STATISTICAL ANALYSIS OF MONTHLY CHILDREN IMMUNIZATION FROM 2022 TO 2024

(A CASE STUDY OF BASIC HEALTH CENTER, OLOJE, ILORIN)

BY

ABDULAZEEZ MUNIRAT OYINDAMOLA

ND/23/STA/FT/0096

A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF STATISTICS

INSTITUTE OF APPLIED SCIENCES (IAS) KWARA STATE POLYTECHNIC, ILORIN.

IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF NATIONAL DIPLOMA (ND) IN STATISTICS

JUNE, 2025

CERTIFICATION

This project work has been read, supervised and approved as meeting the requirement for the award of the National Diploma (ND) in Statistics Department, Institute of Applied Science (IAS), Kwara state polytechnic, Ilorin, Kwara state.

---------- ----------
MISS AJIBOYE R.A DATE
Project supervisor

---------- ----------
MRS. ELEPO T.A DATE
Head of Department

---------- ----------
EXTERNAL EXAMINER DATE

DEDICATION

This project is dedicated to the Almighty God and to parent (Mr. and Mrs. Abdulazeez).

ACKNOWLEDGEMENT

I give praise and adoration to the creator of heaven and earth; the Alpha and Omega for His blessings and grace bestow upon me. And for the wisdom, knowledge and understanding given to me to be able to accomplish this task.

My profound gratitude goes to my supervisor, the person of Miss Ajiboye R.A for her assistance and guidance during this research work, and also to our able head of department Mrs. Elepo T.A and to every one of my lecturers that taught me everything I know in statistics and all, Dr. A.B Aiyelabegan, Dr. Olarinoye, Dr. D.O, Beki, Mr. K.N Yusuf, Mr. F.G Safihi, Pastor Kuranga, L.J, Mr. N.A Alao, Mrs. G.A Yusuf, Mr. Musa O.Y, Mrs. F.B Abdulrahman, Mr. Salami O.O, for the good academic support given since the beginning of our program till point on time.

My special gratitude goes to my parents (Mr. & Mrs. Abdulazeez) my brothers (Kamaldeen, Olarenwaju,Jamiu,Abdulrosheed) my friends (Iqmat,Bukola,Yusuf) been there for me throughout the process of everything in my life.

And also for their support, financially, morally and spiritually. I say a BIG Thank to you and may you reap the fruit of your labour. Amin…….

TABLE OF CONTENTS

ABSTRACT

This study presents a statistical analysis of monthly child immunization data collected from the Basic Health Center, Oloje, Ilorin, Kwara State, between 2022 and 2024. The primary objectives were to describe the immunization trends, visualize the data using multiple bar charts, and determine whether there were significant differences in immunization rates across the three years. Descriptive statistics revealed fluctuations in monthly immunization numbers, with 2023 recording the highest average. A one-way ANOVA test was conducted to assess the statistical significance of these differences. The results showed a significant variation in the mean number of children immunized across the years (F = 64.317, Sig-value (.000) < p-value (0.05)), indicating that changes in policy, awareness campaigns, vaccine availability, or other external factors may have influenced the rates. These findings provide valuable insight for health authorities to better plan and allocate resources for sustained immunization efforts.

Keywords: *Child immunization, statistical analysis, one-way ANOVA, descriptive statistics, public health, Kwara State, vaccine coverage, Basic Health Center, Oloje, SPSS analysis*

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Immunization remains one of the most effective public health interventions known to humankind, significantly reducing the incidence and impact of infectious diseases across all age groups. It is especially crucial during childhood, as early immunization protects children from life-threatening diseases such as measles, diphtheria, tetanus, hepatitis, and tuberculosis. In Nigeria, national and state-level efforts have been directed toward improving immunization coverage, especially in underserved areas. However, regional variations in uptake and administration remain a pressing concern, influenced by several socio-economic, cultural, logistical, and infrastructural factors.

