MEDIATING ROLE OF INNOVATION ON THE RELATIONSHIP BETWEEN MATERNAL HEALTH EQUITY AND SUSTAINABLE RURAL HEALTH IN KADUNA STATE

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Abstract
This study examined the mediating role of innovation on the relationship between maternal health equity and sustainable rural health in Kaduna State, Nigeria. Despite various government interventions aimed at improving maternal healthcare outcomes, disparities in access to quality maternal healthcare services and the shortage of skilled healthcare personnel continue to undermine the sustainability of rural health systems. The study specifically investigated the influence of access to maternal health services, availability of skilled personnel, and quality of maternal services on sustainable rural health, while assessing the mediating effect of innovation on these relationships. The study adopted a cross-sectional survey research design and targeted healthcare professionals involved in maternal healthcare delivery across selected rural health facilities in Kaduna State. A sample size of 365 respondents was determined using the Krejcie and Morgan (1970) sample size determination table. Primary data were collected through a structured questionnaire, and the data were analyzed using Partial Least Squares Structural Equation Modelling (PLS-SEM) with the aid of SmartPLS software. Descriptive statistics were used to summarize respondents' characteristics, while path analysis was employed to test the study hypotheses. The findings revealed that Access to Maternal Health (AMH) has a significant positive influence on Sustainable Rural Health (SRH) ($\beta = 0.692$, $t = 37.590$, $p < 0.001$). Similarly, Availability of Skilled Personnel (ASP) significantly influences Sustainable Rural Health ($\beta = 0.292$, $t = 13.408$, $p < 0.001$). However, Quality of Maternal Service (QMS) was found to have no significant influence on Sustainable Rural Health ($\beta = 0.020$, $t = 0.847$, $p > 0.05$). Furthermore, the study established that innovation significantly mediates the relationship between maternal health equity and sustainable rural health, indicating that innovative healthcare practices and technologies enhance the effectiveness of maternal health equity initiatives in promoting sustainable health outcomes in rural communities. The study concludes that improving

access to maternal healthcare services and increasing the availability of skilled healthcare personnel are critical drivers of sustainable rural health in Kaduna State. Additionally, innovation serves as an important mechanism through which maternal health equity can be translated into improved and sustainable rural health outcomes. The study recommends increased investment in healthcare innovation, expansion of maternal healthcare access, deployment of skilled healthcare workers to rural areas, and the integration of innovative healthcare delivery models into maternal health policies and programmes.

Keywords: Maternal Health Equity, Access to Maternal Health, Availability of Skilled Personnel, Quality of Maternal Service, Innovation, Sustainable Rural Health, Kaduna State, PLS-SEM.

1.0 Introduction

Sustainable rural health systems contribute significantly to reducing maternal mortality, improving child survival, and promoting community development. However, achieving sustainable rural health requires addressing persistent inequities in healthcare delivery and utilization. Despite global efforts through the Sustainable Development Goals (SDGs), many rural communities continue to experience significant disparities in maternal healthcare access and outcomes. In Nigeria, maternal mortality remains one of the highest globally, with rural areas disproportionately affected due to inadequate healthcare infrastructure, a shortage of skilled birth attendants, poor transportation networks, poverty, and limited health information systems. These challenges are particularly evident in Kaduna State, where rural populations face substantial barriers in accessing quality maternal healthcare services. (WHO, 2024).

Maternal health is a cornerstone of public health and sustainable development, reflecting the overall effectiveness and equity of a health system. Despite global commitments such as the Sustainable Development Goals (SDGs), particularly SDG 3 (Good Health and Well-being) and SDG 10 (Reduced Inequalities), maternal health outcomes in rural Nigeria remain suboptimal. Kaduna State, with a large rural population, continues to experience disparities in maternal healthcare access and outcomes compared to urban areas. Maternal health equity emphasizes fairness in access to maternal healthcare services regardless of socio-economic status, geographical location, or cultural background. However, achieving equity alone may not automatically lead to sustainable rural health systems unless effective mechanisms exist to translate equitable access into long-term system resilience and improved outcomes. (Adejoorin,2024).

Maternal health remains a critical component of public health and sustainable development, particularly in developing countries where maternal mortality and morbidity rates remain high. Maternal health equity refers to the fair and just distribution of maternal healthcare services, opportunities, and outcomes among women regardless of their socioeconomic status, geographic location, education, ethnicity, or other social determinants. Achieving maternal health equity is essential for ensuring that all women have equal access to quality antenatal, delivery, and postnatal care services. (Braveman, Arkin, Orleans, Proctor, & Plough, 2022). Despite numerous maternal health interventions in Kaduna State, significant inequities persist in rural areas, including limited access to skilled birth attendants, inadequate health infrastructure, financial barriers, and sociocultural constraints. These inequities have contributed to high maternal morbidity and mortality rates and have weakened the sustainability of rural health systems.

Innovation has emerged as a strategic tool for transforming healthcare systems and improving health outcomes. Healthcare innovation encompasses the introduction of new technologies, digital health solutions, telemedicine services, community-based interventions, mobile health applications, innovative financing mechanisms, and improved healthcare management practices. These innovations have the potential to enhance healthcare accessibility, efficiency, and quality, particularly in underserved rural communities. (Nambisan, Lyytinen, Majchrzak, & Song, 2023). Theoretically, innovation is introduced as a mediating variable because it explains how and why maternal health equity influences sustainable rural health. Maternal health equity creates the conditions for improved healthcare access and quality, but innovation transforms these conditions into efficient, scalable, and sustainable healthcare solutions. Consequently, innovation serves as the causal pathway linking maternal health equity to sustainable rural health, making its inclusion in the model both theoretically and empirically justified. Maternal health equity focuses on ensuring fair access to quality maternal healthcare services regardless of socioeconomic status, geographical location, or demographic characteristics. However, achieving equity alone may not guarantee sustainable rural health outcomes. Rural communities often face challenges such as inadequate infrastructure, shortages of healthcare personnel, poor transportation networks, and limited healthcare financing.

In Kaduna State, several initiatives have been introduced to improve maternal healthcare delivery, including community health programs, digital health interventions, health insurance schemes, and strengthened primary healthcare services. Nevertheless, disparities in maternal healthcare access and outcomes continue to exist across rural communities. While maternal health equity is expected to contribute positively to sustainable rural health, the extent to which innovation facilitates or mediates this relationship remains insufficiently explored. While, government and development partners have introduced various maternal health, programs aimed at improving equity, the long-term sustainability of rural health outcomes remains uncertain. Many interventions are short-lived, donor-dependent, or poorly adapted to local contexts. (World Health Organization, 2024). Emerging evidence suggests that innovation and invention could play a vital role in enhancing the effectiveness and sustainability of maternal health initiatives. However, empirical studies examining how innovation and invention function as mediating mechanisms between maternal health equity and sustainable rural health particularly in Kaduna State.

