

Data Analytics On ICDS Data

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Abstract-Integrated Child Development Services (ICDS) represents one of the world's largest and most unique programmes for early childhood development. ICDS is the ultimate initiative in providing the commitment to her children – It aims to reduce the learning capacity and mortality along with providing the preschool education and reducing malnutrition among children..As a government scheme it generates a huge amount of data containing information related to health of various individuals therefore it is necessary to use data analytics techniques to generate meaningful insights for enhancing the effectiveness of the program.This research paper provides a holistic analysis of performing data analytics on ICDS Data.The study begins with an overview of the ICDS program and collection of the unstructured data along with removal of the unnecessary parts of this data using different reduction algorithms and visualising the data to get proper insights related to data.This paper also gives the idea about the application of the exploratory data analysis (EDA) and various analytical models such as clustering techniques , regression analysis and classification models to achieve the results.The findings of this research gives a complete idea about the impact of the ICDS program and its implementation.

Index Terms—Integrated Child Development Services (ICDS),Data Analytics, Child Nutrition, Predictive Analytics, Public Health Data

I : INTRODUCTION

The Integrated Child Development Services (ICDS) is one of the biggest and most comprehensive program that was launched by the Indian Government in 1975 that for early childhood development and care.This program operates through a network of local centres that are located in rural , urban and tribal areas across the country which are called as Anganwadi.ICDS aims to provide early learning opportunities to children under six years of age and also addressing the nutrition and health issues of pregnant and lactating mothers.Over the years, ICDS continues to grow and expand itself in accordance with many national and international guidelines on maternal and child health.ICDS continues to adopt new technology driven solutions for monitoring of micronutrient supplementation , take-home rations and growth opportunity.ICDS stands as a pillar of the social welfare infrastructure and India's public health system.It provides various services that includes regular health check-ups , immunization , supplementary nutrition , referral services.It also focuses on the reducing the malnutrition and various diseases among children and lactating mothers.

In recent times with the advancement of science and

technologies , the demand for data analytics has also increased in different places one of them being the public health sector.Here Data analytics acts as an important tool for understanding the complex health related situations more efficiently . It also helps in obtaining evidence based insights and informed decision making.One of the main reasons for growing demand of the data analytics in public health sector is tackling the issue of high velocity , volume and variety of the data that is being generated from different sources such as health records , historical records , surveillance system , administrative records and population based surveys.Data analytics presents variety of methodologies that are aimed in extracting different conclusions from a variety of datasets with the ultimate goal of improving and optimising health facilities.These huge amounts of challenges provide an opportunity to continue improve and implement new ways of tackling these situations for better healthcare system.

There are many benefits of using data analytics in public health care which includes identification of population of people that have high risk of malnutrition , it helps in predicting the future health trends of an individual by using predictive modelling and machine learning algorithms moreover it also helps in real time detection of diseases , monitoring trends or implementing rapid response measures in case of outbreaks and mitigating the spread of infectious diseases.It also helps in analysing programmatic data , health outcomes , optimising resource allocation and ensuring proper availability towards every individual.Data analytics enhances the effectiveness and proper implementation of the ICDS scheme among different areas around the country.

The purpose of this study is to use data analytics on these types of government schemes to enhance its accuracy and effectiveness. Moreover through this study the current flaws and failings in this scheme could also be found and worked upon.Though ICDS has been a tangible effort in improving the conditions of children and lactating mothers yet the challenges like inefficiencies and under-utilisation have caused a huge trouble and hindered its growth. It could only be beneficial once the full potential of this scheme has been achieved and its application is properly done in every part of the country with use of optimum resources and less time.

The scope of this research consists of various key areas like analytical techniques and analytical coverage that will help to explore the ICDS data and helps in getting the proper figures related to health and nutrition among various states and districts across the world also it will be helping in identifying different trends and patterns which could be used to identify the change with respect to previous records and determine relationship

between different quantities and their dependency on each other. The study will also be dealing with different visualisation tools and techniques that will give a clear understanding about the data and their results.

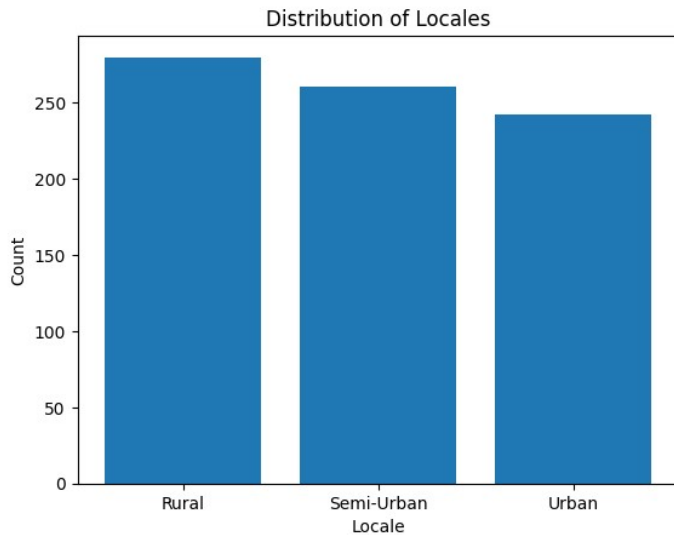


Fig:-1 Distibution of locals

The focus areas of this study will include equity of access , geographical focus , service delivery efficiency , impact of interventions and intended outcomes. That basically means getting the idea of the programs in terms of child and maternal health , the nutrition they are getting and this data will be coming from different geographical locations that includes towns cities and villages . The impact of different sub schemes and their practicality along with equitable distribution of the schemes among various level ensuring availability for everyone and lastly the goal of the improving the policy making and better implementation and effectiveness of this scheme with no compromise in the quality and consistency of the data obtained. This study will help the policy makers and administrators to get a proper idea about this scheme and whether its implementation is going on correctly without any problems. It also aims not only to contribute to academic field but also to pave the path for more sophisticated and practical implementation so as to achieve complete success out of it.

II : Overview of ICDS Data

The Integrated Child Development Services (ICDS) scheme provides various schemes that aim at improving the health condition of mothers and children. Some of the services include immunisation of the children and pregnant women against several diseases which is done in collaboration of local healthcare authorities. Supplementary nutrition that includes balanced diet and provision of food to children below six years of age and their mothers , providing health education that is education of women about different habits related to improving health and importance of nutrition , Regular health check ups are conducted and their health status of the lactating mothers are constantly monitored till they gave birth to the children and many more. The objective of the ICDS is to reduce the malnutrition and mortality rate among womens so as to enhance the capability of the mother to look after the health and education of her children and also improving the nutritional intake of the children of age 0-6 years. One of the main

objective of the ICDS is coordination of the policy and its implementation and providing the hospitals services to anyone who has need of it. Advance medical treatment and constant monitoring of the patients also comes under this scheme.

Though it seems easier, there are many challenges that occur in case of data analytics. One of the main challenges that occur is data collection of ICDS data as it is important for monitoring the reach and effectiveness of the program. One of the challenge is of data quality and reliability that is accuracy of the data that contains data from different sources with the completeness of the data that is being obtained from thousands of Anganwadi centres moreover the data that is being generated is so vast that require complex processed to be broken down to simple and understandable form so as to perform the analysis part. Advance analytics processes helps in maintaining the integrity of the data and it becomes easier to deal with huge data that is big data which only enhances the public health services. Understanding and solving different problems ensure the correctness sin the whole process.