Basic Health Centers (BHCs) serve as the primary point of contact for rural and peri-urban populations in accessing immunization services. The Basic Health Center at Oloje, located in Ilorin, Kwara State, has played a pivotal role in delivering these essential services to children in the area. Monitoring and evaluating immunization trends at such a center is essential for ensuring that no child is left unprotected and that vaccination campaigns and resources are optimally deployed.

From 2022 to 2024, routine immunization data were recorded at the Basic Health Center, Oloje. These monthly records provide insight into the number of children immunized and serve as a basis for assessing the effectiveness of immunization outreach and community health programs. This dataset offers a unique opportunity for statistical analysis, which can uncover patterns, detect anomalies, and help policymakers make evidence-based decisions.

Statistical analysis allows for more than just numerical summaries; it facilitates the identification of seasonal trends, peak and low periods of immunization, and whether significant differences exist in monthly turnout across different years. For instance, certain months may consistently show

higher or lower immunization numbers, hinting at potential operational, environmental, or societal factors influencing turnout.

Descriptive statistics help summarize and present the data in a meaningful way, using measures such as the mean, median, and standard deviation. These statistics offer a snapshot of the distribution and spread of immunization figures over time. Beyond descriptive analysis, visual representations—such as bar charts—enhance understanding by making trends more accessible, especially for non-technical stakeholders.

Furthermore, inferential statistical tools, such as the Chi-square test, are critical in determining whether observed differences across months and years are statistically significant or simply due to chance. This kind of test will help determine if there's a consistent difference in immunization numbers across months over the years studied. For example, if February consistently shows higher figures and July consistently shows lower, a Chi-square test can validate whether this pattern is statistically relevant.

The importance of this study cannot be overemphasized. By understanding the fluctuations in immunization data across months and years, health authorities can develop better policies to address low-coverage periods, improve vaccine supply chains, and increase community engagement. This analysis can also guide resource allocation, staff scheduling, and the planning of immunization outreach programs.

Moreover, given the recent global health challenges such as the COVID-19 pandemic, which disrupted many essential health services, including immunization schedules, analyzing data from 2022 to 2024 is timely. It helps assess how well the system recovered and whether there are long-term effects on immunization behavior or service delivery.

This study is designed not only for academic purposes but also for practical application in public health planning. By utilizing basic but powerful statistical tools, we aim to shed light on the performance of local health systems in immunizing children and provide data-driven recommendations that can enhance service delivery in Basic Health Centers like that of Oloje.

In conclusion, the integration of statistical techniques in analyzing health data is invaluable in assessing program effectiveness and identifying critical gaps in service delivery. Through descriptive statistics, visual tools like bar charts, and inferential methods such as the Chi-square test, this study seeks to contribute meaningful insights into the monthly immunization trends at Basic Health Center, Oloje, Ilorin, Kwara State. Ultimately, this will support efforts to ensure that every child in the region has access to life-saving vaccines, irrespective of the time of year.

1.2 Statement of the Problem

Despite continuous efforts by health authorities, disparities still exist in monthly immunization figures at the Basic Health Center, Oloje. There is a lack of comprehensive statistical evaluation of these monthly trends to determine when immunization uptake is highest or lowest. Without such insight, planning and resource allocation remain inefficient. This study addresses the need for a structured statistical analysis of immunization data from 2022 to 2024 to identify patterns and test for significant differences across months and years.

1.3 Aim and Objectives of the Study

Aim of the Study:

To conduct a statistical analysis of monthly child immunization data from 2022 to 2024 at the Basic Health Center, Oloje, Ilorin, Kwara State.