Maternal mortality and morbidity continue to pose significant public health challenges in Nigeria despite various national and international interventions aimed at improving maternal healthcare services. Rural communities in Kaduna State remain vulnerable to poor maternal health outcomes due to unequal access to healthcare facilities, inadequate healthcare personnel, poverty, low health literacy, and weak healthcare infrastructure. These challenges have contributed to persistent maternal health inequities that undermine efforts toward achieving sustainable rural health. Although governments, development agencies, and healthcare organizations have implemented several programs to improve maternal healthcare delivery, many women in rural areas still encounter barriers in accessing quality antenatal, delivery, and postnatal services. Consequently, disparities in maternal health outcomes between urban and rural populations

continue to widen, threatening the sustainability of rural healthcare systems and the attainment of national health objectives. (United Nations Children's Fund, 2024).
Recent healthcare reforms have increasingly emphasized the use of innovative approaches such as telemedicine, mobile health technologies, community health innovations, and digital health information systems to improve healthcare accessibility and efficiency. While these innovations are expected to enhance maternal healthcare delivery and support sustainable rural health development, empirical evidence on how innovation influences the relationship between maternal health equity and sustainable rural health remains limited, particularly within the context of Kaduna State. (United Nations Population Fund (UNFPA).2024).

Existing studies have largely examined maternal health equity and rural health sustainability as separate phenomena, with limited attention given to the mechanisms through which innovation may strengthen or explain their relationship. This creates a significant knowledge gap regarding the extent to which innovative healthcare interventions contribute to translating equitable maternal healthcare access into sustainable rural health outcomes. Therefore, the problem addressed by this study is the insufficient understanding of the mediating role of innovation in the relationship between maternal health equity and sustainable rural health in Kaduna State. Addressing this gap is essential for developing evidence-based policies and innovative healthcare strategies capable of reducing maternal health disparities and promoting sustainable health systems in rural communities.

Baron and Kenny (1986) assumes that if a relationship has several outcomes which ultimately gives different or mixed results, a mediator should be employed to strengthen or changes the direction of the relationship. There must be a significant statistical interaction between the dependent and the mediator. Hence the introduction of mediating variable to strengthen and change the direction of the relationship between the independent and the dependent variable is necessary.

2.0 Literature Review

Sustainable rural health refers to the ability of rural health systems to continuously provide accessible, affordable, equitable, and high-quality healthcare services to rural populations over the long term while efficiently utilizing available human, financial, and environmental resources. It emphasizes resilience, community participation, and the capacity to meet present health needs without compromising future healthcare delivery. (WHO, 2024). Sustainable rural health refers to the capacity of rural health systems to provide continuous, accessible, effective, and equitable healthcare services that meet the needs of rural populations over time. Roger Strasser (2003), sustainable rural health is a community-oriented healthcare system that ensures the long-term availability of healthcare services through local participation, appropriate workforce distribution, and effective resource utilization.

Sustainable rural health encompasses the capacity of rural healthcare systems to provide continuous, equitable, affordable, and quality healthcare services that meet present health needs while maintaining the ability to meet future demands. Sustainable rural health systems are characterized by resilience, accessibility, efficiency, and community responsiveness (World

Health Organization, 2023). In rural settings, sustainability requires overcoming challenges such as inadequate infrastructure, workforce shortages, limited financial resources, and geographic isolation. Consequently, sustainable rural health aims not only to improve immediate health outcomes but also to strengthen health systems for long-term effectiveness and resilience.

The relationship between maternal health equity and sustainable rural health is direct but often insufficient without supporting mechanisms. While equitable maternal healthcare improves service utilization and health outcomes, the persistent challenges facing rural healthcare systems may limit the long-term sustainability of these gains. This is where innovationbecomes critical. Innovation refers to the introduction and application of new technologies, processes, organizational practices, and service delivery models designed to improve healthcare effectiveness, accessibility, efficiency, and quality (Greenhalgh et al., 2020). Healthcare innovation may include telemedicine, mobile health applications, electronic health records, community-based healthcare models, artificial intelligence-supported diagnostics, and innovative financing mechanisms.

Maternal Health Equity

Maternal health equity is the attainment of the highest possible standard of maternal health for all women, where no woman is disadvantaged in achieving optimal maternal outcomes because of social, economic, geographic, racial, ethnic, or other socially determined circumstances. (Adejoorin,2024). Paula (2014), maternal health equity exists when all women have a fair and just opportunity to attain their full maternal health potential without disadvantages caused by social position or other socially determined circumstances. Maternal health equity refers to the absence of avoidable and unjust differences in maternal health outcomes and access to maternal healthcare services among different population groups. It emphasizes fairness in the distribution of healthcare resources, opportunities, and services, ensuring that all women, regardless of socioeconomic status, geographic location, ethnicity, or educational background, can access quality maternal healthcare throughout pregnancy, childbirth, and the postnatal period (Braveman et al., 2022). Maternal health equity extends beyond mere access to healthcare by addressing structural and social determinants that contribute to disparities in maternal morbidity and mortality.

Access to Maternal Care

Access to maternal care refers to the ability of women to obtain timely, affordable, acceptable, and appropriate maternal health services, including antenatal, delivery, and postnatal care, when needed. Access encompasses geographical accessibility, affordability, availability, and acceptability of services. (Levesque, Harris, & Russell, 2013). Access to maternal care refers to the opportunity and ability of women to identify healthcare needs, seek services, reach services, obtain care, and benefit from healthcare interventions.

Availability of Skilled Personnel

Availability of skilled personnel refers to the presence of adequately trained, competent, and licensed health workers uch as doctors, nurses, midwives, and other healthcare professionals sufficient numbers to provide essential maternal and reproductive healthcare services. (WHO,

2024). A skilled health professional is an accredited health worker such as a midwife, nurse, or doctor trained to manage normal pregnancies, childbirth, and immediate postnatal care and to identify and manage complications. Availability of skilled personnel involves the adequate deployment and retention of qualified healthcare workers capable of delivering essential maternal healthcare services. (Campbell, & Graham, 2006).

Quality of Maternal Service

Quality of maternal service refers to the extent to which maternal healthcare services increase the likelihood of desired health outcomes for mothers and newborns and are consistent with current professional knowledge. It includes effectiveness, safety, timeliness, patient-centeredness, efficiency, and equity in service delivery. (WHO, 2024). Quality of healthcare as care that is expected to maximize patient welfare after considering the balance of gains and losses associated with all components of care. Quality maternal service refers to care that is safe, effective, timely, efficient, equitable, and people-centered throughout pregnancy, childbirth, and the postnatal period. (WHO, 2016).

Innovation

Innovation is the process of developing and implementing new or significantly improved ideas, products, services, technologies, or methods that create value and improve outcomes. In healthcare, innovation involves novel approaches that enhance service delivery, efficiency, accessibility, or quality of care. Innovation is the introduction of new products, processes, markets, sources of supply, or organizational methods that generate economic and social change. Innovation as an idea, practice, or object perceived as new by an individual or other unit of adoption. Innovation is a new or improved product or process that differs significantly from previous products or processes and has been made available to users or implemented in practice. (Rogers, 2023). Innovation serves as the bridge between maternal health equity and sustainable rural health by transforming equitable healthcare policies and interventions into practical and scalable solutions. For instance, equitable policies may increase the availability of maternal health services, but innovative approaches such as telehealth and mobile clinics can extend those services to geographically isolated populations. Similarly, digital health technologies can improve continuity of care, monitoring, referral systems, and communication between healthcare providers and pregnant women, thereby enhancing both access and quality of care.

