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Towards equitable health systems for universal health coverage (UHC) in sub-saharan africa

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Towards equitable health systems for universal health coverage (UHC) in sub-saharan africa

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Editorial: Towards equitable health systems for universal health coverage (UHC) in sub-Saharan Africa

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KEYWORDS

universal health coverage, sub-Saharan Africa, social determinants in health, financial protection, health service coverage

Editorial on the Research Topic
Towards equitable health systems for universal health coverage (UHC) in sub-Saharan Africa

The global commitment to universal health coverage (UHC) goals is evident in many countries' health sector strategies and UHC Roadmaps. UHC requires that everyone has access to the needed health services of sufficient quality to be effective, without facing any financial hardships due to the need to use such services (1). UHC underpins the Sustainable Development Goal (SDG) 3 "Good health and well-being". There are two major dimensions of UHC that countries are encouraged to assess and monitor; financial protection and coverage of quality health services (2, 3). Financial protection is about ensuring that health service use does not affect a household's capacity to purchase necessities like food, shelter, clothing, etc. Coverage with quality health services, on the other hand, is about using needed health services of sufficient quality to be effective without any barriers. As we move towards the 2030 SDG timeline, of concern is the slow progress in Africa as many African households face significant financial barriers to accessing health services, including impoverishment and financial catastrophe (4), and coverage with essential health services remains low.

The UHC average Service Coverage Index (SCI) for the World Health Organization (WHO) African Region increased by only 22 index points between 2000 (24%) and 2019 (46%), while the population spending more than 10% of household expenditure on health services, an indication of financial catastrophe, increased from 51 to 87 million (5). These regional averages mask the persistent inequalities in service coverage and financial risk protection. Using 2021 data, the World Health Organization estimates that most countries in sub-Saharan Africa (**Figure 1**) have a UHC service coverage index for essential health services lower than 50, where 100 represents full-service coverage. While the UHC service coverage index does not explicitly account for the quality of health services, it exceeded

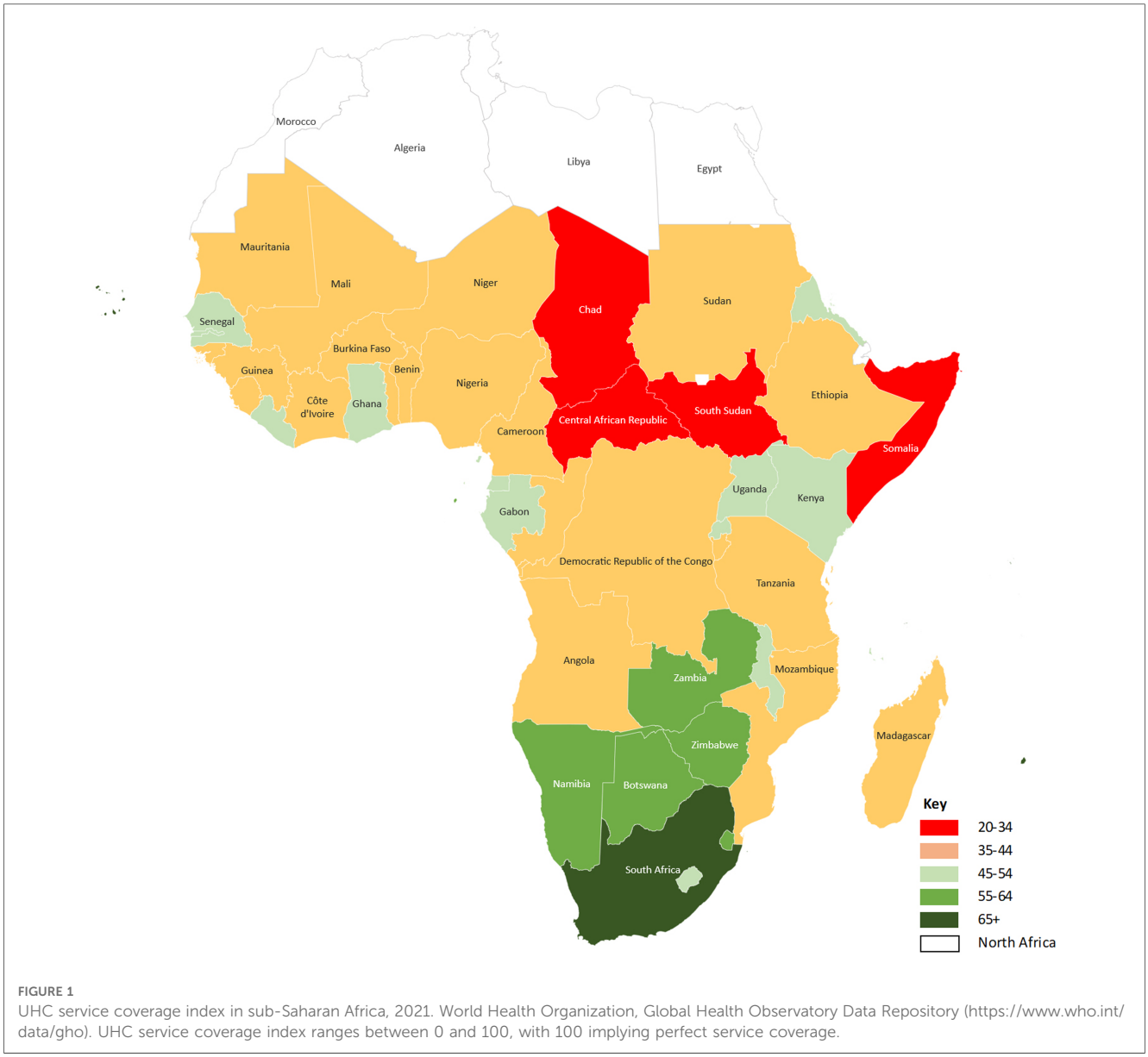

FIGURE 1
UHC service coverage index in sub-Saharan Africa, 2021. World Health Organization, Global Health Observatory Data Repository (https://www.who.int/data/gho). UHC service coverage index ranges between 0 and 100, with 100 implying perfect service coverage.

64 in only Mauritius (66), South Africa (71), Cabo Verde (71), and Seychelles (75). Somalia (27) and Chad (29) have the worst UHC coverage levels in sub-Saharan Africa (**Figure 1**). Although attaining UHC requires more than a well-functioning health system, health systems barriers still play a critical role (6).

In its 2013 World Health Report, the WHO calls for intensifying UHC research to explore solutions to tackle inequities and close the gaps between population groups to leave no one behind (3). This call is even more relevant as we draw closer to 2030. There are no simple solutions to reaching unreached populations, and to address this gap, several countries have turned to pilot projects to explore what works. Positive results have been recorded in several cases, but scaling these to national levels is challenging. The challenge lies in a limited understanding of what explains observed results, as evaluation studies often fall short of exploring underlying mechanisms.

This Research Topic published an initial collection of six research papers covering different countries to respond to the call for research and the need to provide policy-relevant evidence to assist countries in fast-tracking progress towards UHC (Aregbeshola and Olaniyan, Chauluka et al. Mchenga et al. Oladimeji and Fatusi, Oyando et al.) (7).

Employing realist approaches Oladimeji and Fatusi elaborate a middle-range theory highlighting enabling and constraining factors that explained the results of the safe motherhood initiative in Ondo State—Nigeria. Notably, equipping health facilities with health supplies, providing free services, and matching pregnant women with community extension workers, led to positive results. While this was a study from the Ondo State in Nigeria, the methodological rigor engenders a learning experience with wider application in other low-income countries.

Chauluka et al. noting the minimal health insurance coverage for women in Malawi, found that education, occupation and

wealth are significant social determinants of health insurance coverage among women in the country. Prioritising these social determinants of health insurance enrolment is critical for increasing insurance coverage for women in Malawi.

Oyando et al. highlight the gaps in aligning service provision to the need for health services in their study to assess horizontal equity in screening and treating hypertension, a significant public health challenge in Kenya. They further highlight the importance of critical social determinants, including sex, body mass index, wealth, area of residence, and employment status, in explaining observed inequities in screening and treating hypertension in Kenya.

Mchenga et al. developed a UHC index for Malawi using indicators for UHC's two broad dimensions; service coverage and financial protection. Drawing from many data sources, the authors estimated Malawi's UHC index at 69.7%. Service coverage was estimated at 51.6%, which lies in the range indicated in **Figure 1**. The authors highlight the need for policies to address the two UHC dimensions and reduce group inequalities.

In Nigeria, where the maternal mortality ratio remains high, Aregbeshola and Olaniyan assessed horizontal inequity using maternal and reproductive health services. Although there was relative equity in meeting the need for family planning among women in Nigeria, they found significant inequity in women's use of postnatal care, caesarean section delivery, and modern contraceptive to the advantage of wealthier groups. The authors highlight the importance of addressing the needs of women in achieving the SDGs. In their systematic review paper in the Reproductive Health journal, (7) examine factors influencing access and use of youth-friendly sexual and reproductive health services (YFSRHS) in sub-Saharan Africa. They identified both structural (e.g., unfavourable attitudes of health service providers) and individual-level barriers (e.g., limited knowledge and information among the youths) to utilising YFSRHS in sub-Saharan Africa. Importantly, community outreaches and health education emerged as critical factors facilitating the use of YFSRHS.

Conclusion

Sub-Saharan Africa's UHC research agenda is vast, as many of the region's countries have low UHC service coverage index values. As demonstrated by the research summarised in this editorial, significant inequities exist in many health systems. Individuals still face substantial access barriers, especially women, the youth and those from disadvantaged backgrounds. The research papers also demonstrate the poor alignment of service provision to need and the importance of the social determinants as drivers of health inequalities. This accentuates the need for multisectoral action by governments to address the challenges of accessing health services, close the gaps between groups, especially the rich and the poor, and leave no one behind in the move towards UHC. While policy action in other relevant sectors is crucial, within the health sector, paying attention to tailored and contextual approaches that respond to the health needs of the different groups, ensuring that people are aware of their entitlements where such exist, and mitigating financial, physical and other access barriers to ensure people can access quality health services is critical. For equity and to achieve UHC, it is essential to ensure that people finance health services according to their ability to pay but utilise health services based on need without any barriers.

Author contributions

All authors contributed to the drafting, editing and approving the final version. All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Developing Malawi's Universal Health Coverage Index

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The inclusion of Universal Health Coverage (UHC) in the Sustainable Development Goals (target 3.8) cemented its position as a key global health priority and highlighted the need to measure it, and to track progress over time. In this study, we aimed to develop a summary measure of UHC for Malawi which will act as a baseline for tracking UHC index between 2020 and 2030. We developed a summary index for UHC by computing the geometric mean of indicators for the two dimensions of UHC; service coverage (SC) and financial risk protection (FRP). The indicators included for both the SC and FRP were based on the Government of Malawi's essential health package (EHP) and data availability. The SC indicator was computed as the geometric mean of preventive and treatment indicators, whereas the FRP indicator was computed as a geometric mean of the incidence of catastrophic healthcare expenditure, and the impoverishing effect of healthcare payments indicators. Data were obtained from various sources including the 2015/2016 Malawi Demographic and Health Survey (MDHS); the 2016/2017 fourth integrated household survey (IHS4); 2018/2019 Malawi Harmonized Health Facility Assessment (HHFA); the MoH HIV and TB data, and the WHO. We also conducted various combinations of input indicators and weights as part of sensitivity analysis to validate the results. The overall summary measure of UHC index was 69.68% after adjusting for inequality and unadjusted measure was 75.03%. As regards the two UHC components, the inequality adjusted summary indicator for SC was estimated to be 51.59% and unadjusted measure was 57.77%, whereas the inequality adjusted summary indicator for FRP was 94.10% and unweighted 97.45%. Overall, with the UHC index of 69.68%, Malawi is doing relatively well in comparison to other low income countries, however, significant gaps and inequalities still exist in Malawi's quest to achieve UHC especially in the SC indicators. It is imperative that targeted health financing and other health sector reforms are made to achieve this goal. Such reforms should be focused on both SC and FRP rather than on only either, of the dimensions of UHC.

Keywords: Universal Health Coverage (UHC), service coverage, financial risk protection, health system, out-of-pocket (OOP) payments, catastrophic health expenditure (CHE)

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INTRODUCTION

Universal health coverage (UHC) inclusion in the sustainable development goal (SDG) targets (goal target 3.8), and the national commitments to achieve it, has emphasized the need to measure it and track its progress over time (1, 2). According to the World Health Organization (3), the goal of UHC in general is to ensure that everyone irrespective of their socio-demographic characteristics

has access to quality healthcare services when needed without the risk of going bankrupt. Maeda et al. (4) argued that attaining UHC can lead to positive health outcomes, thus helping develop human capital. Development of human capital can then promote job creation, increase financial protection and reduce poverty, promote economic inclusion, and strengthen health security and, thus, macro-stability (4).

According to Wagstaff et al. (2), UHC is defined as having two dimensions: (1) essential health services coverage (3.8.1), which is defined as everyone, irrespective of ability to pay, getting the services they need and (2) financial protection (3.8.2), defined as nobody suffering financial hardship as a result of receiving needed care. The first captures population service coverage, whereas the latter captures the financial expenditures by population group. The summary measure for UHC, therefore, is a combination of the two dimensions (2, 3).

The way UHC is monitored, however, varies by country. While some countries use tracer indicators covering both the service coverage (SC) and financial risk protection (FRP) dimensions (5, 6), other countries have developed composite indices that capture both dimensions (7, 8). Most of this work has been inspired by the pioneering work of the WHO and the World Bank (WB) (9). Malawi is a member of the United Nations SDG and is committed to achieving UHC by 2030 (10). However, the country does not have either a set of agreed tracer indicators or a composite index for monitoring UHC. Given the current policy directions to attain UHC by 2030, the measurement and the tracking of UHC are even more vital.

The goal of this paper, therefore, was to develop a UHC index for Malawi and provide a baseline on which progress toward the attainment of UHC can be measured. To do this, we adopted the WHO and the WB framework for monitoring UHC and the proposal by Wagstaff et al. (2) and Barasa et al. (7) on how to implement the framework. The most recent data available were used for the analysis. Findings from this analysis will inform policy in identifying priority areas for improvement to fast-track the progress toward the attainment of UHC in Malawi.

Healthcare Services Delivery in Malawi

Healthcare services in Malawi are primarily provided by the public sector, which provides the majority (52%) of the health services (11). There are four service delivery levels of care, namely, community, primary, secondary, and tertiary, with inter-level referrals as required (10). At the *community level*, health services are provided by health surveillance assistants (HSAs), health posts, dispensaries, village clinics, and maternity clinics (10). Under the Ministry of Health (MoH)-established integrated community case management (iCCM) approach, HSAs are trained and deployed in hard-to-reach areas to provide both promotive and preventive health services for uncomplicated cases of malaria, pneumonia, diarrhea, newborn sepsis, and malnutrition. Approximately 8,900 HSAs have been trained and deployed in all of Malawi's 29 districts to provide iCCM services, representing 94% of the total hard-to-reach areas identified nationwide (10).

The second level is the *primary healthcare*, which consists of smaller-level facilities such as health centers and community and rural hospitals (10). The primary healthcare level delivers both inpatient and outpatient services, and services are mainly provided by midwife assistants, nursing assistants, and clinicians. The *secondary level* constitutes district hospitals, which offer both inpatient and outpatient services to the local catchment population and function as referral facilities for primary healthcare facilities. The services at the district level are provided by nurses, midwives, and general practitioners. Lastly, the *tertiary level* of services comprises five central hospitals, each of which provides specialized health services. At this level of care, you will find specialists in different areas such as neurosurgeons and gynecologists, among others.