Objectives of the Study:

- **i.** Present descriptive statistics of monthly immunization data.
- **ii.** Provide a visual representation of immunization trends using a multiple bar chart.
- **iii.** To determine if there is a significant difference between the mean of children immunized per month across the year of studied

1.4 Significance of the Study

This study is significant as it provides actionable insights into child immunization patterns at the Basic Health Center, Oloje. By identifying months of high and low turnout, health authorities can improve planning, staffing, and awareness campaigns. It also highlights the utility of statistical tools in public health monitoring and evaluation. The findings can help strengthen immunization strategies, ultimately increasing vaccination coverage and reducing preventable childhood illnesses in Ilorin and similar communities.

1.5 Scope and Limitation of the Study

This study focuses exclusively on monthly immunization data recorded at the Basic Health Center in Oloje, Ilorin, from January 2022 to December 2024. The scope includes the use of descriptive statistics, multiple bar charts, and Chi-square testing to assess trends and significant differences over time.

Limitations include the reliance on secondary data, which may be subject to reporting errors or inconsistencies. The study also does not explore factors such as vaccine type, gender, or socio-economic status of the children immunized

1.6 Definition of Terms

- **Immunization:** The process by which an individual is made immune or resistant to an infectious disease, typically by the administration of a vaccine.
- **Vaccine-Preventable Diseases (VPDs):** Diseases that can be prevented through immunization, such as measles, polio, and tetanus.
- **Descriptive Statistics:** Statistical methods that summarize and describe the main features of a dataset, such as mean, median, and standard deviation.
- **Chi-Square Test:** A statistical test used to determine if there is a significant association between categorical variables.

- **Multiple Bar Chart:** A graphical representation used to compare different groups across multiple categories using parallel bars.
- **Health Facility:** A place where healthcare services are provided, in this context, the Basic Health Centre, Oloje Ilorin, Kwara state.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Immunization remains a cornerstone of global public health, particularly in reducing child morbidity and mortality from preventable diseases. As vaccination programs continue to evolve, researchers and healthcare providers emphasize the importance of evaluating their performance through statistical methods. This chapter explores relevant literature on childhood immunization, statistical evaluation of public health data, age-specific immunization trends, and the effectiveness of routine immunization strategies in Nigeria and globally.

2.2 Review of Related Literature

Global Perspective on Childhood Immunization

Childhood immunization is a fundamental strategy for reducing the burden of infectious diseases globally. According to the World Health Organization (WHO, 2021), immunization prevents an estimated 4 to 5 million deaths annually by protecting children from life-threatening diseases like measles, diphtheria, polio, and pertussis. The introduction of vaccines into national health systems has significantly lowered the incidence and mortality rates of many infectious diseases. For instance, the Global Polio Eradication Initiative (GPEI) has helped reduce polio cases by over 99% since its launch in 1988.

Another critical issue is data quality. The WHO (2022) reports that many developing countries lack robust immunization registries, leading to under-reporting or over-reporting of coverage. In such settings, statistical methods play a crucial role in verifying, analyzing, and interpreting immunization trends.

In summary, the global literature highlights the life-saving benefits of immunization, while also acknowledging persistent challenges such as data inaccuracies, inequality in coverage, and the

impact of public health emergencies like pandemics. Statistical analysis of immunization data is thus essential to guide policies and interventions aimed at improving child health outcomes.

Immunization Coverage in Nigeria

In Nigeria, childhood immunization is coordinated by the National Primary Health Care Development Agency (NPHCDA) and implemented through the National Program on Immunization (NPI). Despite free access to vaccines, Nigeria continues to struggle with poor coverage, especially in rural and hard-to-reach areas. The Nigeria Demographic and Health Survey (NDHS, 2018) reported that only 31% of children aged 12–23 months were fully immunized, with significant disparities across geopolitical zones and socioeconomic classes.

Several studies attribute low immunization rates in Nigeria to factors such as maternal education, geographical access to health centers, socio-cultural beliefs, and misinformation. A study by Adedokun et al. (2020) found that children born to mothers with no formal education were less likely to be fully immunized. Furthermore, urban children generally have higher immunization rates than their rural counterparts due to better access to healthcare and information.