The ICDS program deals with a huge amount of data starting from the collection of data. Here the collected data are of varied range and type therefore it is essential to understand what are the different types of data that are being dealt with. One of the important data is the geographical data that is health and nutrition data that includes the nutritional status data having the information about the nutritional beneficiaries also there are growth monitoring data having the information about the height and weight of the individuals during his lifetime and also the health check up files containing the information about treatments provided to the child along with details of the regular examinations. Another type of data is the educational data having the information about the education that includes pre school education data that includes data related to attendance and educational activities performed in Anganwadi centres. Also the data about the sessions conducted with the mother and the children about the necessary information related to nutritional values of fruits and vegetables.

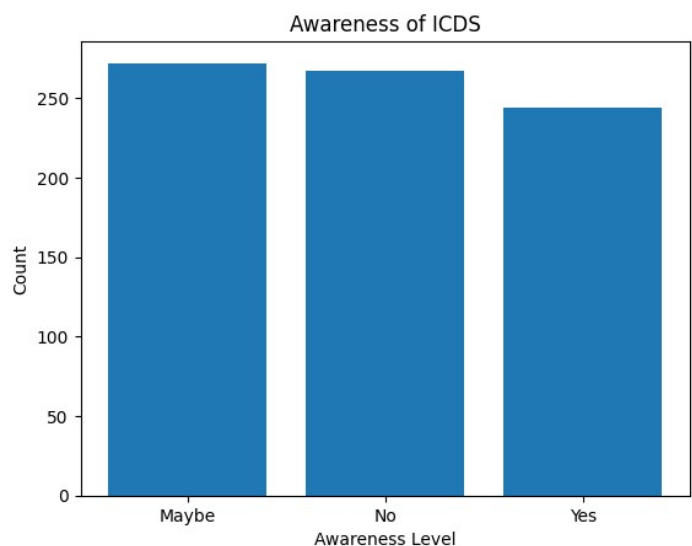


Fig:-2 Awareness of ICDS

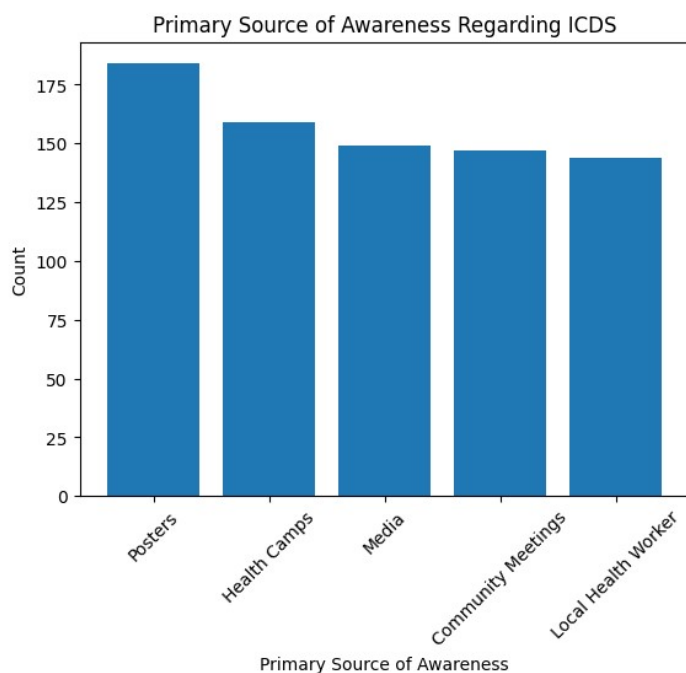


Fig:-3 Primary Source Of Awareness Regarding ICDS

Some other types of data include the demographic data having the information about the age, gender, socioeconomic status, family background, and current location. This type of data helps in identifying the individual and avoid mixing of data of one individual with the data of another individual. Programmatic data tells about the staffing of the individuals in different Anganwadi centres and also about the resources that are allocated in different regions. Service utilisation data has the information about the advance medical supplies that helps in integrating the scheme with different hospitals and also it has the records about the distribution of food and grains. Outcome data deals with the nutritional, health and educational outcome of the scheme along with feedback and satisfactions data for people to write about the review related to the program. Due to the availability of different kinds of large data it became difficult to have the complete information about each individual without having any error in the data. The challenges like mutual data entry creates barrier and increase the analytical time for evaluation of results.

Though the ICDS program is one of the most successful program due to its extensive reach and importance in improving the health of mothers and children but due to its vast data generation and data handling many challenges occur in data collection which makes it very difficult to manage the whole program. Some of the main challenges that occur in data collection and management include the data storage capacity and accessibility. Due to the generation of huge data every second it becomes very difficult to store this data. Data privacy and security is also one of the challenge due to the vast amount of data. Due to the resource constraints it becomes very difficult to manage the data and most of the data that is being entered is entered manually which makes this process slow and chances of human error increases and it also increases the time delays that occur due to this. ICDS generate data from different sources which generates a new challenge to integrate this data that is coming from different sources which makes it difficult

to analyze the data. The staff need to be properly trained so that they will be able to work properly. Due to the large amount of data the chances of occurrence of error also increases therefore error handling becomes evident in this case. All these challenges need to be solved so as to make this work easier and error free.

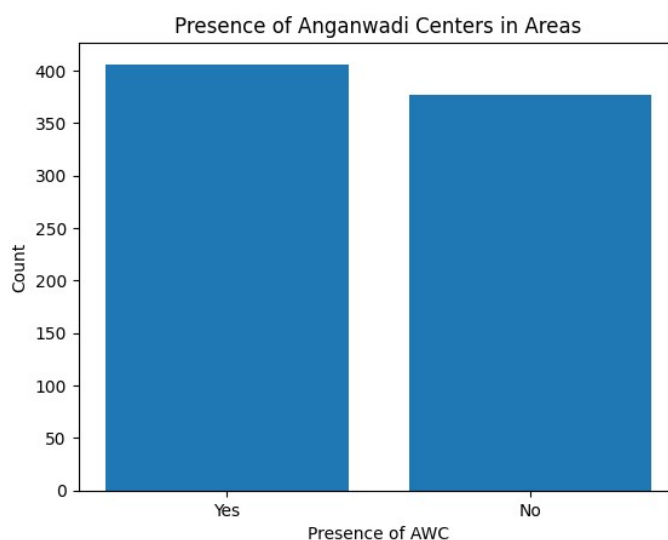


Fig:-4 Presence Of Anganwadi Centers In Areas

Though there are multiple challenges in dealing with ICDS data therefore necessary steps are needed to be taken so as to ensure proper functioning of the ICDS program. One of the things that could be done is technological upgrade. Currently very limited technology is used in the ICDS scheme which makes the work time consuming and difficult therefore it is necessary to improve the technology that is being used. Techniques such as digital data entry, and centralised real-time data management system can improve the data quality and reduces the error in this process. Allocating adequate resources for these steps and managing the infrastructure properly is important which will improve the data collection process. Regular training of the Anganwadi workers should be done so as to upgrade them with new technology. Special measures should be taken so as to improve the data security measures so as to protect the data from getting leaked. Standardized protocols should be implemented to ensure the consistency in the work. With these necessary steps the process of data collection and management will become easier and the chances of error will be reduced.