Besides the government/public sector, other actors include private for-profit (PFP) and private not-for-profit (PNFP). PNFP includes non-governmental organizations (NGOs), company clinics, Christian health association (Christian Health Association of Malawi, CHAM) facilities, and other faith-based owned facilities. PNFP is the second (25%) largest provider of care from the government and mainly provides secondary level of care, followed by a large number of independent private health facilities that provide the remaining 23% of the services (11).

UHC-Inspired Reforms in Malawi

The government of Malawi is committed to providing accessible and affordable healthcare to all its citizens. To meet the health needs of its population, the government developed an essential healthcare package (EHP) consisting of a set of interventions that provide the best value for money (11). First introduced in 2004, EHP interventions are provided free of charge at primary healthcare levels in all public health facilities (11). Over the years, the EHP has been revised in line with the medium-term Health Sector Strategic Plan (HSSP): 2011–2016 HSSP (12) and 2017–2022 HSSP II (10). In each case, the EHP included interventions that are cost-effective and deal with major causes of morbidity and mortality in Malawi, with a focus on ensuring equity (13). As described in the HSSP II (10) and as shown in **Table 1**, the range of services in the package include reproductive, maternal, neonatal, and child healthcare (RMNCH) services, vaccinations, malaria, nutrition, HIV and AIDS, and tuberculosis, among others (11).

However, the network of public health services does not, by the government's definition of physical access (within an 8-km radius of a public health facility), cater to 100% of the population, especially in rural areas where the need for affordable health services is the greatest. Despite the increase in the proportion of the population that resides within an 8-km radius of a health facility (health centers and hospitals), from 81% in 2011 to 90% in 2016 (14), there is still a proportion of the population that remains underserved, especially in rural and hard-to-reach areas.

Although the primary provider of healthcare in Malawi is the government, the CHAM also plays a significant role in the provision of healthcare services in Malawi. About 75% of health services in remote and rural areas are provided by CHAM facilities (15). Currently, an estimated 3.7 million Malawians live in CHAM catchment areas. Since 2006, as a way of increasing equitable healthcare access to basic healthcare services among the rural poor, the government started exploring strategic

TABLE 1 | Interventions included in the essential health package (EHP).

EHP category	Intervention package
RMNCH	ANC package including tetanus toxoid, deworming, iron and folic supplements, syphilis detection, IPT, insecticide-treated bed net (ITN) distribution to pregnant women, and urinalysis
	Modern family planning including all modern contraceptive methods
	Delivery package
Vaccine-preventable diseases	Essential vaccine package including rotavirus vaccine, measles, polio, and HPV, among others
Malaria	First-line uncomplicated malaria
	Complicated malaria treatment
	Malaria diagnosis
Integrated management of childhood illnesses	ARIs
	Diarrheal diseases
	Nutrition
	Malaria diagnosis
Community health package	Community health package
NTDs	Treatment and mass drug administration
HIV/AIDS	HIV prevention
	HIV testing
	HIV treatment
Nutrition	Vitamin A supplementation
	Deworming
	Management of severe malnutrition
TB	TB testing
	TB treatment
NCDs	Treatment of injuries
	Mental health treatment
	Testing of pre-cancerous cells
	Diabetes and hypertension treatment
Oral health	Tooth pain treatment

MoH (11).

ANC, antenatal care; IPT, intermittent presumptive treatment; RMNCH, reproductive, maternal, neonatal and child healthcare; HPV, human papillomavirus; ARIs, acute respiratory infections; NTDs, neglected tropical diseases; TB, tuberculosis; NCDs, non-communicable diseases.

partnerships with CHAM through an arrangement called service legal agreement (16). In essence, CHAM would provide health services free of charge to the user and the government would reimburse CHAM for the cost of providing the health services.

HEALTH FINANCING

There are three main financing actors in Malawi's health sector: government, donor, and private. The government finances the health sector using public funds from tax collection, return on government assets, and other sources. Donors, on the other hand, finance the sector through supporting the government's development budget, procuring medical commodities, and directly supporting programs and other providers (14). Last but not least, private financing comes from household out-of-pocket (OOP) expenditure, firms, and private insurance providers. The key indicators for health financing between 2015 and 2018 are described in **Table 2**.

Several issues are apparent from **Table 2**. (1) The Malawian health system faces many challenges to effectively provide primary healthcare services, among them being inadequate funding. For example, in recent years, the budget allocation of this sector has been consistently lower than the recommended Abuja target of 15% of the gross domestic product (GDP). (2) The health sector is heavily dependent on donor funding. (3) Household OOP expenditures are the main contributors to private health financing.

Despite the provision of free primary healthcare services in all public facilities and the removal of user fees in selected CHAM facilities (16), Malawi still lags behind in attaining the UHC goals of providing quality healthcare services and ensuring FRP. For instance, a study conducted by Leslie et al. (17) reported that, for key maternal and child health interventions in Malawi, effective coverage is 24.7%. A study conducted by Mchenga et al. (18) in 2017 reported that the incidence of catastrophic expenditure in Malawi varied between 0.73 and 9.37%. The researchers used thresholds of 10–40% of non-food expenditure, leading to an addition of 0.93% of the population being pushed into poverty due to OOP expenditures.

Currently, voluntary private medical insurance plays a negligible role in financing healthcare in Malawi. For example, between 2015 and 2018, private health insurance contributed an average of 3.6% to total health spending, as shown in **Table 2**. Generally, pooling in Malawi is significantly fragmented and has a limited redistributive capacity. Estimates of the resource mapping study suggested that only 26% of all health resources are in any form of pool (14). Furthermore, the donor landscape is highly segmented, with most donors channeling their support "off-budget" outside of government systems (14). The challenge with off-budget funding is that it is difficult for the government to have proper oversight in the allocation of resources and implementation of programs. This results in misalignment with government priorities, high transaction costs, and inefficient resource allocation, which tends to exacerbate inequities in the targeting and delivery of health programs (14). There is also little joint planning between the major development partners and the Ministry of Health and Population (MoHP) and district health management teams.

METHODS AND DATA

Study Framework

To compute the UHC index, we adopted the framework proposed by Wagstaff et al. (2). The UHC index therefore is a representation of two components: SC and FRP. Based on the framework, the SC component is made up of two domains capturing essential health interventions: prevention and treatment indicators. Similarly, the FRP dimension also comprises two domain indicators: incidence of catastrophic healthcare spending and the proportion of the population that is impoverished by OOP. Additionally, given that at the core

TABLE 2 | Key health accounts findings.

Indicators	2015/2016	2016/2017	2017/20118	Average
Total health expenditure (THE) (MWK million)	429,095	495,353	502,773	476,694
THE (US $ million)	678.95	685.14	693.48	687.17
Per capita total expenditure on health (at average US $ exchange rate)	40.3	39.4	39.5	39.8
THE as a percentage of GDP	11.3	10.7	9.8	10.6
Government expenditure on health as a percentage of THE	24.7	22.7	24.4	23.9
Donor expenditure on health as a percentage of THE	58.4	59.9	57.6	58.6
Total private expenditure as a percentage of THE	16.9	17.5	17.9	17.4
Out-of-pocket expenditure on health as a percentage of private expenditure on health	73.5	72.7	70.8	72.3
Out-of-pocket expenditure on health as a percentage of THE	12.4	12.7	12.7	12.6
Health insurance as a percentage of private expenditure on health	26.5	27.3	29.2	27.7
Health insurance corporations as a percentage of THE	2.8	3.8	4.3	3.6

MoH (14).
GDP, gross domestic product.

of UHC is equity, it is essential that the tracking of UHC progress takes into account an equity analysis. This is done by computing an achievement index that relates directly to the concentration index (2). The concentration index is an important tool for measuring inequalities, and it quantifies the degree of socioeconomic-related inequality in a given health variable (2). How the achievement index is computed for each of the indicators is explained in the proceeding sections.

Summary of the UHC Index

As previously indicated, we used the approach by Wagstaff et al. (2) to summarize the UHC index, which uses geometric means. The argument given for the use of geometric means is that they are more sensitive to extreme values. As a result, they implicitly assign more weight to health services with lower coverage and are less sensitive to the scale on which input variables are measured compared to when using arithmetic means (9).

Using the two dimensions SC and FRP, the UHC index is presented as the geometric mean as follows:

$$\mathrm{UHC} = \mathrm{SC}^{\varphi} \cdot \mathrm{FP}^{1-\varphi} \tag{1}$$

where SC is the service coverage, φ is a weight for SC, FRP is the financial risk protection, and $1 - \varphi$ is the weight for FRP. In terms of the exact weights to be used, most policy makers use 0.5 for each (2). In this study, we adopted the same weights. The range of the index is between 0 and 100, with higher numbers representing higher UHC progress.

The individual components are in turn calculated as follows. The SC is calculated as a geometric mean of two dimensions: prevention and treatment. Firstly, the prevention dimension was defined as follows:

$$\mathrm{SC_P} = \mathrm{SC_{P_1}^{\alpha_1}} \mathrm{SC_{P_2}^{\alpha_2}} \ldots \mathrm{SC_{P_n}^{\alpha_n}} \tag{2}$$

where $\mathrm{SC}_{P_1}^{\alpha_1}$ is prevention indicator 1 with equal weights of α_i, $i = 1 \ldots n$. Secondly, the treatment dimension was defined as follows:

$$\mathrm{SC_T} = \mathrm{SC_{T_1}^{\beta_1}} \mathrm{SC_{T_2}^{\beta_2}} \ldots \mathrm{SC_{T_n}^{\beta_n}} \tag{3}$$

where $\mathrm{SC}_{T_1}^{\beta_1}$ is treatment indicator 1 with weight β_i, $i = 1 \ldots n$. In line with Wagstaff et al. (2) and Barasa et al. (7), the geometrical mean of the treatment indicators was computed assigning the indicator for hospital admission a weight of 50% and the other 50% being shared equally among the rest of the treatment indictors.

With both components calculated, the summary measure for SC was then calculated as follows:

$$\mathrm{SC} = \mathrm{SC_P^{\pi}}.\mathrm{SC_T^{1-\pi}} \tag{4}$$

where SC_P^{π} is the prevention dimension with weight π and $\mathrm{SC}_T^{1-\pi}$ is the treatment dimension with weight $1 - \pi$. Wagstaff et al. (2) assigned the prevention indicator a lower weight of 25%, which is relatively higher than the share of prevention in total health spending in the OECD (Organization for Economic Co-operation and Development) countries and in Asia. In this study, however, we assigned a 30% weight to the prevention indicator based on the findings of the 2020 National Health Accounts, which showed that, between 2015/2016 and 2017/2018, the health spending on preventive care as a share of the total health spending was an average of 30.8% (14). Nevertheless, as part of the sensitivity analysis, we also used 25% to assess whether there would be a difference, but we did not observe any difference in the summary measure of SC.

We calculated the population-level averages for each of the SC indicators to obtain population-level estimates. To account for inequality in service coverage, concentration indices for each of the SC indicators were computed ranked by inequality components such as household income level and education level of the household head, among others, depending on the data. We then computed an achievement index to account for the differences across demographic groups. This was done by assigning an achievement score below the population mean to variables with high SC rates and were pro-rich and *vice versa* (2). Put simply, this was done by computing the multiplication of the population mean of the SC indicator by its concentration index complement (2, 19), such that each individual intervention and

composite intervention was adjusted for inequality, giving us an inequality-adjusted SC summary measure.

Like the SC component, the financial risk protection component, *FRP*, is a geometric mean of two domains. The first is the incidence of "catastrophic" health payments, FRP_{CATA}. We defined catastrophic health payments as payments that exceeded the 40% threshold of non-food expenditures, as proposed by the WHO. The 40% threshold was chosen because it takes into account the money that remains after all the basic needs have been met. As such, it is the best estimate of capacity to pay for healthcare expenditure (7). We then computed the complement of the incidence of catastrophic health expenditures (CHEs) in order to obtain the proportions of households that did not suffer from any CHEs (2). The proportions of households with no CHEs were considered to have some level of FRP. This was defined as follows:

$$FRP_{CATA} = \frac{(1 - Cata)\ (1 - Cata_{MAX})}{(1 - Cata_{MIN})\ (1 - Cata_{MAX})} \quad (5)$$

where Cata is the proportion of households incurring catastrophic expenditures; the subscripts MIN and MAX represent minimum and maximum values, respectively. To examine inequality in FRP, we computed the population means of the complements of CHE indicators and their concentration indices. To account for the differences in the distribution of catastrophic spending across demographic groups, we multiplied the indicator with its corresponding achievement index.

The other component of FRP is the "impoverishing" payments, FRP_{IMPOV}. This indicator considers individuals who were pushed into poverty by OOP spending over a given period (usually a 1-year period). The complement of which is the proportion of individuals who do not get into poverty due to OOP expenditures and was calculated as follows:

$$FRP_{IMPOV} = \frac{(1 - Impov)\ (1 - Impov_{MAX})}{(1 - Impov_{MIN})\ (1 - Impov_{MAX})} \quad (6)$$

However, on slight departure to Wagstaff et al. (2), Barasa et al. (7) defined the impoverishment indicator as the percentage of the population that is poor and had reported to spending OOP for health (i.e., the proportion of the poor population that has gotten deeper into poverty) plus the percentage of non-poor individuals who got poor due to OOP spending. The authors' justification is that, in the context of UHC, poor people are already in a vulnerable financial state as such FRP means that these people should not spend money OOP to access health services. Given that the majority of the population in Malawi is poor, just like in most low- and middle-income countries (LMICs), we adopted the definition of Barasa et al. (7) of impoverishment to avoid overstating FRP. Therefore, the complement of the FRP indicator was computed as the percentage of the population that does not get poor or is deep into poverty by spending OOP for health.

Validation/Sensitivity Analysis of the UHC Index

To validate our results, we performed the following sensitivity analyses: (1) we computed the inequality-unadjusted geometric summary of the UHC index. (2) While the starting point of the analysis the assumption made was that treatment interventions had a 70% weight in comparison to prevention interventions in computing the SC summary measure, equal weights of 50% each for the prevention and treatment indicators were used in the sensitivity analysis. (3) For hospital admissions, the base case scenario assumed a 50% in comparison to the other treatment interventions; the sensitivity analysis assigned equal weights to all treatment interventions. (4) Lastly, a reduced summary measure of UHC was computed with some of the service capacity indicators excluded.

Selection of Indicators and the Guiding Principles

In selecting indicators, the WHO and the WB advised that authors should make sure that they are relevant, of high quality, and that data are available (9). Based on these guidelines, we therefore selected indicators based on the following principles: firstly, the index captures both prevention and treatment indicators. Prevention indicators include both health promotion and prevention of illnesses, whereas treatment indicators include remedial, rehabilitation, and palliation services (1). For policy relevance, the analysis in this study was based on indicators capturing essential services that were included in the Malawi health benefit package, as described in **Table 1** (10). Secondly, the index covered key RMNCH services and communicable and non-communicable diseases. Lastly, due to data limitations, only indicators whose data are routinely available through routine health surveys were included. The indicators included in this analysis are discussed below.

Service Coverage Indicators

As explained earlier, SC indicators comprised two domain indicators: prevention and treatment indicators. Between the two SC components, the easier one to operationalize was the prevention component, with data easily available. To capture the prevention component, nine indicators were used: whether a pregnant woman had received at least four antenatal care (ANC) visits; whether a child was fully immunized; cervical cancer screening; whether a pregnant woman was given iron–folic acid (IFA); at least two tetanus toxoid (TT) injections during pregnancy; use of mosquito net for children under 5; whether a pregnant woman used a mosquito net; proportion of women on modern contraceptive methods; and met the needs for family planning.

On the other hand, due to data scarcity, the treatment component was difficult to operationalize (2). Nonetheless, 13 indicators were identified and used for the analysis: skilled birth attendant (SBA); treatment of diarrhea in children with oral rehydration salts (ORS) or a homemade solution; whether a child with acute respiratory infection (ARI) got medical treatment; mother or child postnatal check by skilled personnel; effective tuberculosis (TB) treatment coverage; proportion of HIV-positive people receiving antiretroviral therapy (ART); treatment coverage among people with cardiovascular diseases; proportion of people with diabetes receiving treatment; and whether the baby was delivered in a health facility.