Empirical Review

Mobolaji, Kabir, Kemisola, gheneruemu, Magbagbeola & Abiodun (2024) The sustenance of any household is tied to the well-being of the mother's health before, during, and after pregnancy. Maternal health care has continued a downward slope, increasing maternal mortality in rural communities in Nigeria. Presently, few empirical findings connect maternal healthcare facilities' use to mothers' well-being in Nigeria. Using maternal health facilities and the well-being of rural women is crucial in achieving the United Nations' Sustainable Development Goals 1, 2, and 3 (No poverty, zero hunger, good health, and well-being). Objective the objective of the study was to examine the level of maternal healthcare utilization and its effect on mothers' well-being status among mothers in rural Nigeria. Methods In this study, secondary data extracted from the Nigeria's 2018 National Demographic Health Survey was used. Data was analyzed with

Multiple correspondence analysis, Fuzzy set analysis, and Extended ordered logit model. Results Women in rural Nigeria were moderate users of maternal health care services and had moderate well-being indices (0.54 ± 0.2, 0.424 ± 0.2, respectively). Mothers' moderate well-being status was increased by using maternal health care facilities, having a larger household, and having mothers who worked exclusively in agriculture. Conclusion we concluded that mothers in rural Nigeria use maternal healthcare facilities moderately, and their well-being level was improved using maternal healthcare facilities. Therefore, Nigeria's Ministry of Health should raise awareness about the vitality of mothers using health care services before, during, and after pregnancy. In order to promote greater female participation in full-scale agricultural production, it is imperative for the Nigerian government to allocate substantial resources in the form of subsidies and incentives. The Nigerian government should source these resources from various channels, including expanded development cooperation. Additionally, policymakers should focus on designing developmental programmes specifically tailored for rural households and the health sector.

Jamila, Temitope , Duro, Mallika and Rosa (2025)Maternal and child health (MCH) remains a significant public health issue, particularly in low- and middleincome countries (LMICs) where the burden of maternal and child mortality is highest. Over the past three decades, global policy frameworks ranging from the Safe Motherhood Initiative (1987) to the Sustainable Development Goals (2015) have evolved to strengthen MCH outcomes. However, significant implementation challenges persist, limiting progress in many regions. This review aims to assess the global landscape of maternal and child health policies, highlight key successes, identify persistent gaps, and provide strategic insights to inform future policy formulation and implementation. We conducted a narrative review to explore the global landscape of maternal and child health policies. Electronic databases searched included PubMed, The Lancet, ScienceDirect, Global Health, Google Scholar, and Scopus. Search terms combined keywords related to maternal health, child health, and newborn health with policy-related terms using Boolean operators to enhance search sensitivity. Only English-language studies were included, with no restrictions on publication date. Following a systematic process of title screening, abstract review, and full-text evaluation, 24 studies were included in the final analysis. Key global policies including the Safe Motherhood Initiative and SDGs have contributed significantly to improvements in maternal and child health. Notable successes include Rwanda's use of community health workers to reduce maternal mortality, Peru's efforts to combat child malnutrition, and GAVI's vaccination programs, which have saved millions of children's lives. However, critical challenges persist, including health workforce shortages, inadequate funding, poor quality of care, weak data systems, and insufficient focus on rural populations and adolescent health. Effective implementation of maternal and child health policies requires strong political will, sustained financing, health system strengthening, and active community engagement. Future interventions must be evidence based, context-specific, and equity-focused, with continued investment in workforce development, quality improvement, and robust data systems to achieve universal MCH coverage.

Nkoyo, Mojeed, & Evangel (2024) Maternal mortality remains a critical public health issue, disproportionately affecting underserved communities worldwide. Despite advancements in

healthcare, significant disparities persist in maternal health outcomes, particularly in marginalized populations such as Black, Indigenous, and rural women. This review explores the complex factors contributing to maternal mortality disparities, focusing on systemic inequities that hinder access to quality healthcare. Key drivers include socioeconomic barriers, implicit bias, and racial discrimination within healthcare systems, all of which exacerbate the challenges faced by women in these communities. Additionally, geographic disparities wherein rural populations often lack sufficient healthcare infrastructure further contribute to unequal maternal health outcomes. The analysis highlights the intersection of social determinants of health, such as poverty, education, and environmental factors, which amplify risks for maternal mortality in underserved populations. These determinants, combined with structural barriers to healthcare access, create a multifaceted crisis that requires targeted interventions. To address these disparities, the review reviews policy initiatives, including the expansion of Medicaid and the implementation of culturally competent care models. It also examines community-based solutions, such as the integration of doulas and community health workers, as well as the role of telehealth in mitigating access challenges in remote areas. By presenting case studies on Black maternal health in the U.S. and Indigenous maternal health in Canada, the review underscores the need for systemic reforms to eliminate healthcare inequities. It concludes with recommendations for future policies and practices aimed at improving maternal health outcomes in underserved communities, emphasizing the importance of a holistic approach that combines healthcare access, education, and social support to reduce maternal mortality rates and achieve health equity.

Okunade, Adedapo, Adejumo and Islamiyyat (2025), Maternal mortality remains one of the most pressing public health challenges in Nigeria, Particularly in rural and underserved Communities. Despite national and Global initiatives. Nigeria continues to report alarmingly high maternal mortality ratios, with rural areas of Lagos and Ogun States facing severe disparities due to poor infrastructure, socio-culturabarriers, financial constraints, and a shortage of skilled health professionals. This study systematically reviews the effectiveness of community-based health interventions in reducing maternal mortality in these rural settings. Using a structured literature review approach, relevant peer-reviewed articles, policy reports, and institutional documents from 2013-2023were analyzed across databases such as PubMed, Scopus, and Science Direct. Finding sindicate that interventions leveraging community health workers, traditional birth attendants, mobile health clinics, health education campaigns, and community-based financing schemes have significantly improved maternal health outcomes. These strategies enhanced antenatal care attendance, increased skilled birth deliveries, facilitated timely referrals, and promoted safe delivery practices. However, persistent challenges such as inconsistent funding, weak integration with formal healthcare systems, socio-cultural resistance, and inadequate infrastructure continue to hinder sustainability and scalability. The review highlights the importance of culturally sensitive health education, government investment, and stronger policy integration to strengthen community-based interventions. Lessons from global best practices suggest that sustained funding, effective referral systems, and workforce capacity building are critical to achieving reductions in maternal mortality. This study contributes valuable insights for policymakers, healthcare providers, and development partner's seeking evidence-based strategies to improve maternal health outcomes in rural Nigeria.

Salewa, Ngozi, Chiamaka (2023), presents the Integrative Maternal Health Model (IMHM), a holistic framework designed to address these issues by combining community-based interventions, technological innovations, and stakeholder collaboration. The model emphasizes the use of telemedicine, mobile health applications, and cultural sensitivity training to enhance healthcare delivery while engaging local communities to foster trust and acceptance. Implementation strategies focus on workforce development, infrastructure enhancement, and partnerships with governments and nongovernmental organizations. A robust framework for measuring success, including maternal mortality rates, accessibility metrics, and patient satisfaction, is proposed to ensure accountability and continuous improvement. Policy recommendations highlight the need for dedicated funding, supportive legislation, and innovative financing mechanisms to sustain the model. Future research directions explore the role of technology, cultural dynamics, and climate resilience in refining and scaling the IMHM. By addressing medical and social health determinants, the IMHM offers a scalable solution to reduce maternal mortality and morbidity, empowering women and promoting health equity in rural settings.