In rural areas like Ilorin East in Kwara State, outreach programs and periodic immunization campaigns have been used to complement routine services. However, coverage often remains inconsistent due to logistical constraints, seasonal migration, and health worker shortages. The role of community engagement and mobile health interventions has shown promise in bridging these gaps.

Therefore, understanding immunization patterns through statistical tools is essential in a country like Nigeria, where multiple socio-economic and systemic factors hinder optimal vaccine coverage. This research aligns with national health priorities by using data to assess progress, highlight disparities, and suggest improvements in local immunization programs.

Statistical Approaches to Immunization Data

Statistical analysis of health data is essential for uncovering trends, evaluating program effectiveness, and informing public health interventions. Immunization data, in particular, benefits significantly from statistical evaluation as it deals with time-based, age-disaggregated, and population-specific records. Common statistical tools used include descriptive statistics, bar charts, trend analysis, and hypothesis testing methods such as the Chi-Square Test of Independence.

Descriptive statistics help summarize the key characteristics of immunization data. Measures such as mean, median, and standard deviation provide a clear view of the distribution of immunized children across years and age categories. Visual tools like multiple bar charts are effective in identifying fluctuations and patterns in immunization coverage over time.

Inferential statistical techniques are crucial in testing hypotheses about associations between categorical variables. The Chi-Square Test, for instance, can determine if there is a significant relationship between a child's age group and the year of immunization. According to Ogunyemi and Akindele (2019), such methods offer a robust way to detect disparities or consistencies in healthcare delivery across different population segments.

In conclusion, statistical analysis is indispensable in immunization studies, offering tools to describe, visualize, and test relationships within health data. It enables evidence-based planning and resource allocation, especially in settings with limited resources and varying program effectiveness like Nigeria.

Data Visualization in Health Studies

Data visualization is a powerful tool in public health research and service delivery, offering a way to present complex information in a clear and interpretable format. In immunization studies, visual representations such as bar charts, line graphs, and heat maps are commonly used to track coverage levels over time, across locations, and among different demographic groups.

Multiple bar charts are especially effective when comparing multiple groups—such as age categories—across several time points, like years. According to Krum (2018), visualized data increases the likelihood of accurate interpretation and decision-making by non-technical stakeholders, including policymakers and local health administrators.

In a study on immunization patterns in Uganda, Nanyunja et al. (2017) used multiple bar charts to illustrate disparities in immunization coverage across districts and over a five-year period. The visual representation highlighted not only the temporal decline in certain regions but also showed how specific age groups were consistently underserved. This prompted the Ministry of Health to launch targeted interventions for the lagging areas.

Similarly, Adeyemi and Bakare (2020) emphasized that visual tools are essential for reporting facility-level data. In their review of routine immunization data in Southwest Nigeria, they noted that bar charts were useful for community mobilization, allowing health workers to demonstrate progress or setbacks in a way that community members could easily understand.

In summary, data visualization is a necessary companion to statistical analysis in immunization studies. It supports transparency, fosters community engagement, and enables evidence-based decision-making at all levels of the health system.

Impact of External Events on Immunization Programs

External events, particularly public health crises and natural disasters, have significant implications for immunization programs. These events can disrupt vaccine supply chains, limit access to healthcare facilities, and shift public health priorities, resulting in decreased immunization coverage. One of the most notable disruptions in recent history was the COVID-19 pandemic, which severely affected routine immunization services globally.

According to WHO and UNICEF (2021), over 25 million children missed at least one routine vaccine dose in 2021 alone, largely due to COVID-19-related service disruptions. Lockdowns, fear of contagion, and the redirection of healthcare resources to pandemic control efforts all contributed

to declines in vaccine uptake. These impacts were especially felt in developing countries with already fragile health systems.

Statistical analysis can help quantify the impact of these events. For instance, a significant drop in immunization numbers in 2020 might be attributed to COVID-19, and statistical tests can be used to assess whether these changes were statistically significant or part of a larger trend. This helps in separating random fluctuations from real, event-driven changes.