Under the treatment domain, as recommended by the WHO and WB (9), service capacity and access indicators were accounted for to capture the capability of the Malawian health system to adequately provide healthcare access. This includes key areas such as everyday medical examinations, mental illness treatment, emergency care, and surgical procedures (9). The indicators chosen to proxy service capacity and access included hospital bed density (proxies hospital admission), core health professional distribution and density, which include general medical doctors, specialist medical doctors, non-physician clinicians, nursing professionals, and midwifery professionals, access to essential medicines, and health security measure (9).

In summary, the chosen service coverage indicators met three requirements: (1) they included an element of prevention and treatment; (2) the indicators covered services capturing the healthcare needs of individuals during the entire life span, i.e., children, reproductive age population, and the elderly; and (3) the health service indicators represented a variety of needs, such as child and maternal healthcare, treatment for infectious and non-communicable diseases, and facility-level outpatient and inpatient care.

Detailed descriptions of the service indicators are given in **Table 3**. It should be noted, however, that the definition for each indicator was adopted from the WHO and WB report that tracks UHC in selected LMICs (9).

Financial Risk Protection

As discussed earlier, two indicators were used to estimate the level of FRP: incidence of catastrophic healthcare expenditures and impoverishment due to OOP payments. The difference between CHEs and impoverishing health expenditures is that the latter can push a household into poverty or further into poverty if already below the poverty line. **Table 4** summarizes the definition of the FRP indicators.

Data Sources

The following variety of data sources were used for the analysis: the 2015–2016 Demographic and Health Survey (DHS) (20) and the 2013–2014 Multiple Indicator Cluster Survey (MICS) (21) to analyze utilization and access of maternal and child health services; 2018 Facility Assessment Survey (11) used to analyze facility-level capacity; the MoH tuberculosis data extracted from the Ministry dataset used to analyze TB effective treatment; the MoH HIV/AIDS data extracted from the Ministry dataset to analyze access to ART for people living with HIV/AIDS; the Malawi STEP Survey (22) used to analyze non-communicable disease prevention and treatment services; and the 2016/2017 Integrated Household Survey (IHS) (23) used to analyze household-level expenditure on healthcare.

Both the DHS and MICS are household-based surveys collected by the Malawi National Statistics Office with technical assistance by the ICF through the DHS program. The surveys are conducted every 5 years and gather data on marriage, fertility, family planning, and reproductive and child health. The response rate for both surveys was very high, over 90%. The DHS program has policies in place of editing and imputation to ensure that the data accurately reflect the population studied, including sampling weights, median calculations, missing values, wealth index, and other tools of demography.

The 2018/2019 Malawi Harmonized Health Facility Assessment (HHFA) survey is a facility-level census that collects data on how equipped facilities are to provide primary healthcare in Malawi. This survey was conducted by the MoH with financial support from the Global Fund. The Malawi HHFA underwent an external quality assurance process by an independent team engaged by the Global Fund (11).

The Malawi IHS is also a household-based survey that collects comprehensive data on household expenditures, including spending on health, household, and individual demographic characteristics, outpatient care in the past 4 weeks prior to the survey, and inpatient care in the last 12 months prior to the survey. Both the inpatient and outpatient care data are collected at the individual level. The IHS is also collected by the National Statistics Office with technical assistance from the WB. To ensure data quality, sampling weights were used. Similar to the DHS and MICS, the response rate was very high at 93%.

Finally, the WHO STEPwise approach to NCD risk factor surveillance (STEPS) survey estimates the prevalence of non-communicable diseases (NCDs) and their risk factors in Malawi. The survey uses a standardized questions and protocols to allow comparisons across countries.

RESULTS

Level of Universal Health Coverage in Malawi—UHC Index

The analysis showed that the inequality-adjusted UHC index (which was calculated as a geometric mean of the financial risk indicators and service coverage indicators) for Malawi is 69.68%, whereas the unadjusted UHC index is 75.03%. Further sensitivity analysis of the UHC index based on different weights and exclusion of service capacity indicators resulted in the following: 75.03% for unadjusted, 67.66% when both treatment and preventive indicators were given the same weight of 50%, and 61.83% when we included capacity indicators and maintained equal weights all throughout.

Health Service Population Coverage

The findings of the key healthcare interventions at the population level are presented in **Table 5**. The utilization of ANC and family planning services remains very low in Malawi. Only 51% of women reported to having at least four ANC visits in 2016. The modern contraceptive prevalence rate is reported at 58%, whereas the met need for family planning services among married women is 59%. About 89% of women in Malawi received iron–folic acid supplements and at least two doses of TT injection during pregnancy, whereas 90 and 92% of the women reported to having been assisted by skilled personnel (doctor/nurse/midwife) and having delivered in a health facility, respectively.

Although 76% of children in Malawi were fully immunized, mosquito net use was reported in less than half (50%) of children under 5 and pregnant women. About 87% of the households reported having access to clean drinking water, whereas only 52% reported having access to improved non-shared toilet facilities.

TABLE 3 | Operational definitions for indicators of the universal health coverage (UHC) index in Malawi.

Dimension	Coverage indicators	Definition	Numerator	Denominator	Data source	Data quality
Prevention indicators	Iron and folic acid (≥100)	Percentage of pregnant women who took iron and folic acid supplementation	Number of women who took iron and folic acid tablets during pregnancy	Total number of women who delivered in the last 2 years	DHS/MICS	Uses sampling weights to ensure quality
	TT (2 injections)	Percentage of pregnant women immunized with at least two TT injections	Number of women immunized with at least 2 TT injections during pregnancy	Total number of women who delivered in the last 2 years	DHS	Uses sampling weights to ensure quality
	≥ 4 Antenatal checkups	Percentage of pregnant women with at least 4 ANC checkups during pregnancy	Number of pregnant women with at least 4 ANC visits	Total number of women aged 15–49 years who delivered in the last 2 years	DHS	Uses sampling weights to ensure quality
	Contraceptive prevalence rate	Percentage of couples using any method of contraception	Number of couples using any method of contraception	Total number of eligible couples	DHS/MICS	Uses sampling weights to ensure quality
	Full immunization	Percentage of 1-year-old children who are fully immunized	Number of 1-year-old children who have received 3 doses of a vaccine containing diphtheria, tetanus, and pertussis; 1 dose of BCG; 3 doses of polio; and 1 dose of measles vaccine	Total number of 1-year-old children	MICS	Uses sampling weights to ensure quality
	ORS use rate	Percentage of children under 5 who received ORS for diarrhea episode in the last 2 weeks	Number of children under 5 given ORS for diarrhea in the last 2 weeks	Total number of children under 5 having episodes of diarrhea in the last 2 weeks	MICS	Uses sampling weights to ensure quality
	ITN coverage for malaria prevention	Percentage of population who slept under an ITN the previous night.	Number of people who slept under an ITN	Total population	DHS/MICS	Uses sampling weights to ensure quality
	Improved water and sanitation	Percentage of households using improved water and improved sanitation facilities	Population living in a household with drinking water from: piped water into dwelling, plot, or yard; public tap/stand pipe; tube well/borehole; protected dug well; protected spring; or rainwater collection AND living in a household with: flush or pour-flush to piped sewer system, septic tank, or pit latrine; ventilated improved pit latrine; pit latrine with slab; or composting toilet	Total population	DHS	Uses sampling weights to ensure quality
	Tobacco control	Age-standardized prevalence of adults ≥15 years not smoking tobacco in the last 30 days	Adults 15 years and older who have not smoked tobacco in the last 30 days	Adults 15 years and older	STEP Survey	Uses a standardized tool developed by the WHO
	Cervical cancer screening	Cervical cancer screening among women aged 30–49 years (%)	Women ages 30–49 who have tested for cervical cancer	Total number of women aged 30–49 years in the sample	STEPs Survey	Uses a standardized tool developed by the WHO
Treatment indicators	Treatment of cardiovascular disease	Age-standardized prevalence of raised blood pressure among adults aged 18+	Number of adults aged 18 or older with systolic blood pressure ≥140 mmHg or diastolic blood pressure ≥90 mmHg	Number of adults aged 18 or older	STEPS Survey	Uses a standardized tool developed by the WHO
	Management of diabetes	Age-standardized prevalence of raised blood glucose among adults 18+	Number of adults aged 18 or older on medication for raised blood glucose	Number of adults aged 18 or older	STEPS Survey	Uses a standardized tool developed by the WHO

(Continued)

TABLE 3 | Continued

Dimension	Coverage indicators	Definition	Numerator	Denominator	Data source	Data quality
	Institutional delivery	Percentage of pregnant women delivering in any level of public or private institution	Number of women delivering in any level of public or private institution	Total number of women who delivered in the last 2 years	DHS	Uses sampling weights to ensure quality
	Postnatal care	Percentage of women who reported having received postnatal checkups within 6 weeks after delivery	Number of women who received postnatal check within 6 weeks after delivery	Total number of live births	DHS	Uses sampling weights to ensure quality
	Medical treatment for acute respiratory infection (ARI)/pneumonia in children	Percentage of children under 5 with suspected pneumonia (cough and difficulty breathing NOT due to a problem in the chest and a blocked nose) in the 2 weeks preceding the survey taken to an appropriate health facility or provider	Number of children under 5 with suspected pneumonia in the 2 weeks preceding the survey taken to an appropriate health provider	Number of children under 5 with suspected pneumonia in the 2 weeks preceding the survey	MICS/DHS	Uses sampling weights to ensure quality
	Tuberculosis treatment	Percentage of incidence TB cases that are detected and successfully treated in a given year	Number of new and relapse cases detected in a given year and successfully treated	Number of new and relapse cases in the same year	MoH NTP annual report	Routinely conducted by the MoH and cross-checked for any errors
	HIV treatment	Percentage of people living with HIV currently receiving antiretroviral therapy (ART)	Number of adults and children who are currently receiving ART at the end of the reporting period	Number of adults and children living with HIV during the same period	MoH HIV data	Routinely conducted by the MoH and cross-checked for any errors
	Hospital[a] access	Hospital (inpatient) admissions per population per year	Number of inpatient admissions (or discharges) per year	Total population	Health facility census data	Data collected by trained health workers at the MoH
	Health worker density	Health professionals (physicians, psychiatrists, surgeons, nurses, and midwives) per capita, relative to the maximum thresholds for each cadre	[[Inline Image]]Number of physicians, psychiatrists, surgeons, nurses, and midwives	Total population	Facility census data Population census	Data collected by trained health workers at the MoH
	Access to essential medicines	Percentage of health facilities with essential tracer medicines	Number of facilities with essential tracer medicines in stock	Total number of health facilities	Facility census data	
	Health security	International Health Regulations (IHR) core capacity index, which is the average percentage of attributes of 13 core capacities that have been attained at a specific point in time. The 13 core capacities are: (1) national legislation, policy, and financing; (2) coordination and national focal Point communications; (3) surveillance; (4) response; (5) preparedness; (6) risk communication; (7) human resources; (8) laboratory; (9) points of entry; (10) zoonotic events; (11) food safety; (12) chemical events; and (13) radio nuclear emergencies.	Number of attributes attained	Total number of attributes	WHO data	

TT, tetanus toxoid; ANC, antenatal care; TB, tuberculosis; BCG, Bacillus Calmette–Guérin vaccine; ORS, oral rehydration salts; ITN, insecticide-treated bed net; DHS, demographic and health survey; MICS, multiple indicator cluster survey; MoH, ministry of health; STEPS, stepwise approach for NCD risk factor surveillance.

*[a]Hospital access was calculated based on inpatient bed density and adopted from the WHO/WB definition (9). The bed density values were rescaled and capped based on the threshold values defined in the harmonized health facility survey. Inpatient bed density had a threshold of 25 per 10,000, while maternity bed density had a threshold of 10 per 1,000. After rescaling these values [i.e., minimum (100, X/threshold * 100)], where X is the bed density, they were combined into a hospital access composite variable for entry into the index calculations, computed as (Inpatient bed density * Maternity bed density)$^{1/2}$. The thresholds chosen were based on the Malawi health facility assessment benchmark.*

TABLE 4 | Definitions of the financial risk protection indicators.

Indicators	Numerator	Denominator	Data source
Percentage of the population with no catastrophic healthcare expenditure	Number of households in the survey with no OOP spending exceeding 40% of their annual survey in the preceding 12-month period	Number of households in the survey	IHS4[a]
Percentage of households that did not get poor or pushed deeper into poverty by OOP spending	Number of non-poor households that did not get poor plus the number of poor households with no OOP spending	Number of households in the survey	IHS4

OOP, out of pocket.

[a]*IHS4 was used instead of IHS5 because the aggregated estimates to calculate the expenditure and poverty levels in IHS5 were not publicly available yet.*

Cervical cancer screening is significantly very low in Malawi, with only 11% of women reporting to having been tested for cervical cancer before. Similarly, for NCDs, the treatment rates are very low, with only 24 and 47% of the population being treated for cardiovascular disease (CVD) and diabetes, respectively.

The wealthy population had higher utilization rates for both preventive and treatment services in comparison to the poor, except for treatments for ARIs and fever, which mostly covered the poor (**Table 5**). The inequalities were much more evident for services such as iron–folic acid supplementation during pregnancy [concentration index (CI) = 0.142], utilization of ITN among the under 5 (CI = 0.146) and pregnant women (CI = 0.166), access to improved source of drinking water (CI = 0.291), access to improved non-shared toilet facilities (CI = 0.178), skilled birth attendance (CI = 0.173), institutional delivery (CI = 0.211), and CVD treatment (CI = 0.120). So much that, for all indicators, coverage was less after adjusting for inequality. The weighted summary index of SC was estimated to be 51.74%, whereas the unweighted SC was 53.99%.

District-Level Estimates of the Service Coverage Index

Figure 1 shows the district-level coverage of selected SC indicators from the DHS without the service capacity indicators included. The darker the shade of green, the better the service coverage. The district-level estimates showed geographic variations in the population coverage of services, with the Southern and the Central regions having high service coverage compared to the Northern region.

Financial Risk Protection

The findings for FRP are provided in **Table 6** and showed that the percentage of households with catastrophic healthcare spending is estimated at 1.3%. The results further showed that the poor are more likely to incur CHEs. Additionally, about 1.42% of households got poor due to healthcare expenditures. Furthermore, among the poor households, over 2% were pushed further into poverty due to healthcare expenditures, giving a total of 3.75% of households being impoverished due to catastrophic healthcare expenditures. These estimates gave summary measures of FRP of 97.45% before adjusting for inequality and 94.10% after inequality adjustment.

DISCUSSION

The commitment to UHC both at the national and global levels has emphasized the importance of measuring it to track its progress over time (1, 2). In this paper, we have presented an analysis of Malawi's current status on UHC to provide a basis on which to monitor UHC progress moving forward. For the analysis, we adopted the WHO/WB UHC monitoring framework (9) and suggestions by Wagstaff et al. (2) and Barasa et al. (7).

There are a number of observations that we made. Firstly, looking into the individual UHC dimensions, the SC level was found to be low at 51.59%. This implies that slightly over half of the population have access to both preventive and treatment service indicators. Given that the SC index coverage ranges between 0 and 100%, with high values signifying better coverage, 51.59% is relatively very low and implies that service coverage is inadequate and that, in order to achieve SDG goal 3.81, there is still more that needs to be done. Although the SC level is low, it is significantly higher than the estimate reported by the WHO for Malawi of 44% in 2015 (9), probably because the most recent data they used were for 2010, especially on TB treatment effectiveness and HIV treatment. For this analysis, the HIV and TB data were taken from the MoH, which has relatively higher and the most recent estimates. Nevertheless, the low SC agrees with findings from Hogan et al. (5), which showed low SC indices for LMICs in Sub-Saharan Africa (42%) and southern Asia [53]. The findings are also similar to those reported by Barasa et al. (7) in Kenya who found a low SC of 42% in 2013.