Rachel, Gordon, Alyson, Jordyn, Christiane, Nicole, Naleef , Alicia ,Shannon, Kartik,Venkatesh Lisa & Seuli (2025) Maternal health outcomes in rural areas of the United States are persistently poor, with pregnant individuals in rural areas facing complex health care obstacles. Interventions adapted to the needs of rural patients are critical to mitigate worsening health disparities. To inform future efforts in this field, we conducted a scoping review, given the complex and diverse nature of existing interventions, to synthesize the literature on rural maternal health interventions, analyze mechanisms to improve care, and identify barriers and facilitators to intervention implementation. We conducted a scoping review of peer-reviewed literature across six databases for maternal health interventions in rural populations. Relevant studies were analyzed for study setting, intervention type, impact on maternal health outcomes, and facilitation and barriers of intervention implementation mapped to the Consolidated Framework for Implementation Research. We identified 64 studies published between 2010 and 2024 through comprehensive database searches relevant to our review. We determined six proposed mechanisms of action via thematic analysis across the pregnancy continuum: increased care connection, social support, care frequency, education, self-efficacy, and positive reinforcement. While the facilitators and barriers to implementation varied across the six themes, common facilitators included state-level buy in, integration of community partnerships, cultural humility in study design, and dedicated interdisciplinary teams. Common barriers included lapses in insurance, transportation difficulties, and communication challenges. Our review shares lessons that future interventions and policies can build upon to improve peripartum care for individuals living in rural communities. Further work is needed to address intersectional disparities in rural maternal health and ensure equitable implementation.

Theoretical Framework

The Diffusion of Innovation Theory developed by Everett Rogers explains how innovations are adopted and spread within a social system. The theory suggests that communities experiencing healthcare challenges often adopt innovative solutions to improve service accessibility and

quality. In contexts where maternal health equity is prioritized, governments and healthcare providers are more likely to introduce innovative healthcare interventions aimed at reducing disparities. For example, equitable maternal health policies may encourage: Mobile maternal health services, Telehealth consultations, Digital health education, Community health worker innovations, and Electronic referral systems. Thus, maternal health equity can stimulate innovation in healthcare delivery. According to Rogers, innovation adoption is a social process through which individuals or organizations become aware of, evaluate, adopt, and implement new ideas.

The Social Determinants of Health Theory**,** developed by the World Health Organization, posits that health outcomes are shaped by social, economic, and environmental conditions. According to this theory, inequalities in healthcare access contribute significantly to poor health outcomes. Health is influenced by social and economic conditions. Unequal distribution of resources leads to health inequalities. Access to healthcare alone cannot guarantee good health outcomes. Poverty, education, housing, employment, and social support significantly affect health. Improving social conditions improves health outcomes and reduces disparities. The theory suggests that improving equitable access to maternal healthcare services can reduce maternal mortality and improve rural health sustainability.

In rural Kaduna State, when maternal health services are distributed equitably through adequate healthcare facilities, skilled birth attendants, and affordable maternal care, maternal mortality and morbidity decrease. Improved maternal health contributes to healthier families and communities, thereby strengthening sustainable rural health systems.

3.0 Methodology

The study adopts the survey and cross-sectional research design for this study. It enables researchers to assess perceptions, attitudes, and experiences of respondents regarding maternal health equity, innovation, and sustainable rural health. The survey design also ensures that data are collected from respondents by carrying out a sample survey. That is, the use of questionnaires in getting the desired information from the respondents of the case study.

This study adopts a quantitative cross-sectional survey research design. The design is considered appropriate because it enables the collection of data from respondents at a single point in time and facilitates the examination of the relationships among maternal health equity, innovation, and sustainable rural health in Kaduna State. The study further employs mediation analysis to determine whether innovation serves as a mechanism through which maternal health equity influences sustainable rural health outcomes. The design is suitable for generating empirical evidence and testing the proposed hypotheses Structural Equation Modeling (SEM).The choice of a cross-sectional survey design is justified on Maternal Health Equity, Sustainable Rural Health and Innovation. These variables are measurable through questionnaires administered to healthcare workers, rural women, health administrators, and community health stakeholders.

Population of the Study

The population of this study comprises healthcare professionals and maternal healthcare beneficiaries in rural communities of Kaduna State. The target population includes doctors,

nurses, midwives, community health extension workers, community health officers, health administrators, pregnant women, and nursing mothers who access maternal healthcare services in rural health facilities. These respondents are considered suitable because they are directly involved in the provision and utilization of maternal healthcare services and are therefore capable of providing relevant information on maternal health equity, innovation in healthcare delivery, and sustainable rural health outcomes in Kaduna State.

The population of this study consists of all maternal healthcare stakeholders in rural areas of Kaduna State. Specifically, the target population includes pregnant women, nursing mothers, healthcare professionals (doctors, nurses, midwives, and community health extension workers), health facility administrators, and relevant officials of the Kaduna State Ministry of Health operating within rural healthcare facilities. These groups are considered appropriate because they possess firsthand knowledge and experience regarding maternal health equity, healthcare innovations, and sustainable rural health outcomes.

According to the Kaduna State Primary Health Care Board and Ministry of Health records, Kaduna State has over 1,000 Primary Healthcare Centres and numerous General Hospitals serving rural communities. Therefore, the accessible population may include:

Table 1
List of Maternal Healthcare Stakeholders in rural areas

S/N	Categories	Estimated Population
1	Nurses and Midwives	2,875
2	Community Health Extension Workers (CHEWs)	3,352
3	Community Health Officers	875
4	Medical Doctors	312
5	Health Administrators	249
6	Pregnant women, Nursing mothers	8,520
7	Total	16,183

Source: Kaduna State Primary Health Care Board Records (2026).

A sample is a part or subset of people, items, or events from a larger population that one collects and analyzes to make inferences. Maternal Healthcare Stakeholders estimated population is approximately 16,183 healthcare personnel and Nursing mothers size using the Taro Yamane (1967) formula is:

The target population of the study are healthcare personnel and Nursing mothers in rural areas of Kaduna state. The sample size for this study was determined using the Krejcie and Morgan (1970) sample size determination table. Based on the estimated population of healthcare professionals involved in maternal healthcare services in rural Kaduna State, a sample size of 370 respondents was considered adequate. The Krejcie and Morgan table is widely used because it provides scientifically determined sample sizes for finite populations at a 95% confidence level and 5% margin of error.

Krejcie and Morgan (1970) developed a table that provides the required sample size for a given population at: 95% confidence level, 5% margin of error, and 50% population proportion.

The formula underlying the table is:

$$S = \frac{X^2 NP(1-P)}{d^2(N-1) + X^2 P(1-P)}$$

Where:
S=equired sample size
X^2= chi-square value (3.841 at 95% confidence level)
N= population size
P = population proportion (0.50)
d = degree of accuracy (0.05)
Sample Size from Krejcie and Morgan Table
If your population is approximately 16,183**healthcare personnel,** the table recommends a sample size of about **370 respondents**.