III : Data Analytics Techniques

Data analytics is the process of analyzing raw data to find out valuable insights. It deals with examining a data, removing unwanted things from the data and then understanding the data to find out trends and patterns so as to discover useful information and support decision making. For the Integrated Child Development Services (ICDS) program data analytics can play a crucial role in enhancing the operations. With the integration of ICDS and data analytics the effectiveness of the program can be found out. Data analytics is of different type. The first one is the Descriptive Analytics. In this type of analytics past data is the given the preference that is the historical data is used to identify the trends and discover the changes that occurred. It is generally used to understand the trends over time. Descriptive analysis can be used in ICDS to study the past data about the health service usage, nutrition level and the

attendance rates at the anganwadi centres. The second one is Diagnostic Analytics. Diagnostic analytics understands the data to find out the root cause of any event or outcome. It also analyzes the data to find out any trend or pattern. It answers the question “Why did this happen” which means why any trend or relationship occurred to support any decision with the help of data. This could be used to pattern and establish relations between different entities in ICDS data. Through this the identification of factors such as low educational outcomes and factors leading to malnutrition becomes easier.

The third type of analytics is Predictive Analytics. Predictive analysis is used to access historical data, observe pattern so as to predict future possibilities and trend in the data. This approach helps in better planning of the analysis. It can be used in ICDS data to predict the areas where occurrence of the problem is maximum along with areas where demand of the services grows. The last one is the Prescriptive Analytics. It can be defined as the plan of action to be taken so as to react to an occurrence of problem which basically means “What should be done”. It also gives the idea about how to deal with the future risk that could occur and take advantage of it to give an idea about the decision making. In ICDS it could help in distributing the resources equally and optimally so as to achieve maximum benefit.

Though type of data analytics is important to understand so as to apply it properly in the ICDS data but the techniques used in data analytics are the ways to implement them. There are numerous techniques that help in assuring the proper functioning of analytical tools. The first technique is use of data mining so as to get the proper information about the data it can be used to discover the hidden patterns that might not be visible through simple analysis, statistical analysis is used with the help of mathematical model so as to get the proper estimates. Significance testing and regression analysis comes under this category. Big Data technologies are used to carry out the analysis process in large sets of data efficiently. Machine learning models also play an important role as they are used to predict the future outcomes and also understand complex behaviours and their relations. Visualization tools also play an important role as they are used to summarize the result of data analysis using visualising models like graphs, charts, time series plots and many more. Data analytics can be used in ICDS for proper allocation of resources along with identifying different trend and pattern in ICDS data so as to predict the future changes. It is also used to check the effectiveness of the program by evaluating it in different parameters hence leads to better decision making and increasing the operational efficiency of the program.

Statistical analysis plays a crucial role in data analytics as it deals with using statistical methods in order to properly understand the data and to identify different patterns present within it. In case of ICDS data it helps in evaluating the policies under the scheme on the basis of their influence on the project. Different types of analysis techniques come under statistical analysis. First one is the inferential statistics that deals with hypothesis testing and confidence interval. This type of testing is used by testing an assumption with respect to range of values in case of population parameter. It can be used

to properly estimate the effect of these programs on the children along with it can be used to develop new methods in evaluating the development program of anganwadi centres. Descriptive statistics is used to measure the dispersion in the data and it is also used to describe the relevant features of data quantitatively. Range, standard deviation, mode, mean are used to provide insights around the central value.

Regression analysis is a type of analysis which is used to find out the dependency of one variable on other that is it is used to find out the relationship between a dependent variable and an independent variable. There are different types of regression analysis like linear regression and logistic regression. Linear regression is used for getting the value of one variable on the basis of another variable like predicting the health of a child on the basis of its nutritional intake. On the other hand logistic regression deals with binary outcomes that is either this or that. Other type of analysis include Time Series analysis and correlation analysis. Time Series analysis deals with data that is being collected at regular intervals whereas correlation analysis deals with the extent of dependence of one variable on the other one. Multivariate analysis gives an idea about the use of multiple variables to understand the dependency of one variable on other. Making groups of data items having similarity and using them to evaluate the performance of various groups based on the central group. This is called cluster analysis. Principal component analysis (PCA) is used to transform large data sets into smaller segments so as to reduce the dimensionality of the data. Another type of analysis is regression analysis.

Machine learning algorithms also play a major role in dealing with large datasets and analysis of these datasets. Machine learning is a branch of artificial intelligence that deals with creation of models that work like humans or can think and work in the ways humans do. Machine learning algorithms can help in identifying trends and patterns in the ICDS data and will help in better decision making and also it will help in predicting the future trends based on the current data. There are different types of machine learning. The first one is supervised learning. It is a type of machine learning in which the labelled data is used for the training of the model so that it performs perfectly after the training. Linear regression, logistic regression, Support Vector Machine that is used in classifying problems and Random Forest that is also used for classification of data, comes under the supervised learning. The second type of machine learning type is unsupervised learning. This type of learning does not require human interaction to learn and train data that is it learns itself without human supervision. It is used to find out the hidden pattern in the data. Clustering and Principal component analysis comes under this. It can be used to group anganwadi centres based on the similarity in their service. The last one is the semi supervised learning. This uses both labelled and unlabelled data for its working. This could be used when some of the ICDS data are points.

Other types of learning techniques are neural network or deep learning. This type of learning is generally used to deal with large and complex datasets. Convolutional neural network which is generally used in image processing can be used here to predict the growth of children based on the current health and recurrent neural network can be used here to find the

effectiveness of the data that is being predicted. Reinforcement learning which is used to make decision based on the calculation on the complex data can be used here to get a idea about the dynamic changing data with respect to time. Markov decision process can be used here to optimise the resources that us being allocated to different anganwadi centres. These machine learning models can be used to makes the analysis of the ICDS data faster and more accurate. The implementation of these algorithms will help in increasing the effectiveness of the ICDS scheme.

Visualisation techniques are one of the important tools of data analytics as they are used for converting the datasets into simple charts and tables. these techniques when combined with machine learning techniques make the analysis parts more efficient. They are also used to enhance the process of data analytics and that helps in easier decision making. They can be used in the ICDS data for identifying and understanding the trends and patterns present inside the data and to generate relevant outcomes from the data. There are different type of visualisations techniques that includes box plots, heat maps, scatter plots, bar charts, pie charts and many more. It is important to use these visualising techniques as they provide a clear picture about the data which makes it easier in understanding them. These could further be used to get proper insights about the data and taking necessary actions on the basis of the outcomes obtained. These different types of visualising tools are used in different situation according to the need of understanding of data. Visualisation also helps in identifying the errors present in the data making the dataset making the analysis efficient.