With regard to the service coverage domains, for the prevention indicators, Malawi is doing well in the following areas: tetanus injection, access to improved water source, folic and iron supplements during pregnancy, and full immunization, with estimates ranging between 77 and 89%. However, although maternal and child health services are provided as part of the essential healthcare package and therefore provided for free in all public facilities and selected CHAM facilities (16), ANC and family planning coverage still remains relatively low and pro-rich. The proportion of women reporting to have at least 4 ANC visits is only at 50%, and the family planning prevalence rate is only 58%. Although the lower ANC utilization rate is puzzling, there are possible reasons that could explain this phenomenon. For instance, results for a study in rural Mangochi reported that the focused antenatal care (FANC) requirement for birth

TABLE 5 | Coverage of health services in Malawi, 2015–2019.

Indicators	Mean coverage (95% CI)	Concentration index (SE)	Inequality-adjusted estimates
Prevention indicators			
Four or more ANC visits	50.77 (49.93–51.62)	0.07663616	43.11
Met need for family planning	59.22 (58.46–59.98)	0.05955617	53.27
Family planning prevalence	58.06 (57.28–58.82)	0.05359306	52.69
At least two tetanus injections	89.28 (88.76–89.81)	0.00924494	88.36
Folic and iron supplements	89.36 (88.84–89.88)	0.1419105	75.14
Full immunization	75.66 (74.18–77.14)	0.06168107	69.48
Bed net use by children under 5	43.46 (42.69–44.23)	0.14618039	28.85
Bed net use by pregnant women	46.95 (43.88–50.01)	0.16581048	30.39
Improved source of drinking water	87.13 (86.73–87.54)	0.29130189	58.01
Improved non-shared toilet facilities	51.76 (51.15–52.36)	0.17802085	33.96
Cancer screening	11.96 (10.73–13.18)	0.06166827	5.79
Non-smoking	75.50[a]	0.05620493	71.88
Geometric mean of prevention indicators	55.74	43.02	
Treatment indicators			
Baby postnatal care	63.02 (59.59–66.45)	0.04901072	58.15
Mother postnatal care	43.52 (42.65–44.40)	0.06182999	37.34
ARI treatment	73.44 (71.28–75.60)	−0.04992498	78.44
ORS treatment for diarrhea	64.74 (63.13–66.34)	0.01798706	62.93
Fever treatment	67.10 (65.77–68.45)	−0.02545055	69.64
Skilled birth attendant	90.31 (89.88–90.88)	0.17328123	73.06
Institutional delivery	92.27 (91.82–92.72)	0.21115801	71.15
Tuberculosis effective treatment	87.20	–	87.20
HIV treatment	80,70	–	80.70
Cardiovascular disease treatment	23.42 (19.06–27.78)	0.12034723	11.46
Management of diabetes	47.93 (30.51–65.34)	0.08129232	40.44
International Health Regulations core capacity index	56.13	–	56.13
Health professionals per capita (with threshold): physicians, psychiatrists, and surgeons	45.3	–	45.3
Hospital beds per capita (with threshold)	59.1	–	59.1
Proportion of health facilities with WHO-recommended core list of essential medicines available	38	–	38
Geometric mean of treatment indicators	58.66	55.77	
Overall service coverage index	57.77	51.59	

95% CI, 95% confidence interval; ANC, antenatal care; ARI, acute respiratory infection; ORS, oral rehydration salts.

[a] *The actual figure was 88.75% before rescaling. Tobacco non-smoking is based on age-standardized estimates; as such, it is recommended that it is rescaled to provide finer resolution based on a minimum bound of 50%, so that the rescaled indicator = (X – 50)/(100 – 50) * 100, where X is the prevalence of tobacco non-smoking.*

preparedness which demanded that pregnant women bring a baby wrapper (traditional "chitenje") at the first FANC visit was costly to most rural poor women and made them shun away from using FANC services (24). There is a need for more community advocacy educating women on the importance of ANC in pregnancy. Given that there are community health workers in most rural areas of Malawi, the government should support them to reach out to women and men in their communities.

Similarly, the use of insecticide-treated mosquito nets is generally low among pregnant women and children under 5 despite the nationwide mass ITN distribution campaigns that have been taking place since 2012, with the most recent one happening in 2018 (25). The low ITN use is a concern in the fight to eliminate malaria by 2030, given that Malawi is among the countries with high malaria prevalence rates. The expansion of access to priority healthcare services to the population is a priority area for the Malawi HSSP II (10). The goal is that all the people of Malawi should lead a quality and productive life (10). On the other hand, regarding the treatment indicators, the high rates of skilled and institutional deliveries illustrated the impact of government policies to ensure safe deliveries for both mother and baby.

Secondly, although most of the government policies mainly target poor households, substantial inequalities in healthcare access between the rich and the poor and between rural and urban still exist. This finding is in agreement with the findings reported in the 2017 WHO/WB Global Monitoring Report, which found that only 17% of the poorest households in LMICs received at least six basic health interventions in comparison to 74% of households in the richest quintile (9). This highlights the argument that, without deliberate and proactive efforts to ensure equity, policy reforms aimed at achieving UHC may favorably benefit the rich and exclude the poor, resulting in health systems that are inequitable (26). Given that equity is at the core of UHC in healthcare (9), it is therefore important that progress is made equitably (27, 28).

With regard to FRP, we found that 94.10% of the individuals in our sample were financially risk protected. Our estimate was much higher than that reported in Kenya at 63.78% in 2013 (7). The following are the possible reasons for this high figure

TABLE 6 | Financial risk protection in Malawi.

Indicators	Mean coverage (95% CI)	Unadjusted FRP index	Concentration index (SE)	Inequality-adjusted index
Financial risk indicators				
Incidence of catastrophic expenditures (*a*)	1.33835% (1.14–1.54)		−0.0665735	1.339526489
Percentage of the population that got poor (*b*)	1.42		–	–
Percentage of the population pushed deeper into poverty (*c*)	2.33		–	–
Impoverished indicator (*b* + *c*)	3.75%		–	–
Final financial risk indicators				
Percentage of households with no catastrophic health expenditures (100 – *a*)	98.66 (98.46–98.86)	98.66%	0.0665735	92%
Percentage of households that were not impoverished by OOP spending: 1 – (*b* + c)	96.25	96.25%	–	96.25%
Summary measure of FRP				
Financial protection index	97.45		94.10	

FRP, financial risk protection.

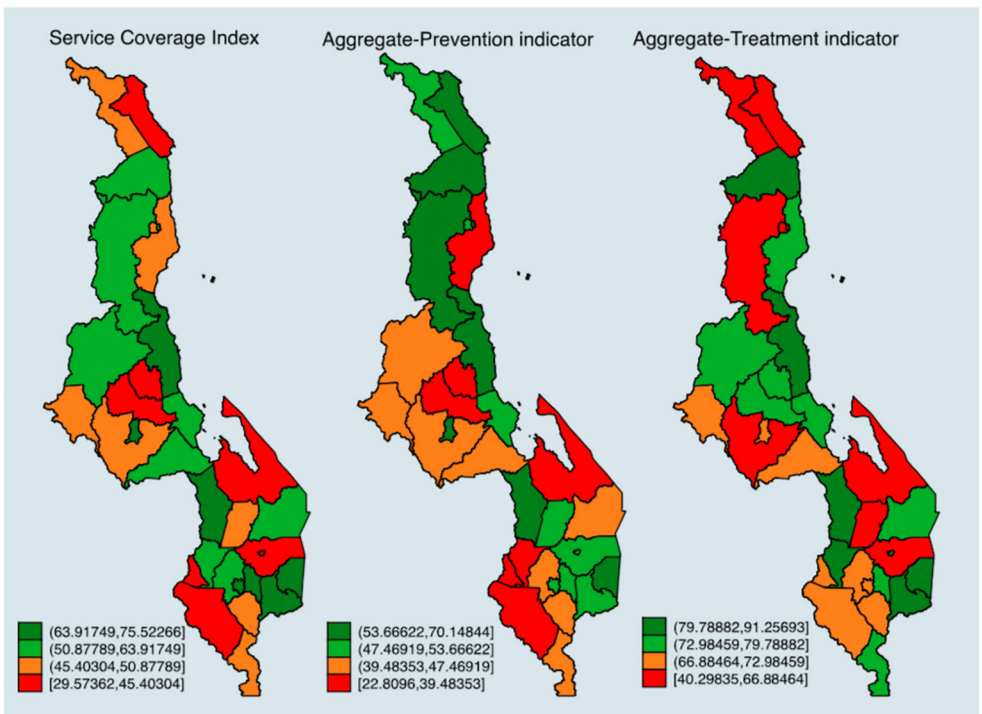

FIGURE 1 | District level distribution of service coverage index. Authors based on the 2015/2016 DHS data.

in Malawi. Firstly, primary healthcare in Malawi is provided for free in all government facilities, whereas in areas with no public facilities, since 2006, the government entered into an agreement with CHAM[1] facilities to remove user fees for selected primary healthcare services. Evidence showed that the agreement between the government of Malawi and CHAM facilities led to reduced OOP expenditures by the poor and also to increased coverage and utilization of maternal and child health services (16). Although the high FRP indicator implies that Malawi is doing well on SDG goal 3.8.2, the poor bear the largest burden of catastrophic healthcare costs. This is consistent with findings that OOP is typically regressive and stresses the need to implement progressive prepayment mechanisms (7, 29–31).

Furthermore, the percentage of Malawians pushed deeper into poverty is higher than the percentage of households who got

[1]CHAM facilities provide 75% of the primary healthcare services in rural and hard-to-reach areas, where public facilities are not available.

poor due to CHEs. This means that any OOP made by poor households toward healthcare services makes them worse off. This underscores the need for Malawi to still prioritize not only service coverage but also FRP. The major challenge that impedes the provision of quality health services for all in Malawi is that healthcare financing remains unsustainable and unpredictable (11). As shown in **Table 1**, donors are the main financiers of total health expenditure (THE), with contributions of 57.6%; at 24.4%, the government of Malawi is the second main funder of THE. Household contribution toward THE is estimated at 12.7%. Although the overall healthcare resource envelope increases with donor funds, the majority of the funds are allocated for vertical programs, such as HIV/AIDS to which donors contribute 95% of the total financing (19). Since funds for vertical programs are earmarked for specific programs, they therefore cannot be reallocated to other priority areas and hence distort the healthcare priorities and lead to health system inefficiencies (9). Additionally, due to fragmentation of the donor funds and lack of on-budget support, planning is increasingly difficult (14).

Currently, Malawi faces a lot of challenges to effectively implement a social health insurance scheme, among them is a narrow formal sector from which to collect premiums (32), which means that over-reliance on OOP will still remain, exposing households to catastrophic payments and impoverishment and preventing progress toward UHC. Another challenge is that healthcare purchasing in Malawi is passive and not strategic, which compromises quality, equity, and efficiency (14).

The overall UHC index was computed by estimating the geometric mean of the summary measure of the service coverage and FRP indicators. The UHC index values ranged between 0 and100%, with values closer to 100 and close to 0 implying high UHC and low UHC, respectively. We found that the overall UHC index for Malawi is 69.68%, which, compared to estimates found in other LMICs, is significantly higher. For instance, Barasa et al. (7) found a UHC index of 52% in Kenya, Prinja et al. (8) found a UHC index of 53% in India, and Wagstaff et al. (2) reported a UHC coverage ranging between 51 and 57% for 1998–2006 in selected low-income countries using the same methods.

Nevertheless, the high UHC index in Malawi can be explained as follows: firstly, although the coverage for most services is high, some service coverage indicators still remain pro-rich; this non-use by the poor is shown in the low levels of OOP payments and the high FRP score (94.10%), and hence a relatively higher UHC score. This finding is similar to the results reported by Wagstaff et al. (2) in Ethiopia, where the service coverage summary measure was low at 35%, but the country had a very high FRP summary measure of over 90%. Secondly, although primary healthcare is free at the point of service, the quality of care is very low, with regular drug stockouts and low client satisfaction and distrust in the provision of public health services (26). These factors may lead to increased OOP expenditures as people may be forced to seek alternative sources of care, i.e., from private facilities. However, given that the majority of the population is poor, they would rather forgo healthcare access than risk the financial burden of accessing care in private facilities or buying medicines at the pharmacy; this is reflected in the high FRP estimate.

Study Policy Implications and Recommendations

Drawing from our findings that service coverage of essential healthcare services is very low at 51.59% and the evidence available from other public documents, for instance the National Health Accounts (14), we made several recommendations that could put Malawi on the path to attaining UHC by 2030. Firstly, to ensure adequate financing in the health sector, the government should focus on reducing the inefficiencies and increasing domestic resource mobilization. An increase in domestic resources would ensure sustainability in health financing and could likely reduce challenges such as consistent drug stockouts. Consistent drug stockouts in public facilities is one of the factors that force households to buy over-the-counter medication or go to private facilities using OOP resources, hence exposing them to the risk of incurring CHEs (10).

Secondly, to ensure quality, efficiency, and equity in the provision of healthcare services in Malawi, there is a need to embrace strategic[2] purchasing practices. For example, currently, the financing and payment for EHP and non-EHP interventions are not clearly separated (14). For EHP interventions to be delivered effectively, the payment and financing of EHP and non-EHP interventions need to be separated through a functional system. Improvements in the delivery of EHP services could potentially increase their uptake and, hence, service coverage.

In addition, there is vast empirical evidence that primary healthcare is the cost-effective delivery route to attaining UHC; as such, Malawi should consider prioritizing and strengthening primary and community healthcare facilities and systems. Finally, currently, Malawi does not have social health insurance, which explains why there are poor people who are pushed deeper into poverty due to OOP expenditures. The government should consider the implementation of a social insurance scheme to provide full protection from OOP expenditures.

Strengths and Limitations

The major strength of the study is its incorporation of indicators that captured the UHC core dimensions and the supply and demand side factors, which, in comparison to other studies available in Malawi, presented a more comprehensive perspective of the linkages of socioeconomic inequalities in health and healthcare.

Nevertheless, we would like to acknowledge the following important study limitations. Firstly, due to data limitations, our analysis did not include neglected tropical diseases such as bilharzia and trachoma, among others, which are mostly prevalent in rural areas; as such, our results may have overestimated the level of UHC. The development of

[2]Strategic purchasing is when decisions about what to buy (benefit package), from whom to buy, and the buying mechanisms from the providers are structured such that they optimize the health system goals of equity, efficiency, and quality (14).

the UHC index was entirely dependent on data availability, which means that the analysis is not a perfect representation of the full dynamics of the access pathway. Secondly, the dependence on self-reported data is another limitation given that such data depend on respondents' intellectual ability and socio-demographic characteristics (33). For example, a better assessment of the healthcare needs by the relatively wealthy may be a function of their better education outcomes. Besides, self-reported data are also prone to recall bias/errors due to longer recall periods. For example, the household surveys asked about the services received 5 years prior to the survey. We tried to reduce recall errors by limiting the sample in the DHS to women who reported to have given birth 2 years prior to the survey and that the baby was still alive.

Thirdly, the household surveys only included data from respondents who agreed to be interviewed; as such, there may be sample selection bias. As a result, the results were not a full representation of the situation in Malawi, but rather indicative. Lastly, as with most household surveys, there were missing variables due to non-responsiveness or error in data entry, which could potentially lead to an over/underestimation of UHC.

In terms of areas of future research, we would suggest the development of district level UHC index to measure the progress of UHC at the district level. This would be critical to identify specific areas that each district needs to work on and provide tailored interventions for the districts to improve their figures for UHC.