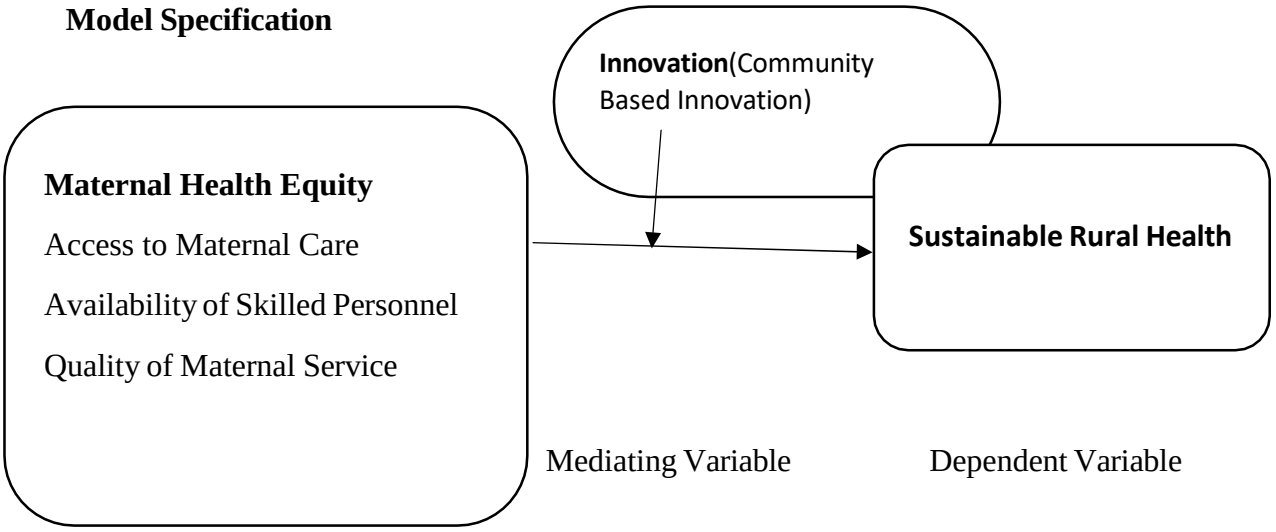
Population (N)	**Sample Size (S)**
5,000	357
6,000	361
7,000	364
8,000	367
10,000	370

Thus, for a population between 8,000 and 16,183, a sample size of **370 respondents** is appropriate.

Source and Method of Data Collection
The primary data is a survey method of data collection in which the respondent's opinions was used to determine the outcome through their perception. The use of 5-point scale Likert was used for the collection of the data from the respondents. This is because it enables clear patterns in responses and it provides an enhanced rationale for reliability and quality of insights.

Technique for Data Analysis
Partial Least Squares Structural Equation Modeling (PLS-SEM)
analysis was employed to test the hypotheses, as the study focused on examining the relationship between maternal health equity and Sustainable rural health was conducted using the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach. Furthermore, the study's hypotheses were tested through bootstrapping analysis. Smart PLS was used to identify which variables in the dataset are qualitative or categorical. For binary variables, create a single dummy variable (0 or 1). For categorical variables with more than two categories, use one-hot encoding, creating binary variables for each category.

Model Specification



Reliability and Validity

the reliability results of the models of the study are presented and interpreted. The reliability and validity test were formulated for the study in order to check the validity and also the level of reliability of the questionnaire that used in collecting the data which is being presented in Table 3 below:

Table 3

Reliability Statistics

Variables	Cronbach's alpha
AMC	0.807
ASP	0.792
CBI	0.802
QMS	0.826
SRH	0.814

Source: Field Survey, 2026.

4.0 Data Analysis and Presentation

SPSS and Smart-PLS 4 were used as statistical tools for data analysis. The data analysis displays the distribution of respondents' answers and demographic factors.

Descriptive Statistics of Variables of the Study

The study's variables are statistically described using mean and standard deviation in the subsection that follows. The outcome is shown in Table 4.

Table 4:
Descriptive Statistics of Variables

Variables	Sample	Mean	Median	Observed min	Observed max	Standard deviation	Excess kurtosis	Skewness
AMC	365	0.000	0.016	-1.540	2.293	1.000	-0.324	0.375
ASP	365	0.000	-0.009	-2.039	2.639	1.000	0.540	0.425
CBI	365	0.000	0.034	-2.209	2.023	1.000	-0.376	-0.170
QMS	365	0.000	0.034	-2.082	1.849	1.000	-0.629	-0.096
SRH	365	0.000	0.160	-2.251	2.296	1.000	0.419	-0.227

Source: SPSS Output (2026).

Final Description Statistics

Variables	Mean	Standard Deviation
AMC -> CBI	0.371	0.045
AMC -> SRH	0.426	0.032
ASP -> CBI	0.283	0.032
ASP -> SRH	0.120	0.024
CBI -> SRH	0.613	0.027
QMS -> CBI	0.081	0.039
QMS -> SRH	-0.107	0.024

Source: SPSS Output (2026).

A five-point Likert scale was used to measure each study variable. According to Table 4, the standard deviation for Access to maternal care was 0.045 and the mean response was 0.371 respondents moderately agreed with comments regardingAccess to maternal care. Respondents agreed that their Available skilled personnel are above average since they somewhat agreed with remarks about it (0.032 & 0.283). Similar to this, respondents somewhat agreed with assertions about the Quality of maternal service, as shown by a mean response of 0.039 and a standard deviation coefficient of 0.081. This implies that respondents think local microenterprises regularly embrace the idea of product development. With a standard deviation of 0.633 and a mean level of 2.16 inventory, the data indicated that respondents thought the idea of inventory was frequently accepted by them.the standard deviation for planning was 0.693 and the mean response was 1.99 respondents moderately agreed with comments regarding innovation. Respondents agreed that their organisational performance is above average since they agreed with remarks about it as the mean show a score of 1.94 and 0.638.

Discriminant Validity

Table 5a: Discriminant Validity (Fornell-Larcker Criterion)

CONSTRUCTS	AMC	ASP	CBI	QMS	SRH
AMC	0.759				
ASP	0.185	0.727			
CBI	0.447	0.389	0.724		
QMS	0.289	0.450	0.321	0.865	
SRH	0.688	0.392	0.819	0.267	0.757

Source: Smart-PLS Output (2026).

Table 5a, all of the reflective latent constructs in the current study are significantly different from one another, with the exception of the AMC correlation with SRH, which is the only AVE correlation the second was higher than the first at 0.759 and 0.688. This is due to the lack of a substantial association between any of the study's reflective latent variables. More importantly, criterion analysis by Fornell and Larcker (1981) showed that each of the previously stated constructs is unique and captures phenomena that other reflective latent constructs do not. Consequently, an assessment of the discriminant validity based on the cross-loadings criterion is given in Table 5b.

(Cross Loading)

Items	AMC	ASP	CBI	QMS	SRH
AMC1	0.892	0.141	0.389	0.311	0.570
AMC2	0.737	0.143	0.128	0.268	0.349
AMC3	0.539	0.176	0.255	0.052	0.495
AMC4	0.891	0.113	0.458	0.362	0.624
AMC5	0.680	0.145	0.347	0.061	0.483
ASP1	0.110	0.762	0.167	0.329	0.212
ASP2	0.065	0.748	0.127	0.108	0.175
ASP3	0.182	0.790	0.479	0.350	0.444
ASP4	0.126	0.819	0.212	0.340	0.243
ASP5	0.153	0.453	0.115	0.702	0.070
CBI1	0.507	0.453	0.839	0.300	0.816
CBI2	0.276	0.118	0.627	0.064	0.380
CBI3	0.390	0.370	0.898	0.303	0.786
CBI4	0.118	0.160	0.641	0.326	0.315
CBI5	0.038	0.007	0.553	0.037	0.319
QMS1	0.188	0.497	0.295	0.919	0.220
QMS3	0.312	0.437	0.291	0.927	0.260
QMS5	0.248	0.213	0.243	0.735	0.212
SHR4	0.335	0.371	0.713	0.343	0.740
SRH1	0.610	0.438	0.707	0.216	0.823

SRH2	0.559	0.214	0.729	0.236	0.806
SRH3	0.449	0.144	0.452	0.064	0.667
SRH5	0.650	0.263	0.436	0.108	0.740

Source: Smart-PLS Output (2026).