There are different types of visualisation techniques that are used for effective visualisation. These include Line Charts and Time Series Plots that are used for identifying change in the trends over a period of time. They can be used to identify the effectiveness of the ICDS data over a large period of time. Pie Charts are used to represent the proportion of one type of data with respect to the other. It can be used to get an idea about the distribution of the data with respect to age or location. HeatMaps are used in case of representation of data using different colours to identify patterns in the data. Bar charts and histograms are used for visualising the distribution having continuous variables and Scatter Plots are used to visualise the trends when dealing with more than one data. It can be used to identify correlations between the data such as the relationship between education and health. Box Plots provide the summary of the data with the help of quartiles. It can also be used to find out the inconsistencies in the data. With the help of these visualisation techniques it becomes easier to analyse a huge amount of data efficiently moreover it can also be used to communicate results of the analysis to the policy makers so that they can formulate policies regarding the ICDS scheme.

IV : Data Preprocessing

Data cleaning can be termed as an essential facet of the facts preprocessing segment that can be applied on the ICDS facts to be used in appearing records analytics. It incorporates identifying and editing errors, gaps, and omissions with the dataset to ensure it's of high quality and reliable for analysis. ICDS information can originate from several property, and

may be burdened with numerous data quality problems, as a result of which the validity and effectiveness of the information obtained and choice made should be verified and corrected by means of comprehensive cleansing. Here's an intensive have a look at the statistics cleaning technique: Here's an intensive have a look at the statistics cleaning technique: This first of all, every missing data should be recognized so that it will not be overlooked and hence be handled appropriately through the various available techniques with an aim of preventing early and wrong conclusion. Sometimes record are not clear and this is not an irregular incidence especially if dealing with humongous databases and if not done well, the consequences could be misleading especially on the analysis being conducted. In many ways, things that are 'missing' or 'left blank' in the large scale ICDS dataset may look 'imperfect' from the side of incomplete information if it is present, then it may get entered wrong or the device may fail. To take care of lacking data: Despite this, there is a need to make improvements for minority sectors that may lack sufficient information to prosecute and defend cases.

Identify Missing Values: To conclude the argument on lacking value in a data set, apply quantitative analysis in statistics to review the data set. **Imputation:** Where the values are expected to be zero, you replace them with expected values; in addition to the ergonomic practices including an advocate, median or mode together with the mean. However, to ensure that imputation is maximally beneficial, it needs to be done well adequately in order to avert emergence of skewed data set. In the case of data cleaning elicited in the paper, the removal of duplicates is done manually in the spread sheet and automatically in the database with the use of a range of methods depending on which of the entries has been deemed to be a duplicate. Some of the data imperfections include, for instance; duplication of records within the particular dataset could pose a disadvantage in that it can cause biases during evaluation and direct towards a wrong conclusion. It is in the same way gentle that reproduction entries inside the ICDS incident codes could have been raised due to several and diversified causes causing distress ranging from get entry to errors to gadget troubles. To address duplicate entries: **Identify Duplicate Entries:** The goal of such approach is to prevent or slow down data replication from the provided dataset: Records can be manipulated. **Record Linkage:** Incorporate redundancy into the statistic of a topic and/or distribute them to the corresponding exact pointing numerical reference.

To address duplicate entries: **Identify Duplicate Entries:** The goal of such approach is to prevent or slow down data replication from the provided dataset: Records can be manipulated. **Record Linkage:** Incorporate redundancy into the statistic of a topic and/or distribute them to the corresponding exact pointing numerical reference. Standardizing Data Formats are such data source may also be also different in terms of their format and their representation also which could be sometimes quite inconvenient or necessary problematic also while comparing. Specifically, the opportunities that could be found regarding the ICDS dataset are still potential, records quality details, codecs, and other aspects of the identification could be extended, and at the same time, the time and efforts required for data analysis could also be reduced.

To standardize records formats: Convert Data Types: These records which were obtained above need to be normalized in some way in order to simplify it trends in right direction (For instance; date needs to be formatted in to something that is easily recognizable rather than how it is in the database and all other numerical values in the record need to be normalized in such a way so as to trend in the everyday scale). Normalize Data: On another note, records can be made to fit one popular fashion style or rates, and scoring for criterion, referenced standards could be performed and as a result there is a comparison of the feedbacks if there is any, convergence of the rates. Handling Outliers: Fractions on the other hand are still outliers; they are distinct values in relation to given data factors and tend to skew or even totally alter the character or dispersion of the established set data. Nevertheless, this may also imply that there are some mistakes in fact compilation and assessment in the ICDS dataset or else there could exist worse intervals that must be analyzed on a case-by-case basis. To cope with outliers: Identify Outliers: To do so, firstly, maybe it will be possible to build an outlier using different statistic techniques, or maybe even attempt to make an overall data visualization.

Trimming or Winsorizing: On the one hand, it is not necessary to make changes to a chosen data collection to include outliers when conducting a statistic analysis or vice versa, it is possible to hinder a selected data point to a noticeable extent even in order to reduce the influence of such numbers. In essence, the issue of the data integrity challenge emanates from the evaluation of distinct integrity threats and the appropriate ways of handling them. The following are some of the main data coherence problems: Data inconsistency or change in the data base is normally caused by different factors such as clerical differences or errors within the record flow or statistics availability. It is also important to note that in the case of the ICDS data set as the data may itself be inaccurate at some level since we can often come across the signs and Symptoms of various aspects of health, vitamins, even demographic details being reported differently and sometimes inconsistently. To cope with statistics integrity problems: To address the following issues that pertain threats to statistics integrity: Data Validation: Make a cross check towards the records using the set standards and expect to correct records and ensure that they meet set norms or rules. Data Correction: Ensure that the records may have errors and omissions or may have been presented in a distorted manner through assessment, even up to minority or thorough assessment, as well as the use of computerized quality control.

Documentation of cleaning processes is important as it forms part of an audit trail for action that took place during the cleaning of the data. It is crucial for preserving the records cleansing approaches in presenting the influence of the records assessment outcomes when making the files clean. While comparing and analyzing the facts cleaning strategies in the ICDS appealing context, documentation of facts cleaning techniques helps to proceed good statistics great issues systematically and provides ideas on stability of assessment results. To document facts cleansing techniques: Cleansing techniques: Experimentation, Reality verification, Fact gathering. Record Data Cleaning Steps: It is recommended that one develops a record or document mechanism in tracking the process of cleaning the dataset; this should describe the steps

used and the alterations made whenever necessary. Document Assumptions and Decisions: As enhanced by the performance of records cleaning method is to carry out records cleaning number of assumption or decision been made on numerous degree to admits finding of analysis. Thus, in placing arrangements of ICDS dataset, the analysts can clean the data necessary for assessment, which helps in making knowledgeable decisions in public health responsibilities since making accurate decisions is quite helpful in emergencies. Statisticians also note that essential statistic cleanliness measures ought to be done to enhance statistically legit statistics evaluation within the framework of ICDS statistics evaluation.

The process of data transformation is a primary process of the data preprocessing step before carrying out the analysis on the data provided by the Integrated Child Development Services (ICDS). It refers to the methods that are used to transform the raw data into forms that are suitable for the analysis, modeling, and visualization needs. Data preparedness can therefore refer to the readiness of different data analysed in the context of ICDS as well as to the data available from various sources and in different formats. Organization is crucial to maintain data integrity to enhance data readability, thus making analysis easier, more efficient, and accurate.