CONCLUSION

This study developed a composite UHC index for Malawi using the most recent data available. Our findings showed that, while Malawi is doing moderately well on the overall UHC level, service coverage is still low and inequalities in both UHC dimensions remain a concern. A commitment to attaining UHC by 2030 means that evidence-based health financing and other health sector reforms should be made to achieve this goal. As evidenced from the results of the study, such reforms should be a combination of both UHC dimensions and not only either of the dimensions.

DATA AVAILABILITY STATEMENT

Publicly available datasets were analyzed in this study. This data can be found here: https://dhsprogram.com/data/available-datasets.cfm; https://microdata.worldbank.org/index.php/catalog/3818; https://extranet.who.int/ncdsmicrodata/index.php/catalog/629/get_microdata.

AUTHOR CONTRIBUTIONS

MM conducted the data analysis and drafted the manuscript. GM conceived the study and reviewed the manuscript. AC and EC reviewed the manuscript. All authors contributed to the article and approved the submitted version.

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Socioeconomic Inequity in the Screening and Treatment of Hypertension in Kenya: Evidence From a National Survey

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Background: Non-communicable diseases (NCDs) account for 50% of hospitalisations and 55% of inpatient deaths in Kenya. Hypertension is one of the major NCDs in Kenya. Equitable access and utilisation of screening and treatment interventions are critical for reducing the burden of hypertension. This study assessed horizontal equity (equal treatment for equal need) in the screening and treatment for hypertension. It also decomposed socioeconomic inequalities in care use in Kenya.

Methods: Cross-sectional data from the 2015 NCDs risk factors STEPwise survey, covering 4,500 adults aged 18–69 years were analysed. Socioeconomic inequality was assessed using concentration curves and concentration indices (CI), and inequity by the horizontal inequity (HI) index. A positive (negative) CI or HI value suggests a pro-rich (pro-poor) inequality or inequity. Socioeconomic inequality in screening and treatment for hypertension was decomposed into contributions of need [age, sex, and body mass index (BMI)] and non-need (wealth status, education, exposure to media, employment, and area of residence) factors using a standard decomposition method.

Results: The need for hypertension screening was higher among poorer than wealthier socioeconomic groups ($CI = -0.077$; $p < 0.05$). However, wealthier groups needed hypertension treatment more than poorer groups ($CI = 0.293$; $p < 0.001$). Inequity in the use of hypertension screening ($HI = 0.185$; $p < 0.001$) and treatment ($HI = 0.095$; $p < 0.001$) were significantly pro-rich. Need factors such as sex and BMI were the largest contributors to inequalities in the use of screening services. By contrast, non-need factors like the area of residence, wealth, and employment status mainly contributed to inequalities in the utilisation of treatment services.

Conclusion: Among other things, the use of hypertension screening and treatment services in Kenya should be according to need to realise the Sustainable Development Goals for NCDs. Specifically, efforts to attain equity in healthcare use for hypertension services should be multi-sectoral and focused on crucial inequity drivers such as regional disparities in care use, poverty and educational attainment. Also, concerted awareness campaigns are needed to increase the uptake of screening services for hypertension.

Keywords: socioeconomic inequality, horizontal inequity, decomposition analysis, hypertension, Kenya

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INTRODUCTION

Non-communicable disease-related morbidity and mortality pose an increasing challenge globally, especially in low-and middle-income countries (LMICs), where most of the world's population live (1). In 2016, for instance, ∼40 million deaths globally were due to non-communicable diseases (NCDs) with LMICs accounting for 80% of the deaths (2). LMICs also continue to struggle in containing the relatively high disease burden from maternal and child ill-health and infectious diseases such as HIV/AIDS, tuberculosis, leading to a "double burden" of communicable and NCDs (3, 4). This not only poses further resource constraints to the already overstretched healthcare resources in LMICs but is also a threat to the attainment of equity in health and healthcare between and within countries (5–7).

The major NCDs—cardiovascular diseases (CVDs), cancers, chronic respiratory diseases and diabetes—present a unique challenge to the global health agenda of attaining universal health coverage (UHC)[1] by 2030 (1). Furthermore, the detrimental health, economic, and developmental consequences of NCDs have seen their inclusion in the 2030 Sustainable Development Goals (SDGs) (8). SDG 3.4 explicitly aims to reduce by one-third premature mortality due to NCDs through prevention and treatment. Prioritising the reduction of shared NCDs risk factors such as physical inactivity, unhealthy diets, use of tobacco, and harmful use of alcohol is imperative to achieve the SDGs (9). Similarly, for hypertension which is a major risk factor for CVDs (1), evidence shows that increasing access to preventive interventions such as timely screening among those at risk and providing treatment to those diagnosed are cost-effective measures of attaining the NCD pre-mature mortality target (10–12).

A well-functioning health system should ensure equity in the utilisation of health services, that is, based on need and not the ability to pay (13, 14). Yet, there is convincing evidence that the poor (who bear the greatest NCDs burden and are most in need of screening and treatment) relative to the rich, utilise NCDs healthcare services the least (15–19). This phenomenon is termed *the inverse care law* (20). Demand and supply-side factors such as high levels of poverty, the substantial economic burden associated with the long-term care of NCDs, and insufficient health system capacity to handle NCDs (chiefly at the primary care level) are some of the reasons that contribute to socioeconomic inequalities in NCDs (1, 3, 15, 17, 21–23).

Empirical evidence from previous studies that assessed inequity and socioeconomic inequality in hypertension converge to the same conclusion: that the poor, relative to the wealthy, utilise fewer hypertension services (15, 17, 18, 24, 25). Elwell-Sutton et al. (15), for instance, showed marked pro-rich inequality in the utilisation of treatment services for hypertension and dyslipidaemia in China. In addition, pro-rich horizontal inequity in the utilisation of hypertension, hyperglycaemia and dyslipidaemia treatment were reported in the same study (15). Of interest, income and other non-need factors (i.e., health insurance, education and longest-held occupation) mainly explained the observed inequality in NCDs treatment. These findings compare well with studies from other LMICs, which generally show that income, area of residence, level of education, occupational class, increasing age and lifestyle risk factors are significant contributors to the socioeconomic inequality in the prevalence or utilisation of NCD services (18, 25, 26).

In Kenya, NCDs account for 50% of hospitalisations and 55% of inpatient deaths, with estimates indicating that mortality due to NCDs is likely to increase by over 50% in the next decade (27). Besides, there are stark disparities in screening and treatment services utilisation for hypertension, mainly to the disadvantage of poorer socioeconomic groups. For example, 73% of the poorest quintile population have never been screened for hypertension compared to 38% in the richest quintile (27). Furthermore, a study in Kenya that estimated socioeconomic inequalities in hypertension prevalence found that the poor bore the highest burden, with body mass index (BMI), wealth status and education level mainly explaining the observed inequalities (24).

Although there is evidence suggesting inequalities in NCDs in Kenya, there is still a gap in knowledge, especially in assessing horizontal equity (i.e., equal treatment for equal need) in utilising screening and treatment for NCDs based on need. Also, to our knowledge, no study has assessed the factors contributing to socioeconomic inequality in using both interventions for hypertension in the Kenyan context. Therefore, using a nationally representative NCDs risk factors survey data set, this study aims to assess horizontal inequity in the screening and treatment of hypertension and decompose socioeconomic inequalities in the screening and treatment of hypertension in Kenya.

METHODS

Data

This paper used the most recent and nationally representative cross-sectional STEPwise survey (STEPs) conducted by the Kenya National Bureau of Statistics (KNBS) between April and June 2015 in the country's 47 counties (27). The survey used the fifth National Sample Survey and Evaluation Programme (NASSEP V) master sample frame developed by the KNBS. The sample frame was developed using the Enumeration Areas (EAs) generated from the 2009 Kenya Population and Housing Census to form 5,360 clusters split into four equal sub-samples. A three-stage cluster sample design was used to collect the STEPs data. In the first stage, a total of 200 clusters (100 rural and 100 urban) were selected systematically from the NASSEP V sampling frame using the equal probability selection method to ensure the resulting sample retained the properties of probability proportional to size as was used in the creation of the frame. The second sampling stage involved a uniform selection of 30 households from the listed households in each cluster. An eligible participant was randomly selected from listed household members in the third sampling stage (27).

A total of 6,000 households were identified, but 4,754 consented (i.e. 79.2% response rate) and participated in the study. A total of 4,500 households were retained after data cleaning.

[1]UHC aims to ensure utilisation of quality healthcare services by everyone based on need and without suffering financial hardship.

A more detailed description of the STEPs data collection methodology is contained elsewhere (27). Sample weights were included in the statistical analyses to ensure that estimates were nationally representative. De-identified data set from the STEPs survey (which is available upon request from KNBS) was used in this study. Additionally, ethics clearance was obtained from the Human Research Ethics Committee of the University of Cape Town (Ref: 186/2020).

Measuring Socioeconomic Status

Socioeconomic status (SES) can be measured using several approaches classified as "direct measures," that is, expenditure, income, consumption; and "proxy measures," including education, occupation or social class, but mainly asset indices (28). It is important to note that there are debates on the right choice of SES measure regarding health inequality assessment. Some argue that the choice of welfare measure may not overly affect inequality findings (29, 30) while others maintain that the computed health inequality results could be sensitive, in some contexts, to the choice of welfare measure (28, 31). Following similar studies (17, 32) and based on data availability, principal component analysis (PCA) (33) was used in this paper to generate an index of SES.

Briefly, the multivariable statistical approach (PCA) reduces the number of variables in a data set into smaller dimensions (34). Put another way, beginning with an initial set of correlated variables, PCA generates uncorrelated components, in which case each component or index is a linear weighted combination of the original variables (33). The first principal component provides what is needed to construct a household welfare index–if it explains a substantial proportion of the variance, with larger weights assigned to assets that vary most across households (29, 34). Data on 15 selected variables (e.g. source of drinking water, type of sanitary facility, roof, floor and wall material, source of energy for cooking and lighting, and ownership of TV, radio, refrigerator, washing machine, bicycle, motorcycle, landline, and cell phone) were used to generate standardised weighted scores. These variables were used to create a dummy of each variable, signifying the presence of each item given that categorical variables are converted into a meaningless scale in PCA (35). The composite weighted index was used to rank the sample into five wealth quintiles (1—poorest, 5—richest).

Defining Hypertension

Having hypertension was defined in this paper based on any or all the three criteria: (1) previous hypertension diagnosis by a health worker, (2) use of prescribed anti-hypertensive medication or (3) having a systolic and/or diastolic blood pressure of $\geq$ 140/$\geq$ 90 mmHg (36).

Measuring Need and Use of Hypertension Screening and Treatment

The need for hypertension *screening* was defined as individuals who smoke, are obese ($\geq$ 30 kg/m^2) and are 30 years and above (for both men and women), as stipulated in Kenya's cardiovascular treatment guidelines (36). The need for hypertension *treatment* was defined as those diagnosed with hypertension in the survey (i.e. a third systolic and/or diastolic blood pressure of $\geq$ 140/$\geq$ 90 mmHg, respectively) (36).

TABLE 1 | Definitions of variables used in the analysis.

Intervention	NCD	Need	Use
Screening	Hypertension	Respondents who are obese ($\geq$30 kg/m^2), smoke and are aged at least 30 years and have not been screened in the past	Respondents reporting ever screened by a health worker
Treatment	Hypertension	Respondents diagnosed with hypertension in the survey (i.e. systolic and/or diastolic blood pressure reading $\geq$ 140 mmHg or $\geq$ 90 mmHg)	Respondents reporting the use of prescribed anti-hypertensive treatment at least two weeks before the survey

The utilisation of screening services was assessed as having ever received a screening service for hypertension from a formal health provider (i.e. doctor or other health workers) before the survey. Similarly, utilisation of treatment was assessed as taking prescribed hypertension treatment two weeks before the survey. For a granular presentation of inequality findings, the share of need and use of screening and treatment interventions were compared across the SES groups and regional divides in Kenya. **Table 1** further summarises the definitions of variables used in the analysis.

Analytical Approaches

Measuring Inequality in Care Utilisation

Inequality in screening and treatment can be assessed using various methodological approaches, as discussed by Wagstaff et al. (37). This paper used the concentration curves and concentration indices to assess inequality in the screening and treatment of hypertension. The rationale for using these measures is their consistency in ranking individuals according to their SES; sensitivity to changes in population distribution across SES, and ability to assess relative vs. absolute inequality (37–39). The concentration curve (CC) plots the cumulative share of the use of screening or treatment services (y-axis) against the cumulative share of households, ranked from poorest to richest (x-axis). So, if everyone uses screening or treatment services irrespective of their SES rank, the CC will consistently lie on the equality (45-degree) line. If, by contrast, there is a pro-poor (pro-rich) distribution in the use of screening or treatment services, the CC will lie above (below) the line of equality, with the gap between the CC and equality line depicting the extent of inequality (40).

The concentration index (CI_H) was computed as twice the covariance between screening or treatment for hypertension and an individual's socioeconomic rank divided by the mean of the health variable. Theoretically, the CI_H lies between -1 (i.e. when the use of screening/treatment is concentrated on the poorest individual) and $+1$ (i.e. when the use of screening/treatment is concentrated on the richest individual).

Overall, a positive (negative) CI_H corresponds to a pro-rich (pro-poor) distribution. For a binary variable, the concentration index does not lie within the usual bounds but rather between (μ_H - 1) and (1- μ_H) and thus requires normalisation (41). Although there is a debate between Wagstaff (41–43) and Erreygers (44, 45) regarding the appropriate normalisation approach, this paper used the Wagstaff's (41) normalisation primarily because the health variable of interest was binary (i.e. 1 = use of screening/treatment; 0 = otherwise).

Decomposing the Concentration Index of Screening and Treatment

While the CC and the CI_H are relevant in examining the existence of socioeconomic inequalities in screening/treatment; they do not explain the factors contributing to observed inequality. Consequently, to understand the factors contributing to relative inequality, the CI_H was further decomposed following the methodology suggested by Wagstaff et al. (46). Identifying these factors is critical for policy decisions around addressing the "underlying causes of inequality." Thus, CI_H can be decomposed as:

$$CI_H = \underbrace{\sum_{j=1}^{J} C_j\left(\beta_j \bar{Z}_j/\mu_H\right)}_{Deterministic} + \underbrace{(GC\varepsilon/\mu_H)}_{Unexplained} \quad (1)$$

where Cj ($\overline{Z}_j$) is the concentration index (mean) of the jth contributing factor, $GC\varepsilon$ is the generalised concentration index of the error term (ε) and β_j is obtained from the linearly additive equation related to the contributing factors (z) to the screening or treatment variable (h) shown in Equation 2.

$$h_i = \alpha + \sum_j \beta_j Z_{ij} + \varepsilon_i \quad (2)$$

where α and β_j are the coefficients to be estimated and ε_i is the error term. The deterministic portion of the concentration index in Equation 1 can be interpreted as the contribution of each contributing factor (z) to the concentration index (CI_H), which consists of two parts. It is a product of the concentration index of each contributing factor (Cj) and the elasticity of h_i with respect to z_j(i.e. $NGj = \beta_j\overline{Z}_j/\mu_H$). The unexplained portion is computed as the difference between CI_H and the deterministic portion. The residual cannot be systematically explained by variations in the contributing factors across socioeconomic groups (46). The generalised linear model (with binomial family and identity link) was applied in the decomposition analysis (47). Guided by variable availability in the dataset and well-established literature in the field (15, 24–26, 48, 49), determinants of care utilisation were separated into "need" (i.e. body mass index (BMI), age and sex for screening; age and sex only for treatment) and "non-need" (i.e. education level, exposure to media, employment status, rural or urban residence, and quintiles of SES) factors for both screening and treatment. A negative (positive) contribution suggests a given determinant contributes to inequality in the pro-poor (pro-rich) direction.