Based on the cross-loading analysis and the indicators' loadings (i.e., shaded loadings) of each construct being larger than their corresponding loadings diagonally, Table 5b above shows that all of the reflective latent variables in the current study had discriminant validity. Lastly, the heterotrait-monotrait (HTMT) ratio of correlation measure, which is regarded as superior to the two previously discussed methods, was used to assess the discriminant validity of the reflective constructs. Although the Fornell-Larcker criterion and cross-loading evaluation are the two most widely used techniques for evaluating discriminant validity, Henseler et al. (2015) asserted that they do not always show that discriminant validity is lacking in the great majority of research situations. They propose the HTMT as an alternative approach based on the multitrait-multimethod matrix to assess discriminant validity using the HTMT ratio of correlations. By contrasting the novel approach with the Fornell-Larcker standard and assessing (partial) cross-loadings, Duarte and Amaro (2018) further demonstrated the advantages of HTMT using Monte Carlo simulation trials.

Assessment of the Structural Model

This section presents the structural equation model for the direct and moderating relationships, which is based on bootstrap analysis. With a total of 5000 bootstrap samples, the traditional bootstrapping method was applied to investigate the importance of the path coefficients of direct and mediating linkages for 115 cases (Hair et al., 2014; Hair et al., 2012; Henseler et al., 2009). Nonetheless, the purpose of this study is to empirically examine the relationships between independent variables (IVs) and dependent variables (DV), as well as the mediation function of innovation between the two.

Table 6:
Measures and Threshold Values for Assessment of Inner Model

Assessment Measure	Measure	Threshold value
Path Coefficient	T-value	1.96 ($p < 0.05$)
Coefficient of Determination	R^2	0.037(weak), 0.301(mediocre), 0.813(good)
Effect Size	F^2	0.02(weak), 0.15(moderate) and 0.35(strong)
Predictive Relevance	Q^2	0.02 (small), 0.15 (medium), 0.35 (strong)

Henseler et al., (2009) and Hair et al., (2014).

Path coefficient estimations, coefficient of determination (R2 values), f2 effect sizes, and predictive relevance (Q2) were the main factors for the evaluation of the inner model (Hair et al., 2014). In addition, the thresholds listed in Table 6 had been taken into account for this study.

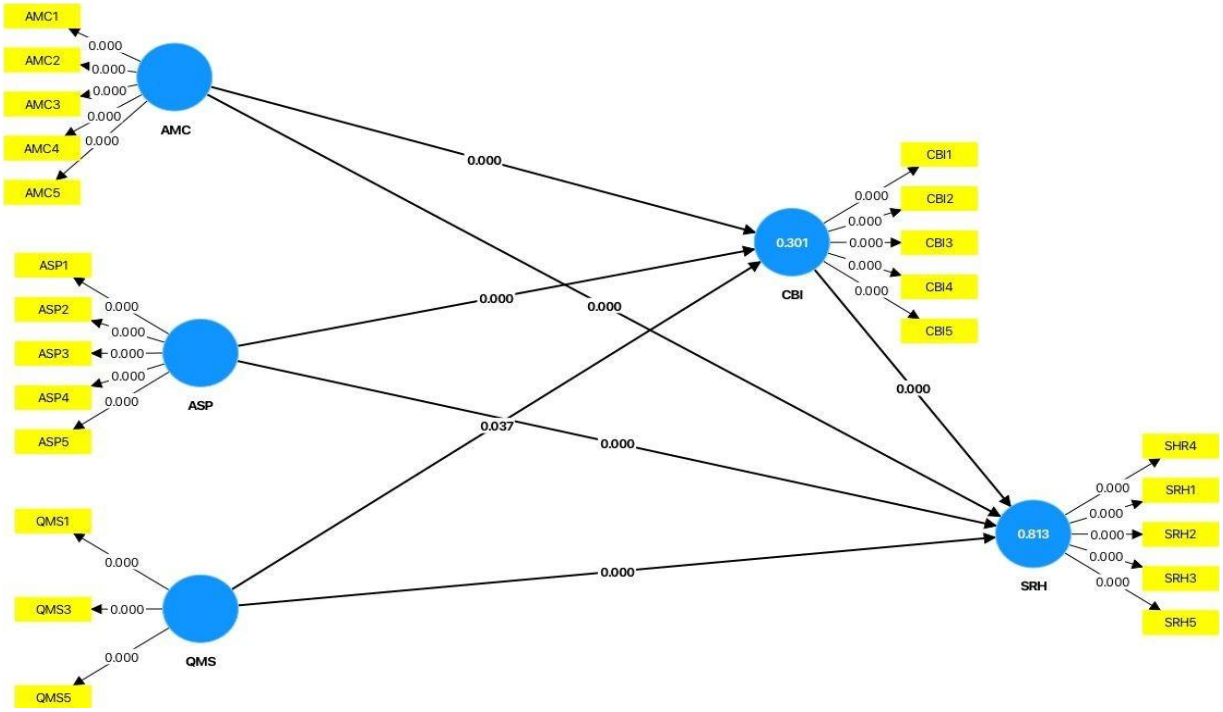


Figure 1: PLS boostrapping

Hypotheses Testing for Direct Relationships

Figure 1 shows the direct relationship between the study's dependent variable (Sustainable Rural Health) and the three independent variables (Maternal Health Equity). The results of the structural model based on the causal relationships between the study's criteria variables and predictors are also displayed in Table 7 below. These results are interpreted using the t-value, standard error (SE), and coefficients (Beta) of the path connection. (T Statistical). At the 5% level, the hypothesis' significance was assessed.

Table 7:
Hypotheses test for direct and moderating relationship

R/Ship	Beta Values	Std. Dev.	T Statistics	P Values	Decision
AMC-> SRH	0.692	0.016	37.590	0.000	Reject
ASP-> SRH	0.292	0.022	13.408	0.000	Reject
QMS -> SRH	0.020	0.023	0.847	0.000	Reject
MHE->CBI>SRH	0.104	0.031	0.583	0.000	Reject

Source: Smart-PLS Output (2026)

Access Maternal Health (AMH) has significant influence onSustainable Rural Health (SRH) of Kaduna State.It is seen on Table 7 that Access Maternal Health (AMH) is significantly related to Sustainable Rural Health (SRH) with (β=0. 692, T- stat = 37.590, p<0.000). Therefore, $H0^1$Access Maternal Health (AMH) has significant influence on Sustainable Rural Health (SRH) of Kaduna Stateis empirically rejected. Similarly, Availability of Skilled Personnel(ASP) has

significant influence on Sustainable Rural Health (SRH) of Kaduna State.Availability of Skilled Personnel(ASP) is significantly related to Availability of Skilled Personnel(ASP) with (β=0. 292, T- stat = 13.408, p<0.000). Therefore, $H0^2$ Availability of Skilled Personnel has significant influence on Sustainable Rural Health (SRH) of Kaduna Stateis empirically rejected. Quality of Maternal Service (QMS) has significant influence on Sustainable Rural Health (SRH) of Kaduna State.Quality of Maternal Serviceis significantly related to Sustainable Rural Health (SRH) with (β=0. 020, T- stat = 0.847, p<0.000). Therefore, $H0^3$ Quality of Maternal Service (QMS) has significant influence on Sustainable Rural Health (SRH) of Kaduna Stateis empirically rejected.