Understanding the impact of external events is crucial for building resilient immunization programs. It allows health planners to prepare contingency strategies, such as mobile vaccination teams, catch-up campaigns, or remote monitoring systems to maintain coverage during crises.

In conclusion, immunization programs do not operate in isolation from the broader socio-political environment. Disruptions such as pandemics, economic instability, or misinformation can drastically affect vaccine uptake. As this study evaluates immunization trends from 2020 to 2024, it is essential to account for such external factors when interpreting the results and recommending policy actions.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the methodological framework adopted for the statistical analysis of child immunization data from the Basic Health Center, Oloje. It includes the techniques used to analyze monthly immunization records from 2022 to 2024. The section provides details on the sources of data, the statistical tools employed descriptive statistics, multiple bar charts, and hypothesis testing using the Chi-square test and the methods for data presentation.

3.2 Statistical Techniques

This study applies both **descriptive** and **inferential** statistical techniques to examine the immunization data of children.

i. Descriptive Statistics

Descriptive statistics provide a summary of the basic features of the data collected. The following descriptive measures are employed:

- **Frequency distribution**: Shows how often each age group was immunized within each year.
- **Measures of central tendency**: Mean, median, and mode help to determine the average number of children immunized.
- **Measures of dispersion**: Standard deviation, variance, range (minimum and maximum) are used to understand the variability in immunization numbers across age groups and years.

These values help identify age groups or time periods with higher or lower immunization coverage, thus supporting trend analysis.

ii. Data Visualization

To enhance the clarity and communicability of the analysis, **multiple bar charts** are used to represent the immunization figures across age groups and years. This visual method helps to compare the data across simultaneously. It allows quick identification of peak immunization periods, underperformance, or trends in different months categories over the three-year span.

Inferential Statistics

Inferential statistics go beyond merely describing the data. They help to determine whether observed differences or associations in the dataset are statistically significant or occurred by chance.

ONE-WAY ANOVA:

One-Way Analysis of Variance (ANOVA) is a statistical method used to compare the mean of three or more independent groups to determine if at least one group mean is significantly different from the others. It tests the effect of a single categorical independent variable (factor) on a continuous dependent variable.

When to Use One-Way ANOVA:

- You are comparing three or more groups (e.g., types of diets, treatment groups, teaching methods).
- Each group is independent (i.e., participants belong to only one group).
- Your outcome variable is continuous (e.g., test scores, weight, blood pressure).
- You suspect that at least one group may be different from the other

Hypotheses for ANOVA

Null Hypothesis (H_0): $\mu_1 = \mu_2 = \mu_3 = ... = \mu_k$ (all group means are equal)

Alternative Hypothesis (H_1): At least one group mean is different

An ANOVA (Analysis of Variance) table is used to summarize the results of an ANOVA test, which examines whether there are statistically significant differences between the means of three or more groups. Here's a standard format for an **ANOVA table**, along with explanations for each component:

Source of Variation	**Sum of Squares (SS)**	**Degrees of Freedom (df)**	**Mean Square (MS)**	**F-ratio (F)**	**p-value**
Treatment	SSTreatment	t−1t - 1	SST / (t - 1)	MST/MSE	p-value
Block	SSBlock	b−1b - 1	SSB / (b - 1)	MSB/MSE	p-value
Error	SSError	(t−1)(b−1)(t - 1)(b - 1)	SSE / (t-1)(b-1)		
Total	**SSTotal**	**bt − 1**			

Hypothesis Testing

- **Null Hypothesis (H_0):** There is no significant difference in the mean of the total number of children immunized per month across the years.
- **Alternative Hypothesis (H_1):** There is a significant difference in the mean of the total number of children immunized per month across the years.

