE* has presented a paper titled ***" Study of Factors Affecting Significantly on Type of delivery among Reproductive Women in Baramati "*** in the International Conference on ***" Trends, Innovations and Technological Advancements in Nursing Education "*** held on 23rd & 24th August, 2023 organized by ***Department Of Nursing***, Shri Jagdishprasad Jhabarmal Tibrewala University Vidyanagri,Chudela, Jhunjhunu, Rajasthan.

Er. Bal Kishan Tibrewala President	Dr. Madhu Gupta Registrar	Dr. Rajesh G Konnur Convener

Shri Jagdishprasad Jhabarmal Tibrewala University
Vidya nagari, Chudela, Churu- Jhunjhunu Road, Jhunjhunu, Rajasthan- 333010

Online National Conference
(Multidisciplinary)

" Care Gap: A Vision to Achieve The Universal Health Coverage In India "

Organized by

Department of Nursing

This is to certify that Dr. /Mr. /Ms . **Mohite Priti Manohar** has participated in the National Conference on " **Care Gap: A Vision To Achieve The Universal Health Coverage In India** " held on April 25th & 26th 2022 organized by Institute of **Nursing**, Shri Jagdishprasad Jhabarmal Tibrewala University, Vidyanagri,Chudela, Jhunjhunu, Rajasthan.

President	Registrar	Convener
Dr. Bal Krishan Tibrewala	Dr. Madhu Gupta	Prof. Dr. Anupama Oka

Shri Jagdishprasad Jhabarmal Tibrewala University
Vidya nagari, Chudela, Churu- Jhunjhunu Road, Jhunjhunu, Rajasthan- 333001

Online National Conference
(Multidisciplinary)

on

" Enlightening Life with Yoga & Meditation To Strengthen Nation in Challenging Environment of Pandemic "

Organized by

Institute of Yoga & Natural Health Science

This is to certify that Dr. /Mr. /Ms. **Mohite Priti Manohar** has participated in the National Conference on "*Enlightening Life with Yoga & Meditation To Strengthen Nation in Challenging Environment of Pandemic* " held on November 19 th 2021 organizedby Institute of **Yoga & Natural Health Science**, Shri Jagdishprasad Jhabarmal Tibrewala University, Vidyanagri, Chudela, Jhujhunu, Rajasthan.

President	Registrar	Convener
Er. Bal Krishan Tibrewala	Dr. Madhu Gupta	Dr. Pragati Bhutoria

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On

Recent Advances in Statistics

(ICRAS-2021)

11-12 October 2021

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S.P. Patil

Dr. Mrs. Patil S. P.
Convener

Dr. P

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Journal of
The Maharaja Sayajirao University of Baroda

Certificate of Publication

Certificate of publication for the article titled:

A STATISTICAL ANALYSIS OF FACTORS IMPACTING ON THE WEIGHT OF NEWBORN BABY IN BARAMATI

Authored by

Priti M. Mohite

PhD. Scholar, Shri Jagdishprasad Jhabarmal Tiberewala University Jhunjhunu, Rajasthan-333001

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Punyashlok Ahilyadevi Holkar Solapur University
Dnyanteerth Nagar, Solapur-Pune National Highway, Kegaon, Solapur- 413255, Maharashtra (India)
School of Computational Sciences
Department of Statistics
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A National e-Conference on
"Recent Advances in Applied Statistics"

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This is to certify that Mrs Priti Manohar Mohite

from Shree Jagadishprasad Jhabarmal Tibrewala University Rajasthan

has participated in the National e-Conference on Recent Advances in Applied Statistics (NCRAAS-2021) organized on April 24th, 2021 by Department of Statistics, School of Computational Sciences, Punyashlok Ahilyadevi Holkar Solapur University, Solapur (MS).

Chandrakant G. Gardi Organizing Secretary	Prof. (Dr.) Vikas B. Ghute Convener, NCRAAS-2021 & Director	Dr. Mrunalini Fadanvis Vice Chancellor

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8th & 9th Oct., 2021

Certificate of Appreciation

This is to certify that Ms. Priti Manohar Mohite, Research Scholar JJTU Rajasthan has participated and presented a paper titled Awareness of Maternal Care Among Reproductive Women in Baramati in National Conference at AIMS Baramati.

Dr. P. V. Yadav Co-Coordinator	Dr. V. N Sayankar Coordinator	Dr. M. A. Lahori Director

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INTERNATIONAL CONFERENCE ON

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Organized by

Department of Physics

on

3rd & 4th January, 2023

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This is to certify that Mr./Miss./Dr./Prof. Priti M. Mohite *of* Shri. J.J.T.U., Jhunjhunu, Rajasthan. *has participated and presented a research paper entitled* "Factors Affecting Utilization of Antenatal Care among Pregnant Women in Baramati." *in the international conference on "Recent Trends in Materials Science-Synthesis, Characterization and Applications" (RTMS-2023) organized by, the department of Physics, Tuljaram Chaturchand College, Baramati, Dist - Pune, State-Maharashtra, (India) during 3rd and 4th January, 2023.*

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'Woman Today as Savitri Reborn'

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CERTIFICATE

This is to Certify that Prof./Dr./Mrs./Ms. Priti Manohar Mohite

from Shri Jagdishprasad Jhabarmal Tibrewala University

has Chaired the Session / Present as a Resource Person / Presented Research Paper in Oral / Poster Presentation / Participated / in the National Conference on 'Woman Today as Savitri Reborn'. held at Tuljaram Chaturchand College, Baramati - 413 102, Dist-Pune, Maharashtra (India).

Mrs. Sushma Sangai	Dr. Seema Naik Gosavi	Dr. Ajit Telave	Dr. Chandrashekhar Murumkar
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