Given the challenge in computing analytical standard errors (SEs) for the components in the decomposition (i.e. elasticities and each contributing factor's contribution to the concentration index) in Equation 1, the bootstrap method (50, 51) was used to obtain such SEs in the analysis. The sampling structure of the data was taken into account as applied by Ataguba et al. (52) to avoid inconsistent estimates of bootstrap SEs. A total of 1,000 replications were used to estimate the SEs for each estimate.

Measuring Horizontal Inequity in Care Utilisation

Horizontal equity analysis assesses inequity in care utilisation by standardising health service utilisation based on need (40). Inequity in care use estimated through the horizontal inequity (HI) index embodies the principle that healthcare should be utilised according to need (i.e. "equal treatment for equal need"). The HI was computed as the difference between the concentration index for actual (observed) care utilisation and need-expected utilisation. An indirect standardisation approach was used to predict the need-expected utilisation of screening and treatment (40, 53). HI lies within the range of -1 to $+1$, with a negative (positive) value indicating a pro-poor (pro-rich) inequity. Theoretically, a zero value for HI means there is no inequity. To estimate how much care each individual would receive if they were treated equally to everyone in the sample with equal needs, we fitted a regression model (40). All statistical analyses were conducted in Stata (version 15.1).

RESULTS

Descriptive Analysis

Most respondents were female (60%). About 30% aged 20–39 years and 47% had attained primary education (**Table 2**). Only 19% of respondents were not employed, and more than half (54%) resided in a rural area. Hypertension prevalence was 30%, with a higher prevalence among wealthier individuals (**Table 2**). In addition, the prevalence of hypertension was higher among obese individuals (52%) compared to other BMI categories (underweight 19%, normal 26%, and overweight 39%) (data not shown). Although there was no significant difference, the prevalence of hypertension was slightly higher among non-smokers (30%) compared to non-smokers (29%) (data not shown).

Inequality in Need and Use of Hypertension Screening and Treatment Services

Poorer individuals had a higher need for hypertension screening (concentration curves lie above the equality line), while hypertension screening favoured the rich (concentration curves lie below the equality line) (**Figure 1**). Although not significant, the need for hypertension screening was pro-poor ($CI = -0.036$; $p > 0.05$). On the other hand, hypertension screening ($CI = 0.293$; $p < 0.01$) was significantly pro-rich (**Table 3**).

A further breakdown of who benefits from hypertension screening revealed that the wealthier quintiles benefited disproportionately more than they should given their share of

TABLE 2 | Descriptive statistics grouped by wealth quintile.

	All	Household socioeconomic groups					*p*-value*
	Col %	Poorest quintile	2nd quintile	3rd quintile	4th quintile	Richest quintile	
N	4,500	918	891	899	909	883	
Sex							
Female	60.0	65.2	60.4	58.4	61.1	54.8	<0.01
Male	40.0	34.8	39.6	41.6	38.9	45.2	
Age (years)							
<19	4.5	5.0	5.5	4.4	4.2	3.5	<0.01
20–29	28.6	24.3	25.7	26.2	30.1	36.8	
30–39	28.0	28.7	29.4	27.9	24.6	29.2	
40–49	17.7	16.8	15.9	20.0	19.0	16.6	
50–59	12.1	13.5	13.1	12.0	12.8	8.9	
60+	9.2	11.6	10.5	9.5	9.3	5.0	
Education level							
No formal schooling	16.8	50.9	11.0	9.1	8.5	3.4	<0.01
Primary	46.5	40.0	63.3	59.1	45.3	24.9	
Secondary	25.5	8.2	22.0	25.5	33.0	39.1	
Tertiary	11.2	0.9	3.7	6.3	13.2	32.6	
Marital status							
Married/Cohabiting	67.9	72.6	65.2	68.2	70.0	63.1	<0.01
Not married	32.1	27.4	34.8	31.8	30.0	36.9	
Exposure to media							
Has TV/Radio	70.3	30.7	65.6	78.5	70.3	95.4	
No TV/Radio	29.7	69.3	34.4	21.5	29.7	4.6	<0.01
Employment status							
Unemployed	18.5	3.6	9.2	15.5	24.8	40.1	<0.01
Informal employment	39.7	33.9	43.0	43.9	39.4	38.4	
Formal employment	41.8	62.5	47.8	40.6	35.8	21.5	
Residence							
Rural	53.7	77.9	76.5	56.3	42.5	14.3	<0.01
Urban	46.3	22.1	23.5	43.7	57.5	85.7	
BMI (Kg/m^2)							
<18.5 (underweight)	11.7	27.3	10.4	9.0	6.8	4.8	<0.01
18.5–24.9 (normal)	56.8	60.8	66.0	59.4	54.8	42.7	
25.0–29.9 (overweight)	21.0	9.5	17.6	22.6	22.8	32.6	
≥30.0 (obese)	10.5	2.4	6.0	9.0	15.6	19.9	
Presence of NCD							
Has hypertension	30.2	24.7	28.4	30.9	32.7	34.1	

**p-value from Chi-squared test.*

need (**Figure 2A**). For example, while only 17% of those needing hypertension screening are in the wealthiest quintile, 27% of individuals using screening interventions are in the wealthiest quintile (**Figure 2A**). There were disparities in the need and use of hypertension screening in all the regions (**Figure 2B**). For instance, the disparity between the share of need and use for hypertension screening was highest in the Rift Valley region (27% vs. 31%) (**Figure 2B**).

Figure 1B shows a pro-rich distribution of the need for hypertension treatment, a finding confirmed by the concentration indices in **Table 3**. The use of hypertension treatment was pro-rich ($CI = 0.030$; $p > 0.05$) (**Table 3**). However, none of the pro-rich or the pro-poor inequality findings for hypertension treatment was statistically significant at conventional levels. Individuals in the poorest quintile were disadvantaged in using hypertension treatment compared to their population share of need. For instance, while 17% of respondents needing hypertension treatment are in the poorest quintile, only 8% of those using hypertension treatment are in the poorest quintile (**Figure 3A**). Overall, a disproportionate share exists in using hypertension treatment in the Kenyan regions, given the population share of need. Notably, the disparity in the need and use of hypertension (28% vs. 20%) treatment was highest in the Rift Valley region (**Figure 3B**).

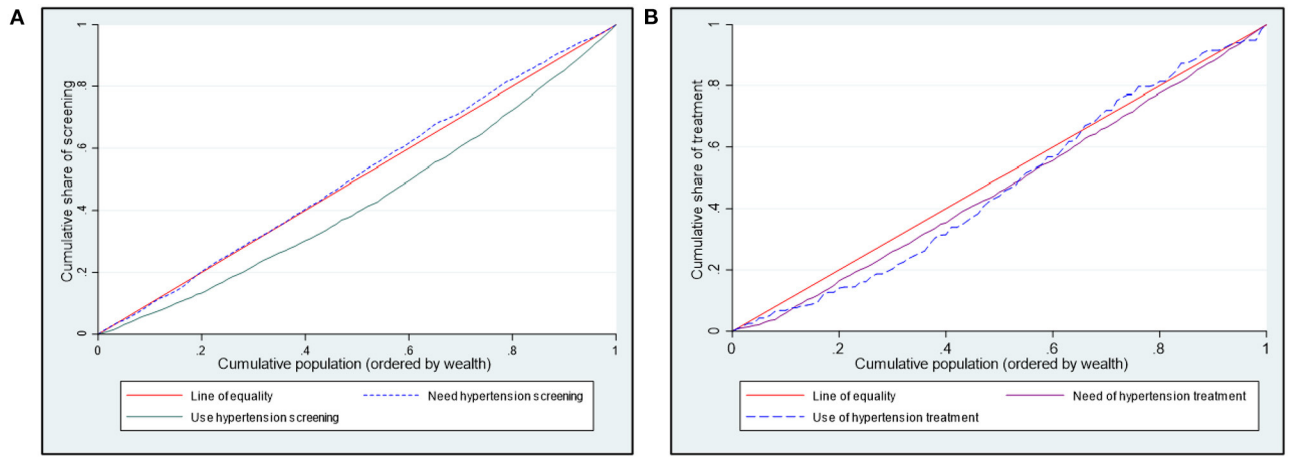

FIGURE 1 | Concentration curves showing need and use of hypertension **(A)** screening and **(B)** treatment in Kenya.

TABLE 3 | Concentration indices for need and use of screening services for hypertension in Kenya (STEPs 2015).

Intervention	Concentration index	Std. Error	*p-value*
Need hypertension screening	−0.036	0.027	0.186
Screening for hypertension	0.293	0.041	<0.001**
Need hypertension treatment	0.026	0.044	0.552
Use hypertension treatment	0.030	0.088	0.738

***p < 0.001.*

Inequity in Using Screening and Treatment Services for Hypertension in Kenya

The use of hypertension screening was significantly pro-rich after controlling for need ($HI = 0.185$; $p<0.001$). Also, the use of hypertension treatment services was significantly pro-rich at conventional levels (**Table 4**).

Decomposition of Inequality in Care Use

Summary results of the decomposition analysis of inequality in screening and treatment are presented in **Figures 4**, **5**, showing an aggregate contribution of need and non-need factors. In general, non-need factors contributed most to the pro-rich inequality in screening and treatment. Specifically, wealth status, exposure to media, education, and area of residence contributed most to inequality in screening among the non-need factors for hypertension. For the need factors, BMI explained inequality in the pro-rich direction for hypertension screening. However, sex explained inequality in the pro-poor direction for hypertension screening (**Figure 4**).

Non-need factors like wealth and employment status were the largest contributors (in the pro-rich direction) to the inequality in hypertension treatment (**Figure 5**). Additionally, age and education status also contributed to inequality in hypertension treatment in the pro-poor direction (**Figure 5**).

As shown in **Table 5**, sex was the main statistically significant contributor to inequality in hypertension screening among the need factors. Only a few categories are significant for some need factors like age and BMI. Among non-need factors, exposure to media was a statistically significant contributor (in the pro-rich direction) to inequality in hypertension screening. For hypertension treatment, age explained the inequality in the pro-poor direction. Among the non-need factors, wealth status explained, to a greater extent, inequality in hypertension (in the pro-rich direction) treatment (**Table 5**). However, none of the need and non-need contributors to inequality hypertension treatment was statistically significant at conventional levels.

DISCUSSION

This study demonstrated the existence of socioeconomic inequality and horizontal inequity in the use of screening and treatment interventions for hypertension in Kenya. These findings can serve as a baseline for future progress assessments towards attaining SDG 3.4 targeted at NCDs and UHC goals in Kenya. In general, the results confirm that need does not match the use of screening and treatment services for hypertension across the SES groups and the Kenyan regions.

This paper's findings add to the evidence that the Kenyan health system is unequal and inequitable (54–56). It suggests that policy interventions geared towards attaining equity in the Kenyan health system should pay special attention to NCDs like hypertension. Among other policy options, it has been established that timely screening among those at risk and treatment among those diagnosed are cost-effective strategies for combating the burden of hypertension (10, 11). However, our findings reveal considerable gaps in meeting the population need for both interventions in Kenya.

Poorer socioeconomic groups need more hypertension screening than their wealthier counterparts, but wealthier socioeconomic groups benefit more from screening services than their share of need. This finding could, in part, be explained

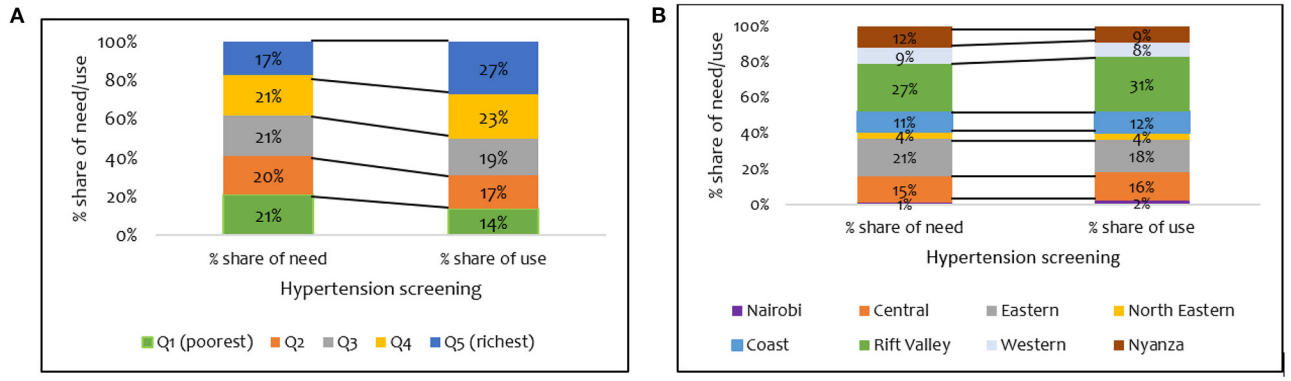

FIGURE 2 | Distribution of share of need and use of hypertension screening services by **(A)** wealth quintile and **(B)** regions in Kenya (STEPs 2015).

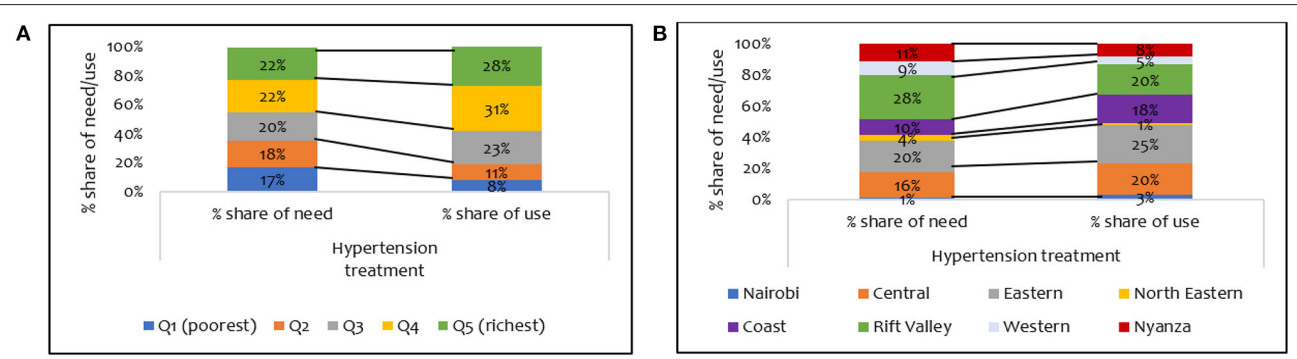

FIGURE 3 | Distribution of share of need and use of hypertension treatment services by **(A)** wealth quintile and **(B)** regions in Kenya (STEPs 2015).

TABLE 4 | Inequity in the utilisation of screening and treatment services for hypertension in Kenya (STEPS 2015).

Intervention	Horizontal equity index
Hypertension screening	0.185*** (0.024)
Hypertension treatment	0.095*** (0.074)

*Standard errors reported in parentheses. ***$p < 0.001$.*

by broader access barriers such as availability (i.e. biased availability of health facilities in urban locations), acceptability (i.e. providers and patients attitudes and expectations of each other) and affordability of screening services (57). For instance, transport costs have been shown to not only lead to catastrophic expenditures for hypertension treatment in public health facilities in Kenya but also contribute to about 40% of total out-of-pocket costs (58). Furthermore, the unaffordability of NCDs screening services in Kenya has been documented, with healthcare costs being disproportionately higher in the private relative to the public sector (59). Sex was the primary "need" factor contributing to socioeconomic inequality in hypertension screening, suggesting that females are more likely to seek screening services for hypertension. A similar finding has been reported in a study that assessed socioeconomic inequality for diabetes and hypertension screening in South Africa (25). Of interest, being obese was the other significant contributor (in the pro-rich direction) to socioeconomic inequality in hypertension screening (**Table 5**). Given that being obese is a risk factor for cardiovascular diseases (27), this finding suggests that those who are wealthy and obese are more likely to utilise hypertension screening services compared to other BMI categories. Also, given that "non-need" determinants such as exposure to media and education contributed to inequality in the screening for hypertension in the pro-rich direction, unawareness of the importance of timely or early screening may provide some insights into the possible reasons for the underutilisation of screening services among poorer socioeconomic groups.