Hypotheses Testing for Moderation Relationships

The test for mediation first looks only at the main effects of the independent variables on the dependent variable, then only at the main effects of the independent variables, including the moderator, and lastly at the interaction terms, which are the independent variables multiplied by the mediator variable (Esposito Vinzi et al., 2010). The product of the variable indicators represents the latent interaction variables (Chin et al., 2003). Accordingly, the mediating effect only holds true when these interaction terms are substantial (Hair Jr. et al., 2013). The mediating analysis in this study was conducted using the PLS two step technique. When dealing with continuous predictor and mediator variables, this approach is especially recommended for enhancing estimation and detection of the interaction effects (Helm et al., 2010; Henseler & Fassott, 2010). The latent variable scores of the lower order components (LOCs), which are Access Maternal Health, Availability of Skilled Personnel, and Quality of Maternal Serviceon the higher order component (HOC), which is Sustainable Rural Health, were first obtained using the repeated indicator approach because the reflective-reflective type of hierarchical component model (HCM)(Afthanorhan & Afthanorhan, 2014; Becker, Klein, & Wetzels, 2012). The values of each LOC were then used as a reflective indicator to the HOC in a two-stage technique that was implemented utilising the latent variable scores that were collected (Hair et al., 2014; Ringle et al., 2012).

The outcomes of the interaction between innovation and the relationship between Maternal Health Equity and Sustainable Rural Health were studied and reported after the aforementioned technique. The repeated indicator model in figure 4.5b displays the mediator's hierarchical component model (HCM), which is reflective- reflective in nature. This is accomplished by repeatedly measuring all lower order component (LOC) indicators, such as Access Maternal Health, Availability of Skilled Personnel, and Quality of Maternal Service, on the higher order component (HOC), Sustainable Rural Health. The latent variable scores for LOCs were then obtained and used in further analysis.

The results are displayed in Table 7 above for both the direct and moderating relationship. Of special interest is the significance of the interaction term. If the interaction term has a large effect on the endogenous construct, it is observed that the mediator has aninsignificant mediating effect on the link between the IVs and DV and vice versa. A significant mediating effect on SRH occurs when CBI and SRH does interact, as shown by the bootstrapping result in the table (β= 0.104, T- stat = 0.583, p<0.000). The mediating relationship between CBI*MHE on SRH was not significant. Thus, hypothesis H03 is acceptable in light of this finding.

Coefficient of Determination: R-Squared

The coefficient of determination, or R-square level, was used to analyse the amount of variance that the external latent variables explained on the endogenous latent variables.

Table 8:
Coefficient of Determination: R-Squared

Construct	R Square
MHE	0.995
SRH	0.778

Source: Smart-PLS Output (2026).

Table 8 shows that 77.8% (0.778) of the variation in Maternal Health Equity may be attributed to Access Maternal Health, Availability of Skilled Personnel, and Quality of Maternal Service while, 99.5% (0.995) of the variation in Sustainable Rural Healthmay be attributed to Maternal Health Equity. According to Chin's (1998) recommendation that R2 values of 0.67, 0.33, and 0.19 be assessed as substantial, moderate, and weak, respectively, the R2 value explained by these latent variables on the target endogenous latent variable is therefore substantial.

Assessment of the Effect Size: F-Squared

According to Hair, Ringle, and Sarstedt (2013), the effect size (f2) need to be assessed subsequent to the endogenous latent variables' coefficient of determination. The effect size is the difference in R2 between the main effects when one exogenous latent variable is included in the model and when it is also removed.

$$F^2 = \frac{R^2 \text{ included} - R^2 \text{ excluded}}{1 - R^2 \text{ included}}$$

Where:

The value f^2 defines how much an exogenous latent construct will influence an endogenous latent construct. R^2 Included is the endogenous latent variable's R^2 score prior to the elimination of a certain exogenous latent variable. R^2 Excluded, on the other hand, represents the changes in the endogenous latent variable's R^2 value following the removal of a particular exogenous latent variable from the model. According to Hair et al (2013) advice, the formula above f^2 values of 0.02, 0.15, and 0.35 indicated Small, Moderate, and Substantial effects, respectively (Cohen, 1988). For the effect size, refer to Table 4.7.4.

Table 9:
Determination of the Effects Size; F-Square (f^2)

Constructs	f^2	Effect Size
AMC-> SRH	0.141	Small
ASP-> SRH	0.174	moderate
QMS> SRH	0.266	moderate

Source: Smart-PLS Output (2026).

The effect of Maternal Health Equity on Sustainable Rural Health is displayed in Table 9.The exogenous variables that have a minor effect on Maternal Health Equity which include Access Maternal Health, Availability of Skilled Personnel, and Quality of Maternal Service. According to Cohen's (1988) criteria for effect size interpretation, the results also suggest that the effects of these three exogenous latent variables on Sustainable Rural Health can be categorized as small, moderate, and substantial, respectively.

Assessment of Predictive Relevance: Q-Squared

As a measure of prediction accuracy, researchers are advised to look at Stone-Geisser's Q2 value in addition to the R2 value level (Geisser, 1974; Stone, 1974). The predictive utility of a model is measured by this criterion (Hair et al., 2014). But according to Stone (1974) and Duarte and Roposo (2010), this criterion can be seen as an extra assessment of the model fit in the PLS-SEM analysis. Consequently, the Q2 shows how well the model and its parameter estimations produce the observed values (Chin, 1998).The capacity of the external latent variables to predict the endogenous latent variable was also evaluated using Stone-Geisser's Q2 value in this model (Geisser, 1974; Stone, 1974). A cross-validated redundancy criterion was applied to measure the predictive relevance (Q2) using the blindfolding procedure. Table 10 presents the findings to be as OM with a Q2 value of 0.348 and OP with Q2 value of 0.405.

Table 10:

Predictive relevance on endogenous variables: Q-square

Construct	Q^2 (=1-SSE/SSO)
MHE	0.348
SRH	0.405

Source: Smart-PLS Output (2026).

Discussion of the findings

The study found that Maternal Health Equity significantly influences Sustainable Rural Health in Kaduna. Efficient practices such as resource allocation, process optimization, and quality control are essential for improving Sustainability. Therefore, Hypothesis 1 (HO1) was rejected. Similarly, Availability of Skilled Personnel has significant influence on Sustainable Rural Health (SRH) of Kaduna Stateis empirically rejected, indicating that Health care Management should deploy skilled personnel with technical abilities, Trained, and highly rated personnel. As a result, Hypothesis 2 (HO2) was also rejected. Therefore, $H0^3$ Quality of Maternal Service (QMS) has significant influence on Sustainable Rural Health (SRH) of Kaduna Stateis empirically rejected. indicates that improvements in the quality of maternal healthcare services alone may not be sufficient to significantly enhance sustainable rural health outcomes in Kaduna State. This suggests that other factors, such as access to maternal healthcare, availability of skilled health personnel, healthcare infrastructure, health financing, community participation, socioeconomic conditions, and innovative healthcare interventions, may play a more critical role in promoting sustainable rural health. The finding further implies that policymakers and healthcare administrators should adopt a more comprehensive approach to rural health development rather than focusing exclusively on service quality improvements. However, the study revealed that innovation significantly moderate the relationship between Maternal Health Equity and

Sustainable Rural Health. This suggests that while both innovation and Maternal Health Equity independently enhance Sustainable Rural Health, their interaction produce an amplified effect. Thus, Hypothesis 3 (HO4) was rejected.