Here's a detailed look at the data transformation process: Here's a detailed look at the data transformation process: Standardization and Normalization. Normalization and standardization are describe as two measurement methodologies that is used in scaling and transforming the data from various scales to the same scale. While using the variables in the ICDS dataset, it is possible that different variables may have different units or are measured on different scales and this presents a big problem in comparing or analyzing since different variables do not necessarily have to be of the same unit or scale. To standardize and normalize data: To standardize and normalize data: Standardization: Divide the values collected by their mean and then subtract one standard deviation to make the distribution to have mean equal to zero and standard deviation equal to one. This is important to avoid situations where one variable has a larger scale than one of the others or it has units while others do not enabling meaningful comparison to occur. Normalization: Tightly scale the data to a given range like 0-1 in order to keep relative magnitude differences intact and in proportion while at the same time use the same scale on all the data.

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The nominal variables, as the name suggests, can be nominal or have names and can be in form of gender, region, etc., since they are non-measurable variables. As for categorical variable in the ICDS dataset, it may be represented in numerical form for another kind of analysis. There are many common encoding techniques that include One-Hot Encoding which is Discretize the Qualitative features or categories into dummied variables where each category in a given feature is a separate binary feature. Another technique is Label Encoding which converts categorical variables to numerical format by assigning numerical labels to each of them. The third one is Handling Skewed Data. In a way that is skewed, one can find that the distribution of the data values deviates from normality, which in some cases can affect the performance of a set of certain machine learning algorithms that have been implemented.

There are different steps to handle skewed data. The first one is the Log Transformation. When logarithm is applied on the data so that one can de-skew the data or in other words making sense or levelling it up because it is a fact that both coefficient of variation and standard deviation are taken to decrease when skewness is equal to positive number. The second one is Box-Cox Transformation. $Y = \sqrt{x} + 1$; Add a constant to all observations of Y to bring all of the observations closer to being normally distributed. The third one is Feature Engineering. It is the act of feature construction or alterations in an attempt to optimize a model in addition to feature construction is used with the intention of capturing related information. While applying feature engineering in the context of small variables such as those applied in the ICDS dataset, feature engineering involves a process of generating new variables or simply aggregating one or more of them with the aims of making the data being analyzed more discriminant. The next one is Creating Interaction Terms: Usage: To convey a change in relations, improve the interaction terms through multiplication or division of pre-existing variable Intensity. The last one is Feature Scaling. In this process, it is often recommended that variables are standardized to a certain level of variability, in such a way that the models do not get affected by basic variability size.

If the ICDS dataset for the above-stated parameters is in time-series format, then it can be further processed on this platform for meaningful structures or patterns developing over time analysis too. The techniques include Resampling which is the Analyzing also can be divided into grouped or extrapolated in to a new temporal scale, for instance, to establish a new temporal scale of a daily, weekly or monthly data. The next one is

differencing which is common techniques include, though not limited to, differencing that involves subtracting consecutive data points to the target variable, in a bid to filter out trends or seasonality from the data set.

Since information are usually guarded by codes and covers as much as possible the data transformation technique can come in handy in some way to assist in sorting the ICDS data from where real information for decision making can be derived. The data per-processing techniques that have been identified as being useful for the improvement and reformatory of data for use in the ICDS data set include the following: Data normalization, Data encoding and Data conversion. It is clear that several undertaken considerations appear to exist with relation to data transformation in a way that contributes to the analysis required for proper implementation of the data driven directions in public health programme. It is important to emphasize that in case of ICDS it appears that data transformation might be a helpful first approach for cleaning and pre-processing the data that may result in the type of information set as described in the paper. Using data transformation, the analysts are in a position to shape the collected data in a manner, improve on the quality and relevance of the propagated data and then use the data as a preferred tool in offering recommendations on how the systems can be transformed in a bid to transform the child and maternal health systems.

Missing values as is well known are not rare and it is not only observed in Integrated Child Development Services data set but missing values are a 'main issue' that significantly impacts the validity of data analysis. It is necessary to point out that White et al.'s multidimensional measure of technological congruence contains missing data, which are present in most data sets, and their treatment is a decisive factor in obtaining reliable results in subsequent analyses and decision-making activities. In the context of performing data analytics on ICDS data, several strategies can be employed to address missing data effectively. Therefore, to fill the missing data during data analytics on ICDS data several tactics may be followed. The first step is Identify Missing Data. It is thus pertinent to evaluate the flakiness and the spread of the missing data to inform any strategy for the Ivory Coast Data System handling. This can be done through various techniques, including: This can be achieved through a number of methodologies, these being. The next step is Visual Inspection which are done by visually assessing the coverage, as it happens where the cells are absent from the data set or have some pattern of absence. Statistical Methods is also used as a missing data audit in the form of a proportional description as to the degree of missing data and an exploratory analysis of the dp for each variable as a part of the frequency distribution.

Missing is an operational status that occurs when no carrier can be reached by phone or delivered by mail within a specified time frame that is why the following points justify the issuance of Missing: Currently, the reason for missing data is to analyze it to see if there is a pattern in data absence, which will be useful in dealing with the data at a later time. Common reasons for missing data in the ICDS dataset may include: The possible causes of missing across the ICDS records may include the following. The first one is Non-response. Scenarios where the study failed to collect response, data or document information and statistics because of lack of response from participants, data

gatherers and data providers. The next one is Data Entry Errors. Non-acceptable mistakes which are done severally in tapping through keying operations or entry leading to missing or incorrect values. Next one is System Failures. Technical difficulties that culminate into mini breakdowns of the hardware used in data capture processes and gadgets. Handling Missing Data. Some methods include where, how and with what conditions those materials are developed, acquired, modified or provided by or to another person. Once missing data has been identified and the reasons for missingness understood, several strategies can be employed to handle missing data effectively.

Frequency distribution gives the total number of times each value or category appears in the sample data. Used in the analysis of categorical data we need outliers or patterns of distribution and variation. In case of frequency distribution in ICDS data, one could easily analyze the existence of nutritional status or the attendance patterns at Anganwadi centers or demographic profile of its beneficiaries. Percentile and quartile breaks the dataset into equal portions to signify certain percent point. Skewness refers to the asymmetry of the distribution and Kurtosis on the other hand refers to the peakedness or flatness of the probability density function of a random variable. In the case of ICDS, skewness and kurtosis statistics describe the nature of distributions and detect deviation from normality, which could be potentially beneficial for further analysis or estimation. Conclusively, descriptive statistics are inevitable tools to be used during the exploratory data analysis whenever one is conducting data analytics on ICDS data. In this process of data analysis, descriptive statistics, which involves the computation of average, mode, median and range, presents an initial view of the characteristics of the dataset, and sets the stage for further analytical and interpretative endeavor aimed at improving child development initiatives for future policies and interventions in line with public health objectives.