Whereas the geographic spread of health facilities in Kenya has increased over time (60), other supply-side factors such as the physical inaccessibility of health facilities remain a barrier for using screening services as the area of residence contributed to pro-rich inequality. Also, the weak health system capacity to offer care for NCDs, particularly at the primary care level, could explain the inequality in hypertension screening (61, 62). A fragmented health service delivery structure biased towards offering curative rather than preventive healthcare services is among examples of health system weaknesses (63–65).

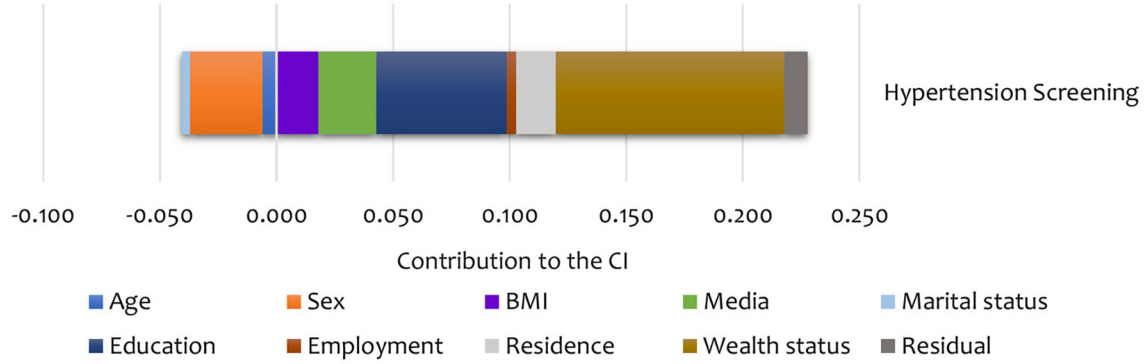

FIGURE 4 | Summary contributions to SES inequality in the utilisation of screening services for hypertension in Kenya (STEPs 2015).

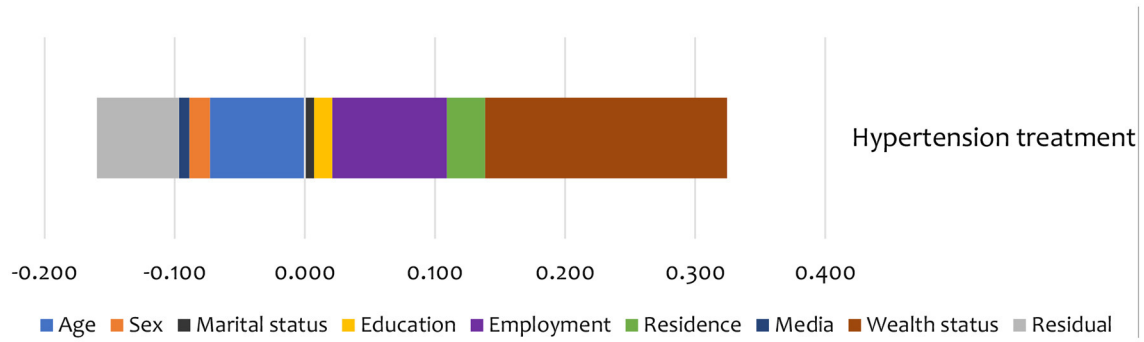

FIGURE 5 | Summary contributions to SES inequality in the utilisation of treatment services for hypertension in Kenya (STEPs 2015).

The inequality and inequity in the screening for hypertension compare well with the findings of a South African study that has shown marked pro-rich inequality and inequity in the screening for hypertension, diabetes and cholesterol, with non-need factors (i.e. wealth status, health insurance, and education) mainly contributing to the inequality (25).

This study also found that hypertension treatment needs do not match how different SES groups use the service. The wealthier quintiles relative to the poorer ones benefited more than their treatment needs, and this disparity existed in the Kenyan regions. Among other things, this finding can be explained by the overall unaffordability of NCDs services in Kenya (59) and the low levels of health insurance coverage (66), with lower socioeconomic groups being disproportionately affected. Similar patterns have been reported in previous studies in Kenya that have assessed inequality in health and healthcare use or access at the sub-national level (24, 54–56). While inequality in the use of hypertension treatment was not statistically significant, the horizontal inequity finding suggests that hypertension treatment is not distributed according to need. Besides, compared to the inequality observed in hypertension screening, the "relative equality" in hypertension treatment could be partly explained by the difference in distribution of the burden of hypertension in the Kenyan population (i.e. 42% of rural dwellers have hypertension while 30% of urban dwellers have hypertension). Therefore, it can be argued that the pro-rich distribution in the use of hypertension treatment services could be as a result of the pro-urban bias in the distribution of healthcare facilities in Kenya and thus the rural dwellers are disadvantaged at utilising hypertension treatment services while they are most in need (60). Of note, the findings compare well with previous multi-country studies that found significant pro-rich inequality in the use of secondary cardiovascular medicines in LMICs (17) and hypertension treatment (32).

In the decomposition analysis of inequality in hypertension treatment, non-need factors primarily contributed to the observed inequality. For instance, area of residence, wealth, employment and education status contributed to inequality in hypertension treatment. Similar findings have been reported in China, where non-need factors such as income, area of residence, longest-held occupation, and level of education were significant contributors to the socioeconomic inequality in the utilisation of hypertension, hyperglycaemia and dyslipidaemia treatment (15). Unlike findings from other settings (18, 26), in this study, hypertension prevalence was higher among wealthier socioeconomic groups than their poorer counterparts. This disproportionate hypertension burden may lead to differences in healthcare demand between the rich and the poor in Kenya.

TABLE 5 | Decomposition analysis of inequality in the utilisation of screening and treatment services for hypertension in Kenya (STEPs 2015).

	Hypertension screening					Hypertension treatment				
Determinants	**Elasticity**	**CI**	**Contribution**	**Total contribution**	**% contribution**	**Elasticity**	**CI**	**Contribution**	**Total contribution**	**% Contribution**
BMI										
Underweight (Ref)										
Normal	−0.004	−0.155*** (0.014)	0.001 (7.976)	0.018	6.068					
Overweight	0.026	0.255*** (0.032)	0.007 (0.004)							
Obese	0.025	0.398*** (0.036)	0.010** (0.002)							
Sex										
Male (Ref)										
Female	0.400	−0.078** (0.017)	−0.031** (0.006)	−0.031	−11.023	0.203	−0.078** (0.044)	−0.016 (1.110)	−0.016	−19.231
Age										
<19 (Ref)										
20–29	0.073	0.115*** (0.025)	0.008 (4.332)	−0.006	−1.666	−0.854	0.115(0.109)	−0.098(2.944)	−0.073	−89.802
30–39	0.095	−0.019** (0.026)	−0.002 (0.267)			−0.511	−0.019(0.084)	0.001(1.264)		
40–49	0.085	0.024 (0.028)	0.002 (0.003)			−0.220	0.024(0.062)	−0.005(0.016)		
50–59	0.058	−0.083 (0.044)	−0.005 (0.010)			−0.148	−0.083(0.062)	0.012(1.000)		
60+	0.063	−0.135** (0.058)	−0.009** (0.004)			−0.060	−0.135(0.088)	0.008(0.013)		
Exposure to media										
No TV/Radio (Ref)										
TV/Radio	0.050	0.531*** (0.023)	0.027** (0.004)	0.027	10.891	−0.021	0.384*** (0.000)	−0.008 (0.997)	−0.008	−26.667
Marital status										
Married (Ref)										
Not married	−0.060	0.058** (0.026)	−0.004 (37.064)	−0.004	−1.226	0.124	0.058 (0.079)	0.007 (0.151)	0.007	18.342
Residence										
Urban (Ref)										
Rural	−0.032	−0.539*** (0.043)	0.017 (3.243)	0.017	6.014	−0.055	0.539*** (0.064)	0.029 (3.851)	0.029	35.877
Employment										
Not employed. (Ref)										
Informal employment	−0.011	0.021 (0.027)	0.000 (0.476)	0.011	3.548	−0.173	−0.081 (0.0978)	−0.014 (0.455)	0.021	25.520
Formal emp.	0.029	0.392*** (0.035)	0.011 (0.017)			−0.082	0.434*** (0.044)	0.035 (8.105)		
Education										
No school (Ref)										
Primary school	0.074	−0.149*** (0.033)	−0.011 (7.858)	0.056	19.905	−0.251	−0.149*** (0.061)	0.019 (0.425)	0.014	46.667
Secondary school	0.079	0.311*** (0.029)	0.025 (298.5)			−0.221	0.320 (0.084)	−0.019 (0.587)		
Tertiary	0.067	0.621*** (0.042)	0.042*** (0.007)			−0.069	0.621*** (0.050)	0.014 (0.896)		
Wealth quintile										
Quintile 1 (Ref)										
Quintile 2	0.026	−0.491*** (0.055)	−0.013 (153.8)	0.098	34.731	0.007	0.491*** (0.059)	−0.004 (0.305)	0.186	227.125

(Continued)

TABLE 5 | Continued

	Hypertension screening					Hypertension treatment				
Determinants	**Elasticity**	**CI**	**Contribution**	**Total contribution**	**% contribution**	**Elasticity**	**CI**	**Contribution**	**Total contribution**	**% Contribution**
Quintile 3	0.037	0.005 (0.069)	0.000 (0.096)			0.118	0.005** (0.083)	0.001 (0.148)		
Quintile 4	0.052	0.508*** (0.073)	0.026 (0.247)			0.196	0.508 (0.098)	0.010 (0.055)		
Quintile 5	0.084	1.000*** (0.038)	0.084*** (0.017)			0.090	1.000*** (0.053)	0.090 (11.462)		
Residual			0.057	0.057	35.758				−0.296	−117.831

*Bootstrapped standard errors in parentheses using 1,000 replications; CI, concentration index; *p < 0.1; **p < 0.05; ***p < 0.01.*

Several policy recommendations are imperative from the findings of this study. First, since service delivery falls within the docket of county governments in Kenya, there is an urgent need to enhance the capacity of primary care facilities to implement cost-effective strategies such as timely screening so that need can match service use for this critical intervention. Second, for demand in the utilisation of screening services to be increased, national and county governments, including other relevant actors, should implement strategic awareness-raising campaigns targeting at-risk populations as age and sex contributed to the SES inequality in the screening of hypertension. This can be through targeted health education messages in the mass media and other appropriate channels. Third, while recent efforts by the government of Kenya to attain UHC by 2022 are timely and commendable, more needs to be done to ensure the realisation of equity in the use of NCD services. Given the interplay of factors beyond the health sector that affect health, as was seen in the role of non-need factors in contributing to inequality in screening and treatment, there is a need for multi-sectoral approaches at various levels (i.e. local, national and regional) to address drivers of poverty and social inequity with a critical focus in marginalised areas. Some of the sectors that could collaborate with the health sector in addressing inequities/inequalities in NCDs include education and media. For instance, for increased health education on NCDs, the education sector can include NCDs in the curriculum. Also, various media channels can be used to raise awareness on the benefits of early NCDs screening as exposure to media was shown to contribute to SES inequality in hypertension screening.

STUDY STRENGTHS AND LIMITATIONS

This study had strengths and limitations. One key strength was the national representativeness of the data set used, which gave the national picture of socioeconomic inequality and inequity in the screening and treatment for hypertension in Kenya. Also, while previous studies have mainly assessed inequalities in the prevalence of NCDs (and in most cases using self-reported data), this study examines inequity and socioeconomic inequality in key interventions using objective measures of need for screening and treatment. This study also used a novel methodological approach: the decomposition analysis, to uncover factors contributing to socioeconomic inequality in screening and treatment for hypertension in Kenya.

This study also had limitations. The first limitation was data-driven. As is common in studies on care utilisation, we relied on self-reported data in defining the use of both screening and treatment. This could potentially bias our inequality findings, especially if there were cases of misreporting. Likewise, although previous studies (67, 68) have reported no association between under-reporting of care utilisation and demographic characteristics, except for age, we cannot rule out under-reporting of care utilisation in the low SES groups. Second, the STEPs data set was cross-sectional in design and thus limiting the establishment of temporal trends in inequality and inequity in the use of screening and treatment. Furthermore, it is essential

to note that causality is not implied for the factors explaining observed inequality in screening and treatment.

CONCLUSION

Kenya faces a rising disease burden from non-communicable diseases, as expected in many low-and middle-income countries. This paper provides the first empirical evidence on socioeconomic inequality and inequity in screening and treatment interventions for NCDs based on need in Kenya. These findings provide a benchmark for future equity and equality assessments for NCDs in Kenya. In keeping with the global UHC agenda and other key NCDs targets, there is an urgent need for concerted efforts to ensure equity in providing NCDs healthcare services in Kenya. Indeed, given the ongoing policy reforms to attain UHC in Kenya, a window of opportunity exists to avert inequity in NCDs, with this paper highlighting some of the critical issues for consideration.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Human Research Ethics Committee of the University of Cape Town (Ref: 186/2020). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

RO, JA, and EB conceived the study. RO conducted the data analysis and wrote the first draft of the manuscript. All authors have read and agreed to the published version of the manuscript.

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Horizontal Inequity in the Utilization of Maternal and Reproductive Health Services: Evidence From the 2018 Nigeria Demographic and Health Survey

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Background: Maternal mortality and poor reproductive health outcomes remain major public health challenges in low-resource countries. The Sustainable Development Goals have proposed new targets to reduce global maternal mortality ratio to 70 per 100,000 live births and ensure universal access to sexual and reproductive healthcare services by 2030. Inequity in the utilization of maternal and reproductive health services leads to poor reproductive health outcomes and maternal mortality. Despite reduction in global maternal mortality over the decades, the level of maternal mortality remains unacceptably high in Nigeria with limited attention given by governments to addressing health inequities. This study aimed to examine horizontal inequity in the utilization of maternal and reproductive health services in Nigeria.

Methods: Secondary data from the 2018 Nigeria Demographic and Health Survey were utilized to examine horizontal inequity in the utilization of maternal and reproductive health services such as postnatal care, delivery by cesarean section, modern contraceptive use, and met need for family planning. Equity was measured using equity gaps, equity ratios, concentration curves, and concentration indices. All analyses were performed using ADePT 6.0 and STATA version 14.2 software.

Results: The overall coverage level of postnatal care, delivery by cesarean section, modern contraceptive use, and met need for family planning was 20.81, 2.97, 10.23, and 84.22%, respectively. There is inequity in the utilization of postnatal care, delivery by cesarean section, and modern contraceptive favoring the rich, educated, and urban populations. Met need for family planning was found to be almost perfectly equitable.

Conclusion: There is inequity in the utilization of maternal and reproductive health services in Nigeria. Inequity in the utilization of maternal and reproductive health services is driven by socioeconomic status, education, and location. Therefore, governments and policymakers should give due attention to addressing inequities in the utilization

of maternal and reproductive health services by economically empowering women, improving their level of education, and designing rural health interventions. Addressing inequities in the utilization of maternal and reproductive health services would also be important toward achieving the Sustainable Development Goal targets 3.1 and 3.7.