5.0 Conclusion and Recommendations

This study examined the mediating role of innovation in the relationship between Maternal Health Equity and Sustainable Rural Health in Kaduna State. The findings revealed that Access to Maternal Health (AMH)has a strong and positive influence on Sustainable Rural Health, indicating that increased access to maternal healthcare services contributes significantly to improving health outcomes and promoting the sustainability of rural health systems. This suggests that when pregnant women and mothers can easily access healthcare facilities, antenatal services, skilled birth attendance, and postnatal care, rural communities are more likely to experience improved health and well-being.

The study further found that Availability of Skilled Personnel (ASP) significantly influences Sustainable Rural Health. The presence of qualified healthcare professionals, including doctors, nurses, midwives, and community health extension workers, enhances the quality and continuity of maternal healthcare services, thereby contributing to sustainable health outcomes in rural areas. However, the study revealed that Quality of Maternal Service (QMS) significantly influence Sustainable Rural Health in Kaduna State. This finding suggests that although quality service delivery is important, it may not independently determine the sustainability of rural health outcomes. Other factors such as healthcare accessibility, availability of skilled personnel, infrastructure, funding, and community participation may have greater influence on sustainable rural health. The study also established that innovation significantly mediates the relationship between Maternal Health Equity and Sustainable Rural Health. This indicates that innovative healthcare practices, technologies, digital health solutions, mobile health services, telemedicine, and improved healthcare delivery models strengthen the impact of maternal health equity on sustainable rural health outcomes. Therefore, innovation serves as a critical mechanism through which equitable maternal healthcare can translate into long-term health sustainability in rural communities.

Overall, the study concludes that improving maternal health equity through enhanced access to healthcare services and increased availability of skilled personnel, supported by innovative healthcare interventions, is essential for achieving sustainable rural health in Kaduna State.
Based on the findings of the study, the following recommendations are proposed:

The Kaduna State Government, Ministry of Health, and development partners should expand maternal healthcare facilities and services in rural communities. This can be achieved through the establishment of additional primary healthcare centres, mobile clinics, improved transportation systems, and community-based maternal health programs to ensure that women can easily access healthcare services during pregnancy and childbirth.

Government and healthcare authorities should recruit, train, and retain more qualified healthcare professionals in rural areas. Special incentives such as rural allowances, housing support, career

development opportunities, and continuous professional training should be provided to encourage skilled personnel to work in underserved communities.

Health authorities should intensify community awareness campaigns on maternal health services, antenatal care, skilled birth attendance, and postnatal care. Community engagement initiatives can help reduce cultural barriers and increase the utilization of maternal healthcare services.

Healthcare policymakers should invest in innovative healthcare solutions such as telemedicine, mobile health applications, electronic medical records, digital referral systems, and remote maternal health monitoring. These innovations can improve healthcare accessibility, efficiency, and continuity of care in rural areas.

References

Adedini Sunday A., Odimegwu Clifford, et al. (2014). Barriers to accessing health care in Nigeria: Implications for maternal health care utilization. *BMC Health Services Research, 14*, 181.

Aregbeshola Bolajoko S., & Khan Shagufta M. (2018). Out-of-pocket payments, catastrophic health expenditure and poverty among households in Nigeria. *International Journal of Health Policy and Management, 7*(9), 798-806.

Andersen R M. (1995). Revisiting the behavioral model and access to medical care: Does it matter? *Journal of Health and Social Behavior, 36*(1), 1-10.

Braveman, P., Arkin, E., Orleans, T., Proctor, D., & Plough, A. (2022). What is health equity? *Behavioral Science and Policy, 8*(1), 1-14.

Braveman, P., et al. (2014). What is health equity? *American Journal of Public Health, 104*(S4), S517-S522

Campbell, O. M. R., & Graham, W. J. (2006). Strategies for reducing maternal mortality. *The Lancet, 368*(9543), 1284-1299Campbell Oona M. R., Graham Wendy J. (2006). Strategies for reducing maternal mortality: Getting on with what works. *The Lancet, 368*(9543), 1284-1299.

Donabedian Avedis (1988). The quality of care: How can it be assessed? *Journal of the American Medical Association, 260*(12), 1743-1748.

Drucker Peter F. (1985). *Innovation and Entrepreneurship: Practice and Principles*. New York: Harper & Row.

Greenhalgh Trisha, Robert Glenn, Macfarlane Fraser, et al. (2004). Diffusion of innovations in service organizations: Systematic review and recommendations. *The Milbank Quarterly, 82*(4), 581-629.

Krejcie Robert V., & Morgan Daryle W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement, 30*(3), 607-610.Kruk Margaret E., Gage Anna D., et al. (2018). High-quality health systems in the Sustainable Development Goals era: Time for a revolution. *The Lancet Global Health, 6*(11), e1196-e1252.

John W. Creswell, J. W., & J. David Creswell, J. D. (2018). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (5th ed.). Sage Publications.

Levesque Jean-Frederic, Harris, M. F., & Russell, G. (2013). Patient-centred access to health care: Conceptualising access at the interface of health systems and populations. *International Journal for Equity in Health, 12*(18), 1-9.

Nambisan, S., Lyytinen, K., Majchrzak, A., & Song, M. (2023). Digital innovation in Healthcare: Advancing sustainable health systems.

Ranjit Kumar (2022). *Research Methodology: A Step-by-Step Guide for Beginners* (6th ed.). Sage Publications.

Rogers, E. M. (2003). *Diffusion of Innovations* (5th ed.). New York: Free Press. Schumpeter, J. A. (1934). *The Theory of Economic Development*. Cambridge, MA: Harvard University Press.

Strasser, R. (2003). Rural health around the world: Challenges and solutions. *Family Practice, 20*(4), 457-463.

World Health Organization (WHO). (2024). Trends in Maternal Mortality 2000-2023. Geneva: WHO

World Health Organization (WHO). (2024). Primary Health Care and Universal Health Coverage Report. Geneva: WHO.

World Health Organization (2022). *Strategies toward ending preventable maternal mortality (EPMM)*. Geneva: World Health Organization.

World Health Organization (2023). *Primary health care measurement framework and indicators: Monitoring health systems through a primary health care approach*. Geneva: World Health Organization.

World Bank (2023). *Improving maternal and reproductive health outcomes in developing countries*. Washington, DC: World Bank.

United Nations Children's Fund (2024). Maternal and Newborn Health Statistics Report. New York: UNICEF.

United Nations Children's Fund (2023). *Maternal and newborn health disparities report*. New York: UNICEF.

Uma Sekaran, U., & Roger Bougie, R. (2019). *Research Methods for Business: A Skill-Building Approach* (8th ed.). Wiley.

World Bank (2024). World Development Indicators: Health Outcomes and Rural Health Services. Washington, DC: World Bank.