Significance Level (α): 0.05 (5%)

3.3 Source of Data

The data used for this study is secondary data obtained from official monthly immunization records maintained by the Basic Health Center, Oloje, Ilorin, Kwara State, covering the period from January 2022 to December 2024**.**

3.4 Data Presentation

The immunization data is organized in a table format showing the number of children immunized each month over the three-year period:

Month	2022	2023	2024
January	150	150	160
February	250	220	175
March	140	110	95
April	125	120	109
May	196	159	107
June	123	210	123
July	89	123	160
August	122	201	180
September	118	167	200
October	111	145	214
November	210	223	111
December	189	123	120

Data Source: Basic Health Centre, Oloje Ilorin.

CHAPTER FOUR

DATA ANALYSIS AND INTERPRETATION

4.1 Introduction

This chapter presents a comprehensive analysis of the immunization data collected from the Basic Health Center, Oloje, Ilorin, covering the period from January 2022 to December 2024. The data analysis includes descriptive statistics, visual representation using a multiple bar chart, and inferential analysis using the Compare mean and One-Way ANOVA. The aim is to summarize the data, visualize trends across months and years, and assess whether monthly variations in immunization are statistically significant.

4.2 Data Analysis

Descriptive

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Total number of children immunized	5528	89	250	165.15	43.328
Valid N (listwise)	5528				

Total Number of Children Immunized per Year

Year	Total
2022	1,823
2023	1,951
2024	1,754
Total	**5,528**

Monthly Mean and Standard Deviation

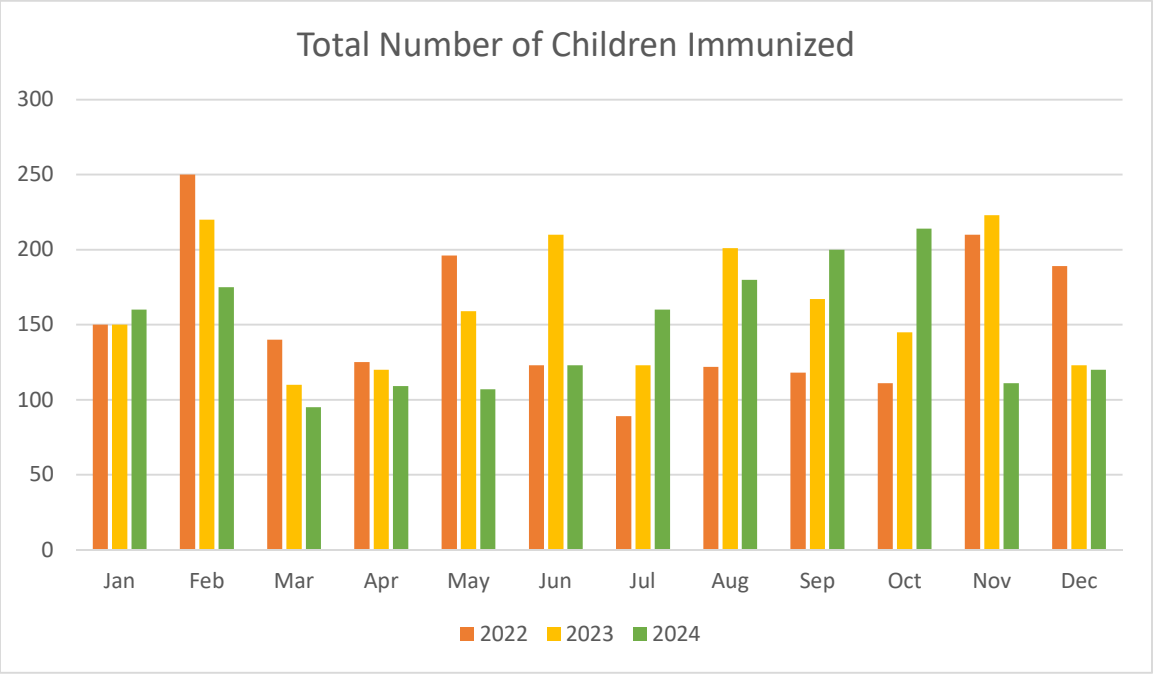
Year	Mean	Standard Deviation
2022	151.91	48.33
2023	162.58	41.43
2024	146.17	40.28

Interpretation

The highest average immunization occurred in **2023**, with a monthly mean of **162.58**, **2022** had the highest variability in monthly immunization (SD = 47.08). The lowest average occurred in 2024, suggesting a possible drop in outreach, awareness, or availability.