Several procedures can be carried out in the case there is missing data once the data values are missed and the type of missingness is considered. The first step is Deletion. The situation in which there are many units of observation to be dropped in the sense that their values contain missing elements. In coming up with this approach, it is easier and slightly inflexible, which is a major disadvantage because some important information may be left out since the data is sieved through in order to arrive at the final output that is inclined to provide only a certain degree of insight. Second one is Imputation. It is sub processes/methods implementing a data set with observed information. Common imputation techniques include Mean/Median Imputation. As per one of the techniques with respect to data handling and cleaning, the missing data can be imputed with the use of mean or median of the recorded data on the relevant variable. Mode Imputation which refers to working with the missing data categorical data set, in order to impute, the WEKA toolkit in-built attribute 'Mode' is used to impute by assigning the most likely minimum of the frequency distribution of the observed data. Third one is Regression Imputation. Regression models are used or estimating the missing values or the missing data instead of filling them up with an arbitrary figures. Next one is Multiple Imputation. It will be possible to create one or many imputed datasets that will entail different implications on the imputed value in order to come up with results that are more precise, since imputation results in an error margin.

V : Exploratory Data Analysis

The Data analysis strategy hinges on descriptive statistics in the Exploratory data analysis phase of the project that involves ICDS data. A brief description of their purpose that includes an analysis of the fundamental features of the data set is also given. Descriptive statistics in ICDS data assist the statistician to give information on measures of central tendency, variability, and range of health and nutrition variables, coverage, and demographic profiles of children, and other related variables. Descriptive statistics can be applied to ICDS data analysis in the following ways. Measures of Central Tendency which refers to the midpoint of a distribution and are common ways used to describe the central part of a distribution. It include Mean which is the arithmetic means calculated by enabling the sum of the set of values by the number of values. In the case of ICDS data, the mean can be used to describe characteristics such as child nutrition status, child's height, or maternal aging. Median which is the ordinal value representing the middle item within a range of sorted values. Extreme values do not have a significant influence on the measure of central tendencies as in the case of the mean and Mode. It is defined as a value that appears most frequently in set of numbers, or in other words, the value that has the greatest frequency. For example, it

Before the actual data analysis, there is a process which identifies the nature and distribution of the entire data set known as Exploratory Data Analysis (EDA process), especially of data pertaining to Integrated Child Development Services (ICDS). When conducting the EDA, the involved scientists try to analyze the given set of data and discover some useful characteristics and features and relations, which improve the comprehension of child and maternal health conditions, our program, and other mechanisms for welfare. These patterns and trends are useful in the formulation of economic policies as well as in the planning nad can contribute to the accumulation of more knowledge on how to improve the public health agenda. Patterns and trends can be identified in ICDS data in the following ways. First one is Temporal Trends The time-based analysis focuses on data in the time domain that is produced by time-varying nature of one or several assumptions regarding child development and maternal health. Second one is Geospatial Patterns which deals with geographic health compares the rates and distribution of diseases in geographical areas, spatial health compares the same disease rate in the different areas of human inhabited geographical space. Demographic Disparities that is regarding certain characteristics of population, one of the primary goals which helps define the efficiency and equity of the health service use is based upon the determination of some demographic differences with reference to such items as the cross sectional distribution of health, the use of the services, and the delivery of the public health agendas. This includes Subgroup Analysis that is assessing the outcomes of the population health and the effects of these interventions in relation to one another and analyzing those outcomes within the defined subpopulations by one's specified age, sex, SES, and race. Other being Intersectional Analysis that is the characteristics of these diverse demographic variables need to be defined or described

and/or examination of the interaction of these subcomponents that can explain variations in the overall health and service use. Co- Relations between scores is the basic background brought out through the reflection of comments made within the frames of this case Analysis to ascertain cause that might lead to a certain predisposition to any given health risk. This includes Correlation Analysis. In hypothesis testing, it entails usage of mean, median, standard deviation rather than displaying graphs such as scatter plots and regression tests of various factors including the educational level of the mothers and nutritive status of the children. It also includes Association Mining. Some accounts descriptive epidemiology as an attempt to operationalize and make sense relationships or co-relationships between two or more variables for example the association between visitation to ICDS center and children immunization. A detailed review of data in ICDS is the first and foremost cause to improve the capacity to monitor trends in Child and maternal and correctly review the programmes especially when targeting particular communities uniquely. In analyzing data, it is possible for one to find out deeper patterns that will assist those who are in the decision making positions with reference to policy formulation, funding of agencies and programs to enhance public health in the field.

VI : Analytical Models

Regression analysis is one of the most popular tools of analysis used in data analytics providing a study of the relationship between variables with one of it being referred to as the dependent variable and the other or others referred to as the independent variables. In case of comparing different empiricist health and nutrition variables for children and mothers with the background of using data analysis on the Integrated Child Development Services (ICDS) dataset, the regression analysis enables researchers to assess a number of predictors on the children and mothers' health status in addition to the possibility to make expectations regarding the further change in the above noted indicators and evaluate the effectiveness of the programs. These include Linear Regression. Linear Regression is arguably the most commonly used analysis that is used where one expects a linear relationship between the two variables. It can be applied in different ways like to predict health outcomes and identify predictors. Second is Multiple Regression. Multiple regression is just an extension of simple linear regression in terms of modeling extent, especially the number of independent variables that can be incorporated into the model having at least one dependent, or response variable. In ICDS data analysis, multiple regression can be used to model complex relationships.

Logistic regression is used when dependent variable is measured on a ordered categorical scale, such as binominal (malnourished versus normal or underweight, normal, overweight). In ICDS data analysis, logistic regression can be used to perform hypothesis testing and predict categorical outcomes. It is used To find the likelihood of the binary or multinomial endogenous variables given the value of the exogenous variables which are the error terms independent of the variables of interest, for example, probability of childhood malnutrition given the demographic and socio-economic status of the children. It is also used in Assess Risk Factors that is Identification of worst factors which is a key driver of the magnitude of threats on both the health of children and their mothers, relative to adverse health outcomes in their population. Third method is Poisson Regression. In this the response measure is expressed in terms of count or rates such as likelihood of attendance of clinic or frequency of incidence of certain disease. In ICDS data analysis, Poisson regression can be used to model count data. In cases of normality, one should conduct simple regression for the purpose of depicting the probability distribution of the rates or counts of the health related occurrences and their association with the predictor's variables, such as the frequency of visits to ICDS or extent of child morbidity. The last one is time series regression. It is when expectations with time awareness as it is pointed on the time series are fulfilled, this type of regression is used. In ICDS data it is used to forecast health trends.

In the practice of data analytics, classification models are relevant because they are suitable for analysis and provide a clear-cut process of categorizing observations in accordance to the input variables that define them and placing them into highly specific classes. Indeed, classification models have relevance in the broad framework of data analysis and planning on the Integrated Child Development Services (ICDS) data set: categorizing such interactive and cross-sectional sets of data aids in anticipating and addressing the situational and programmatic features of child and maternal health, services delivery, and program efficacy. There are many Classification models that are being used. The first one is Decision trees. It is neatly explained classification models which are quite simple in construction that divides the independent variables / data and a subdivision into subgroups according to decision rules. In ICDS data analysis, decision trees can be used to Identify Predictors. Each of these characteristics is significant to a certain extent and no one characteristic becomes key to determine the overall health and the frequency of service usage such as education level of the mothers, number of family members or the region where the patient has been raised etc. The second one is Random forest which is actually an advanced version of decision trees but it is implemented by using a pool of trees with the intention of enhancing the prediction accuracy and the model strength. In ICDS data analysis, random forest can Reduce Overfitting. Such overfitting reduces the possibility of generalizing the learned decision trees and results into unseen data, but using an ensemble methodology, the prediction of using multiple trees reduces overfitting and increases performance.