Data Visualization (Multiple Bar Chart)

A multiple bar chart is used to compare monthly immunization figures across the three years. Each cluster of bars represents a month, and the bars within the cluster show values for 2022, 2023, and 2024 respectively.



Interpretation:

- The chart clearly shows variations in immunization numbers between months and years.
- For example, February consistently recorded high immunization counts across all years.
- Months like July and March typically had lower immunization figures, especially in 2022 and 2023.

- An upward trend is observed in the last quarter of 2024, with October and November showing higher immunization numbers compared to previous years.
- This visual representation supports the statistical findings that immunization numbers vary significantly across months and years.

Inferential Statistics (Compare Mean and One-way Anova)

Compare Mean

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
Total number of children immunized * Year	5528	100.0%	0	0.0%	5528	100.0%

All data was valid — no missing values.

Report

Total number of children immunized

Year	Mean	N	Std. Deviation
2022	151.91	1823	48.330
2023	162.58	1951	41.433
2024	146.17	1754	40.283
Total	153.55	5528	43.328

Interpretation

The average monthly immunization peaked in **2023**, while **2024** had the lowest average.

One-way Anova

Descriptives

Total number of children immunized

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
2022	1823	166.01	49.081	1.150	163.76	168.27	89	250
2023	1951	172.26	39.913	.904	170.49	174.03	110	223
2024	1754	156.34	38.839	.927	154.52	158.16	95	214
Total	5528	165.15	43.328	.583	164.01	166.29	89	250

ANOVA

Total number of children immunized

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	236076.125	2	118038.063	64.317	.000
Within Groups	10139709.255	5525	1835.241		
Total	10375785.380	5527			

Interpretation

- The **F-statistic = 64.317**, with a **Sig-value < 0.05**.

Conclusion: Since Sig-value (.000) p-value < 0.05, we reject the null hypothesis and conclude that there is a statistically significant difference in the average number of children immunized per year between 2022, 2023, and 2024.

CHAPTER FIVE

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

5.1 Summary

This study focused on the statistical analysis of child immunization records collected monthly from 2022 to 2024 at the Basic Health Center, Oloje, Ilorin, Kwara State. The primary objectives were to describe the immunization trends using descriptive statistics, visualize them using multiple bar charts, and test for significant differences in immunization numbers across the years using inferential methods such as Compare mean and ANOVA.

Descriptive statistics showed yearly fluctuations in the average number of children immunized, with 2023 having the highest mean of **172.26**, followed by 2022 with **166.01**, and 2024 recording the lowest mean of **156.34**. These values were computed based on over 5,500 cases, with standard deviations indicating moderate variation within each year.

To test whether these differences in yearly means were statistically significant, a **One-Way ANOVA** was conducted. The result [F = 64.317, Sig-value (.000) < p-value (0.05)] indicated a significant difference in the average number of children immunized across the three years. The findings suggest that external or systemic factors may have influenced immunization coverage over time.

5.2 Conclusion

Based on the results of the descriptive and inferential analyses, it can be concluded that:

- The immunization rate fluctuated across different months and years.
- The highest mean immunization was recorded in 2023, which may reflect improved program execution, awareness, or vaccine availability.

- The lowest mean in 2024, despite some high-performing months, suggests possible inconsistency or challenges in outreach or service delivery.
- The ANOVA result confirms that the observed differences in yearly averages are statistically significant and not due to random variation.

These outcomes underline the importance of consistent immunization strategies and year-round efforts to stabilize and improve vaccination rates.

5.3 Recommendations

1. **Strengthen Immunization Programs:** Health authorities should analyze successful strategies from 2023 and replicate them to improve performance in other years.
2. **Monthly Monitoring and Response:** Establish a robust monthly tracking and feedback mechanism to quickly identify and address drops in immunization rates.
3. **Community Engagement:** Engage religious leaders, community heads, and parent-teacher associations to promote awareness and correct myths about vaccination.
4. **Resource Allocation:** Allocate adequate staff, vaccines, and logistics throughout the year, especially in months where low performance has been recorded.
5. **Further Research:** Conduct follow-up studies to identify the specific causes of immunization variability and evaluate the impact of outreach interventions.

References

Adebola, O., & Adebayo, A. M. (2021). Factors influencing childhood immunization uptake in Nigeria: A systematic review. *Journal of Public Health in Africa*, 12(1), 142-150. https://doi.org/10.4081/jphia.2021.142

Anderson, R. M., & May, R. M. (1991). *Infectious diseases of humans: Dynamics and control*. Oxford University Press.

Babalola, S., & Fatusi, A. (2009). Determinants of use of maternal health services in Nigeria—Looking beyond individual and household factors. *BMC Pregnancy and Childbirth*, 9(1), 43. https://doi.org/10.1186/1471-2393-9-43

Bhutta, Z. A., Lassi, Z. S., Pariyo, G., & Huicho, L. (2010). Global experience of community health workers for delivery of health-related Millennium Development Goals: A systematic review, country case studies, and recommendations for integration into national health systems. *Global Health Workforce Alliance*, 17(4), 1-105.

Centers for Disease Control and Prevention (CDC). (2022). Vaccines and immunizations. https://www.cdc.gov/vaccines/index.html

Eze, E. O., & Umeh, E. S. (2018). Statistical analysis of immunization coverage in Nigeria: A case study of Enugu State. *International Journal of Statistics and Applications*, 8(3), 120-130. https://doi.org/10.5923/j.statistics.20180803.03

Fan, V. Y., & Jamison, D. T. (2010). Why do child immunization rates vary across countries? An empirical analysis. *Health Policy and Planning*, 25(3), 172-179. https://doi.org/10.1093/heapol/czp065

Gavi, the Vaccine Alliance. (2023). Nigeria country profile. https://www.gavi.org/programmes-impact/country-hub/africa/nigeria

Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement*, 30(3), 607-610. https://doi.org/10.1177/001316447003000308

Lwanga, S. K., & Lemeshow, S. (1991). *Sample size determination in health studies: A practical manual*. World Health Organization.

Makinde, O., & Gidado, S. (2019). Immunization coverage and factors influencing childhood immunization uptake in Nigeria. *Nigerian Journal of Clinical Practice*, 22(10), 1322-1329. https://doi.org/10.4103/njcp.njcp_155_19

Nsubuga, F., Whiteside, A., & Mukasa, B. (2016). Challenges and solutions to childhood immunization coverage in Uganda: A qualitative study. *African Health Sciences*, 16(2), 511-517. https://doi.org/10.4314/ahs.v16i2.26

Oladimeji, O. A., & Musa, O. I. (2020). Statistical modeling of childhood immunization coverage in Nigeria. *Nigerian Journal of Statistics*, 11(2), 87-98.

World Health Organization (WHO). (2023). Immunization coverage. https://www.who.int/news-room/fact-sheets/detail/immunization-coverage

Yaya, S., Bishwajit, G., & Ekholuenetale, M. (2018). Factors associated with full immunization coverage among children in Nigeria: Evidence from a nationwide survey. *Vaccine*, 36(23), 3316-3325. https://doi.org/10.1016/j.vaccine.2018.04.019