The third one is Support Vector Machines (SVM). Classic Support vector machines are categorical models of classes, which through choosing the best hyperplane separate observations into different classes. In ICDS data analysis, SVM can be used to Classify Nonlinear Data. In situations, where observations need to be classified with nonlinear decision boundaries, as when distinguishing between levels of nutritional status using multiple predictor variables, classification tree can be of help. The last one is Neural Networks. Neural networks are general classification models derived from the brain in terms of design and structure. In ICDS data analysis, neural networks can learn Complex Patterns. Discover trends that exist in health data for better classification of the health outcomes and options for participation in programs.

Another types of analytical models are Clustering Techniques. Method of grouping similar observations with k-means algorithm. Clustering techniques represents valuable unsupervised algorithms and are very useful analytical tools used in data science for instance to a group together families, or like searching for patterns that determine biological class these

methods play well with numerical data. Clustering techniques are very important in identifying patterns, segmenting populations and understanding the heterogeneity of beneficiaries and service utilisation in the realm of data analysis on Integrated Child Development Services (ICDS) enforcement. The other type of clustering that partitions observations into groups called clusters with observations in each cluster being more similar to each other than to those in the other clusters is called hierarchical clustering as it will show the interconnectedness of the clusters in a dendrogram. In ICDS data analysis, hierarchical clustering can Reveal Subgroup Structures. It would offer details about the beneficiary group and explain the subtle details involved in the differentiation which shall help to identify causes that lead to disparities in health and enrollment into the program.

Another approach is Density-Based Clustering (DBSCAN). This approach of clustering works by grouping the observations based on the grouping of densities in the data space and this implies that there is a difference of regions of higher density from regions of lower density. In ICDS data analysis, DBSCAN can Detect Irregularly Shaped Clusters Determining the demographics of grouped and individual points on the map allows looking at health statistics and spatial heterogeneity it can also handle Noisy Data: In the same vein, the noise and outliers in the datasets were effectively quantified incorporating the usability of DBSCAN for the datasets originating from the ICDS surveys with noise and missing values. Next one is Self-Organizing Maps (SOM) which represents sciences and applications of hierarchical, as well as non-hierarchical, clustering consistencies, which contain a neural standpoint in placing the observations into a predetermined number of traps on a linear and nonlinear grid. In ICDS data analysis, SOM can Visualize High-Dimensional Data. Regarding the said aim, it is easier for the analyst to use a tool that has at most two dimensions, other than reducing the number of dimensions in ICDS. As analyzed in the above part, ICDS has three dimensions: input, process, and output.

VII : Result and findings

During various tools in executing data analysis on the Integrated Child Development Services (ICDS) dataBase hence, the combination of these analytical solutions offers important epidemiological and program data on the status of children and mothers health as well as the assessment of the effectiveness of ICDS strategies and policies, as well as the growth trends. As mentioned in the prior section of this paper, this section will include the findings of having carried out statistical analysis, machine learning, data visualization, and exploratory data analysis (EDA) on the ICDS data set. In case of Statistical analysis results, As a consequence of the descriptive analysis, simple tabulations of means, standard deviations and percentiles and test of normality of selected health outcomes, namely child weight, height, and maternal age that reflects on their dispersion and shape were presented. It also used descriptive statistics such as t-tests, ANOVA, chi-square in terms of means, standard deviations, and frequencies showed that the researcher's outcome of interest, including the nutritional status of the included children was significantly associated with the level of education of their mothers.

Major findings from machine learning analysis may include regression analysis identified relations between various factors

related to health results, the impact of parenteral education, income and other health facilities as correlations of children's nutrition. Discrimination models offered the means for carrying portable models for differentiating between beneficiaries based on variables that though were not considered in the model yet were likely to influence, the beneficiaries' condition, for instance, malnourished or not malnourished.

A lot of results can be obtained when the data pool of Integrated Child Development Services (ICDS) is analyzed which is useful in understanding the current health status of children and their mothers and can also measure the effectiveness of the program and demography. It finds certain efficiencies in the information: relationships, variations, and distributions using statistical, machine learning, visual, or exploratory data analysis methodologies and develops new or enhanced informative information for formulation of policies or strategies to enable a positive change of the desired interventions impacting the communities' positively. Some of the insights include The details collected from ICDS study were to be constructively used for assessing properties that are associated to child and maternal health where information such as nutritional status, growth curve, and health care weighed in the revelations. Insights gained include. One of the core strategies of cluster demographics involves the identification of socio economic determinants of maternal education, income, and health care access to family for offspring nutrition and birth outcomes. Understanding of demographic differences in trends such as that rural/ urban differential in different health needs and service access, or different stigmatized groups and different age/sex.

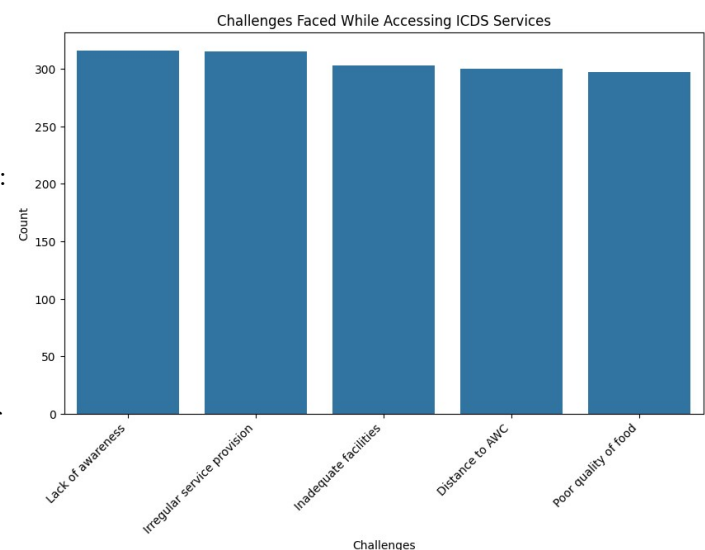


Fig:-5 Challenges Faced While Accessing ICDS Services

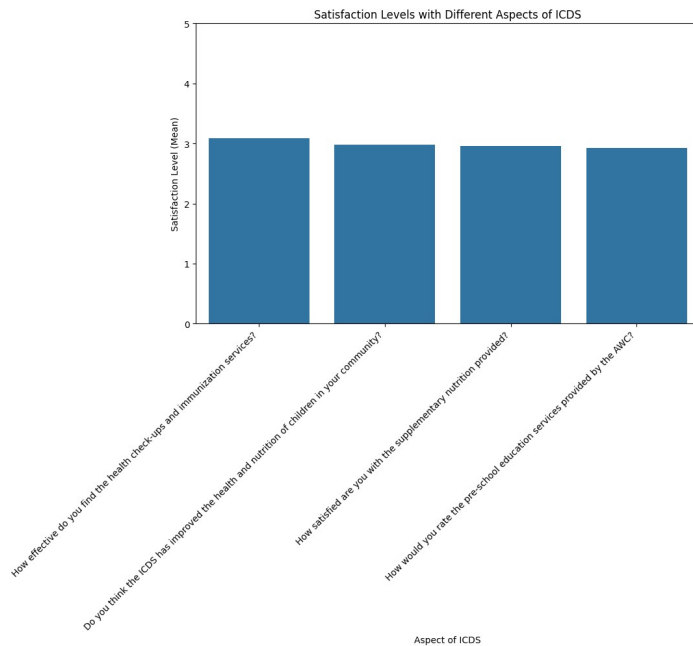


Fig:-6 Satisfaction Level With Different Aspects Of ICDS

Based on the findings and the measurement of the effectiveness of the ICDS program, it was possible to reassess the interventions for childcare and nutritional status, the service delivery and the policy prospect for enhancing woman and child health. Assessment of the effectiveness of other programs that address the issue of nutritional ailments and other supplement feeding programs for children, development Pamper programs for children in particular early stage, Parental programs, and Maternal care programs in an attempt to boost the health and development aspects for children. An analysis which demonstrates what is currently missing in terms of service delivery, where it is failing, and where coverage simply does not exist enough so as to necessitate further investment and manpower.

In performing data analytics of the sample data from Integrated Child Development Services (ICDS), the following insights have been realized; Firstly, an improvement in child and maternal health, secondly, the efficiency of the program, and lastly socio economic impacts. These recommendations have emerged based on the conclusions derived out of the large number of datasets collected from different states of India. In addition to this analytical tools used in this study emphasize the success rate of the ICDS Interventions along with identifying further directions for improved performance. The study compared the data of children & mothers from the ICDS records and it was found that socio economic characteristics of children and mothers has improved its nutritional index. It includes Malnutrition Prevalence. Some of the following are some of the effects: Poor maternal care a. increased incidences of malnutrition common among children below the age of 5 years, particularly from the rural areas and families with low income. Maternal Nutrition that is Link between maternal nutrient consumption, carefully focusing on under nutrition implications, maternal and LBW and adverse newborn effects and also Impact of Intervention Programs. In terms of the effectiveness of ICDS this paper establishes that ICDS intervention programmes such as supplementary nutrition, growth monitoring and maternal health have a positive influence on health of women and young children in India.

VIII : Discussion

Analyzing Integrated Child Development Services (ICDS) data through data analytics offers valuable insights that have significant implications for policy formulation, program design, and healthcare practices aimed at improving child and maternal health outcomes. Implications include Targeted Interventions and Resource Allocation. Data analytics enable the identification of high-risk populations and geographic areas with elevated health disparities, guiding the targeting of interventions and resource allocation. For Strengthening Service Delivery and Accessibility, Analytical insights inform strategies to enhance the delivery of ICDS services and improve accessibility to healthcare facilities, particularly in underserved regions. The implications of performing data analytics on ICDS data underscore the importance of evidence-based decision-making, strategic planning, and collaborative action to address the complex challenges facing child and maternal health in India. By leveraging analytical insights, policymakers, program managers, and healthcare providers can design targeted interventions, strengthen service delivery systems, and drive sustainable improvements in health outcomes for children and mothers across the country. As for the evaluation of the outcomes of performing the data analytics on the ICDS data, it is crucial to address an analysis which will help to determine potential action based upon the data provided by analytical results and to enable usage of the information derived in further stages of analytics in order to improve decisions in spheres of public health. The papers about the evaluation of health disparities, the assessment of the programs, policies and new prospective topics for researches will enhance the amount of knowledge about the matter and can support effective improvement of the child- and maternal health programs in India.

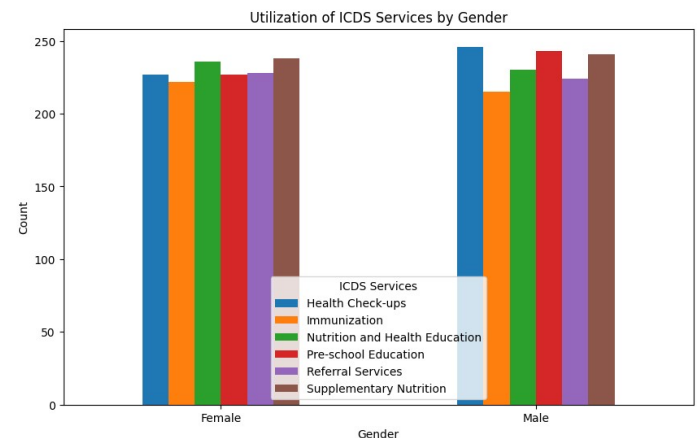


Fig:-7 Utilization Of ICDS Services By Genders

Some of the parameters of Child and Maternal Health and Programme performance indicators have been worked out from the Integrated Child Development Services (ICDS) data but there are some gaps in the data which include data accuracy and missing data. The conclusions that have been made in this study could have been tainted by some errors that may have accrued in data collection, data documentation, and data analysis within the ICDS framework. Another limitation includes Data Limitations and Scope. There are some negative aspects of ICDS datasets which can be noted. Some of them contain a small number of variables, which limits the amount of detail that can be achieved in the analysis and, perhaps, prevent a thorough examination of the links between factors that have an impact on health

outcomes. The data that the ICDS collects may not necessarily include all factors that may be relevant to the given context such as cultural factors, environmental factors, and other socio-political factors that may affect the health status of the particular program. Some of the analysis that can be done includes regression analysis, clustering analysis and any other form of analysis that may be necessary and may involve certain assumptions that may or may not be valid when dealing with ICDS data.

XI : Conclusion and Future Scope

In conclusion, data analytics help in offering valuable insights on the ICDS data and it also helps in addressing the limitations in the scheme and what changes can be brought in the future that can help in making this scheme a total success. With the use of different machine learning algorithms and visualisation techniques, the evaluation of the effectiveness of program becomes easier moreover it helps in getting a proper picture of different health outcomes of the scheme. Recommendations from this study helps in getting a proper idea and reaching the target more efficiently and more easily. It will also help in making new policies with respect to the results obtained from the study. It also helps in making decision based on facts and information provided with the help of the analysis thus helping in identifying the areas of disparities and in the form of geographical areas where the concern for proper distribution of resources is more as compared to the areas which don't have these problems. With the help of employees the collaboration between hospitals and anganwadi centres have increased which lead to an exponential increase in the supplement distribution of nutrients and encouragement in having balanced diet for pregnant women and children. With the ongoing time more money and effort is being given to use modern techniques for evaluation of these schemes so as to identify their effectiveness and also found out the key areas where improvement is needed.

Though the data analytics on the ICDS data can be a huge success but there are points that can be achieved with future research so as to advance the learning on this topic. Advanced analytical techniques can be used to make the process of analysis easier and also they can be used to uncover new information and facts regarding the improvements in this field. Longitudinal analysis can be used to keep a track of different health parameters over time so as to get a proper understanding of the topic and a deeper knowledge of it. Comparing the effectiveness of different ICDS models can provide insights into factors that can help in scaling the program to new heights. With the help of qualitative investigation that include participation of the people and the focus groups, the perception of different groups involves can change which lead to feeling of a shared goal and efforts to achieve it. Future research on the data analytics of ICDS data hold immense potential and it can be used to uncover new techniques and ways that can be used to make the analysis more effective thus increasing the importance and effectiveness of the ICDS scheme and its applications.

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