Keywords: horizontal equity, health inequities, utilization of health services, maternal health, reproductive health, Nigeria

INTRODUCTION

Maternal mortality and poor reproductive health remain major challenges in low-resource countries. About 300,000 women died around the world in 2017, yielding an overall maternal mortality ratio of 211 per 100,000 live births (1). Sub-Saharan Africa (SSA) accounts for 66% (196,000) of all maternal deaths per year worldwide in 2017, yielding a maternal mortality ratio of 542 per 100,000 live births (1). Although there has been reduction in global maternal mortality over the decades, the level of maternal mortality remains unacceptably high in Nigeria with a maternal mortality ratio at 917 per 100,000 live births (2). Consequently, Nigeria contributes 23% of global maternal deaths (1). Nigeria failed to achieve Millennium Development Goal (MDG) 5, which aimed to reduce maternal mortality ratio by three quarters between 1990 and 2015 (3). The country was also off track in achieving universal access to reproductive health. Giving birth in Nigeria is a dance with death for mothers (4).

Inequity in the utilization of health and health outcomes remains a major challenge in low- and middle-income countries (LMICs) (5). Inequity in the utilization of maternal and reproductive health services leads to poor reproductive health outcomes and maternal mortality. Inequity in the utilization of healthcare services remains a policy-relevant issue in both developed and developing countries (5). There is no consensus among scholars on the definition of equity (6, 7). Equity, in some studies, refers to the distribution of resources, benefits, and welfare among different sub-groups of a population based on need, taking into account issues of fairness and justice (6, 8). It is also concerned with equal access to health services, equal health status for all, and utilization of healthcare based on needs (8, 9). Inequity in healthcare is the unfair or unjust distribution and utilization of healthcare resources based on income or socioeconomic status (SES) as well as demographic or other factors but not based on need (8–10). Equity in healthcare is also categorized into horizontal and vertical equity (8, 11). While horizontal equity means that individuals in equal need of healthcare should receive the same treatment irrespective of age, SES, and race (11–13), vertical equity means that individuals with unequal healthcare need should receive unequal treatment of healthcare (11, 13). Equity in healthcare is an overarching goal of many healthcare systems around the world (14).

In 2015, universal health coverage (UHC) was included as a goal of Sustainable Development Goals (SDGs) (15). UHC aims to increase equity in access to quality healthcare services and reduce associated financial risk (16). The SDGs have proposed new targets to reduce global maternal mortality ratio (MMR) to 70 per 100,000 live births and ensure universal access to sexual and reproductive healthcare services by 2030 (15). However, there exist large inequities in the utilization of maternal and reproductive health services within and between countries, and across socioeconomic groups (17–19). Tracking progress toward narrowing the gap in the utilization of maternal and reproductive health services among the poor and better-off households is critical toward achieving the SDGs. Therefore, there is a need for further studies to understand inequity in the utilization of maternal and reproductive health services. Ensuring improvement in health equity is as important as improving maternal and reproductive health.

Some empirical studies have been conducted on equity in the utilization of maternal and reproductive health services in LMICs (18, 20–32). Results from previous studies show that there are stark disparities in the utilization of maternal and reproductive health services. However, there is limited evidence on horizontal inequity in the utilization of maternal and reproductive health services in Nigeria focusing on use of postnatal care (PNC), delivery by cesarean section, modern contraceptive use, and met need for family planning and using the most recent nationally representative household survey. Furthermore, evidence regarding equity in the utilization of reproductive health services is mixed with very limited studies on equity in the utilization of PNC and delivery by cesarean section (19). For instance, Adetsav examined equity gap in the utilization of maternal health services such antenatal care (ANC), skilled birth attendants (SBA), and health facility-based delivery (HFBD) using binary logistic regression and two data sets [2008 and 2013 Nigeria Demographic and Health Surveys (NDHS)] (33). Results showed that there were wide differences in equity gap in SBA and delivery in health facility for rural–urban and pro-rich gaps but ANC visit improved greatly with the richest wealth quintile being favored (33). Using four rounds of the NDHS (1999, 2003, 2008, and 2013) and concentration index, Nghargbu and Olaniyan examined inequity in maternal and child healthcare utilization focusing on ANC, delivery using SBA, and child immunization (11). The study found that there was a pro-rich inequity in the utilization of ANC, SBA, and child immunization from 1999 to 2013 (11). Nwosu and Ataguba assessed socioeconomic inequalities in ANC utilization and the determinants of these inequalities using the 2013 NDHS (34). They found that no ANC visit was disproportionately concentrated among the poor while at least four ANC visits and a higher number of ANC visits favor the rich (34). Using four rounds of the NDHS (2003, 2008, 2013, and 2018), Theil index, and concentration index, Okoli et al. examined the geographical and socioeconomic inequalities

in maternal healthcare utilization in Nigeria (35). It was observed that the utilization of maternal healthcare is lower among poorer and less educated women as well as those living in rural areas and North West and North East geopolitical zones (35). These empirical studies did not focus on use of PNC, delivery by cesarean section, modern contraceptive use, and met need for family planning.

Furthermore, the review of methodological literature revealed that multivariate logistic regression, chi-square test, rate ratios, equity ratios, slope/relative index of inequality, quintile ratios, difference-in-differences method, concentration index, and concentration curve approach were the methods used in evaluating equity in the utilization of maternal and reproductive health services with multivariate logistic regression being the most commonly used method (14, 19). However, concentration curve (CC) and concentration index (CI) are regarded as the best methods in assessing equity in utilization of health services (5, 12). CC provides a complete picture of how the utilization of health services varies across the full distribution of SES while CI quantifies the degree of socioeconomic-related inequality in the utilization of health services (5). Also, previous studies used age, wealth, education, location, ethnicity, religion, and caste as proxies for measuring equity (19, 33).

This study aimed to examine horizontal inequity in the utilization of maternal and reproductive health services in Nigeria. The study adds to the existing literature and contribute to the body of knowledge on equity in the utilization of maternal and reproductive health services by using the 2018 NDHS and focusing on utilization of PNC, delivery by cesarean section, modern contraceptive use, and met need for family planning. The study also contributes to achieving equitable health system in Nigeria by providing insights into the design of a health system that ensures the utilization of maternal and reproductive health services based on need.

MATERIALS AND METHODS

Data Source

Secondary data from the 2018 NDHS were utilized. The 2018 NDHS is a nationally representative survey of men and women aged 15–49 years based on a two-stage sampling technique. The first stage involved the selection of 1,400 Enumeration Areas (EAs) with probability proportional to EA size (the number of households in the EA) (36). A household listing operation was carried out in all selected EAs, and the resulting lists of households served as a sampling frame for the selection of households in the second stage (36). The second stage involved the selection of a fixed number of 30 households in every cluster through equal probability systematic sampling, resulting in a total sample size of ∼42,000 households (36). The survey provides updated estimates of basic demographic and health indicators such as fertility, awareness and use of family planning methods, breastfeeding practices, nutritional status of women and children, maternal and child health, adult and childhood mortality, women's empowerment, domestic violence, female genital cutting, prevalence of malaria, awareness and behavior regarding HIV/AIDS and other sexually transmitted infections

TABLE 1 | Descriptive statistics.

Variable	*N* = 41,821	
	N	%
Maternal age		
15–24	15,267	36.51
25–34	13,200	31.56
35+	13,354	31.93
Maternal education		
No education	14,398	34.43
Primary education	6,383	15.26
Secondary education	16,698	39.93
Higher education	4,342	10.38
Partner's education		
No education	10,196	35.29
Primary education	4,436	15.36
Secondary education	9,769	33.82
Higher education	4,487	15.53
Marital status		
Never married	10,669	25.51
Currently married	28,888	69.08
Formally married	2,264	5.41
Maternal occupation		
Unemployed	14,766	35.31
Employment	27,055	64.69
Partner's occupation		
Not working	1,138	3.94
Formal worker	11,215	38.82
Informal worker	16,535	57.24
Missing	12,933	
Location		
Urban	16,984	40.61
Rural	24,837	59.39
Geo-political zone		
North Central	7,772	18.58
North East	7,639	18.27
North West	10,129	24.22
South East	5,571	13.32
South South	5,080	12.15
South West	5,630	13.46
Religion		
Christianity	20,506	49.04
Islam	20,959	50.12
Traditionalist/other	356	0.85
Parity		
<3 children	22,688	54.25
3–4 children	9,464	22.63
5 or more children	9,669	23.12
Household size		
<5 members	14,067	33.64
Five or more members	27,754	66.36
Gender of household head		
Male	34,614	82.77
Female	7,207	17.23

(Continued)

TABLE 1 | Continued

Health insurance		
No	40,704	97.33
Yes	1,117	2.67
Ethnicity		
Yoruba	5,372	12.85
Igbo	6,714	16.05
Hausa/Fulani	13,718	32.80
Others	16,017	38.30
Birth order		
1	4,649	15.50
2–4	13,252	44.19
5+	12,091	40.31
Missing	11,829	-
SES		
Poorest	7,747	18.52
Poorer	8,346	19.96
Middle	8,859	21.18
Richer	8,840	21.14
Richest	8,029	19.20
Currently pregnant		
No	37,630	89.98
Yes	4,191	10.02
BMI		
Underweight (<18.5 kg/m^2)	28,250	67.55
Normal (18.5–24.9 kg/m^2)	9,127	21.82
Overweight (25.0–29.9 kg/m^2)	2,686	6.42
Obese (30 kg/m^2 or higher)	1,758	4.20

(STIs), disability, and other health-related issues such as smoking (36). The survey sampled 41,821 women aged 15–49 years. Out of the 42,121 women aged 15–49 years identified in the female survey, 41,821 were successfully interviewed, yielding a response rate of 99% (36). The 2018 NDHS data were collected from August 14, 2018 to December 29, 2018 (36).

Outcome Variables

The outcome variables were modern contraceptive use (coded as 1 if women used modern contraceptives and 0 otherwise), met need for family planning (coded as 1 if women had met need for family planning and 0 otherwise), delivery by cesarean section (coded as 1 if a woman delivered by cesarean section and 0 otherwise), and use of PNC (coded as 1 if women received a health check within 2 months after delivery and 0 otherwise). In 2013, the World Health Organization (WHO) updated its guidelines on PNC with the recommendation that women and newborns should receive PNC at a health facility for at least 24 h after birth, on day 3 (48–72 h), between days 7 and 14 after birth, and 6 weeks after birth, regardless of the place of delivery (37). The variable for PNC was derived from the question: How long and how often after delivery did the respondent receive health checks?

Measures of Inequity

Measures of inequity were maternal education, location, and SES. A SES index was constructed using Principal Component Analysis (PCA) based on data from variables on household ownership of assets and housing conditions (38). These variables include ownership of a car/truck, ownership of radio, ownership of refrigerator, ownership of bicycle, ownership of motorcycle, main wall material, main floor material, main roof material, type of fuel for cooking, source of electricity, source of drinking water, time to get to water source, and type of toilet facility used. PCA generated factor score on each household asset. The resulting asset scores were standardized while the standardized scores were used to generate SES quintile as poorest, poorer, middle, richer, and richest.

Analytical Method

All analyses were performed using STATA version 14.2 software and ADePT version 6.0 developed by the World Bank's Development Research Group (DECRG). Descriptive statistics were used to analyze the demographic and socioeconomic characteristics of the study sample in the form of frequency tables and simple percentages. Utilization of maternal and reproductive health services was compared by education, location, and SES. Equity was measured using equity gaps, equity ratios, concentration curves, and concentration indices. Concentration curve was plotted for each maternal and reproductive health services. Concentration curve and concentration index are regarded as the best methods in assessing equity in healthcare utilization because they are consistent with ranking individuals by wealth rather than health status, they are sensitive to population distribution across socioeconomic groups, and they assess relative inequality rather than absolute inequality (5, 12). CC uses the concept of horizontal equity, i.e., treating people with equal need the same and irrespective of their income. It not only represents overall inequity, but also reflects accurately which social classes are allocated with more resources. "Horizontal" inequity was also represented using CI of need-adjusted use of maternal and reproductive health services. Maternal and reproductive health services were indirectly standardized by age and sex within the sample population to reduce the confounding effects of variables correlated with SES and maternal and reproductive health services (5). The standard error and confidence intervals for each concentration index were also calculated (5). Cluster weights were included in the estimation of CC and CIs. Weighting factors constructed by the Measure DHS were used to adjust for common causes, clustering, and sampling weights.

RESULTS

Descriptive Statistics

The characteristics of the study sample are shown in **Table 1**. More than two-thirds (69.07%) of the study sample were currently married. About 65% of respondents were employed. More than two-thirds (68.88%) of the study sample reported that their partner worked in the informal sector. More than half

TABLE 2 | Utilization of maternal and reproductive health service by SES.

Utilization of maternal and reproductive health services	Q1 (%)	Q2 (%)	Q3 (%)	Q4 (%)	Q5 (%)	Total (%)	Equity gap (Q5–Q1) (%)	Equity ratio (Q5/Q1)	*p*-value
Postnatal care checkup	13.00	15.35	22.35	27.87	30.21	20.81	17.21	2.32	<0.001*
Delivery by cesarean section	0.32	0.86	2.05	3.93	10.37	2.97	10.05	32.41	<0.001*
Modern contraceptive use	4.90	7.71	12.39	18.17	24.64	12.50	19.74	5.03	<0.001*
Met need for family planning	78.99	77.06	73.35	71.93	75.67	75.57	−3.42	0.96	<0.001*

*$p < 0.05$ = statistically significant.

TABLE 3 | Utilization of maternal and reproductive health service use by education.

Utilization of maternal and reproductive health services	No education (%)	Primary education (%)	Secondary education (%)	Higher education (%)	Total (%)	Equity gap (%)	Equity ratio	*p*-value
Postnatal care checkup	11.38	23.87	29.27	31.84	20.81	20.46	2.80	<0.001*
Delivery by cesarean section	0.60	1.76	4.13	13.29	2.97	12.69	22.15	<0.001*
Modern contraceptive use	4.83	14.19	18.84	25.13	12.50	20.3	5.20	<0.001*
Met need for family planning	77.87	71.96	73.50	78.34	75.57	0.47	1.01	<0.001*

*$p < 0.05$ = statistically significant.

(59.39%) of the study sample reside in rural areas. Two-thirds (66.36%) of the study sample had five or more members in the household. More than two-thirds (67.55%) of respondents were underweight. Details are given in **Table 1**.

Inequity in the Utilization of Maternal and Reproductive Health Services

Table 2 present results of utilization of maternal and reproductive health services by SES quintiles.

The overall coverage level of postnatal care, delivery by cesarean section, modern contraceptive use, and met need for family planning was 20.81, 2.97, 10.23, and 84.22%, respectively. The utilization of PNC is higher among women from the richest quintile compared to those from the poorest quintile, and this was statistically significant. The rate of delivery by cesarean section is higher among women from the richest quintile compared to those from the poorest quintile, and this was statistically significant. The utilization of modern contraceptive among women from the richest quintile is five times more than those from the poorest quintile, and this was statistically significant. Equity ratio for met need for family planning by SES is 0.96. Results of utilization of maternal and reproductive health services by education are shown in **Table 3**. The utilization of PNC is higher among women with higher education compared to women with no education, and this was statistically significant. The rate of delivery by cesarean section is higher among women with higher education compared to women with no education, and this was statistically significant. The utilization of modern contraceptive among women with higher education is five times more than those with no education and this was statistically significant. Met need for family planning is higher among women with higher education compared to women with no education, and this was statistically significant. **Table 4** presents results of utilization of maternal and reproductive health services by location. The utilization of PNC is higher among women living in urban areas compared to those living in rural areas, and this was statistically significant. The rate of delivery by cesarean section is higher among women living in rural areas compared to those living in rural areas, and this was statistically significant. The utilization of modern contraceptive among women living in urban areas is 1.95 times more than those living in rural areas, and this was statistically significant. Equity ratio for met need for family planning by location is 0.98.

The concentration curves of utilization of maternal and reproductive health services are shown in **Figures 1–4**. Results show that there is inequity in the utilization of PNC, delivery by cesarean section, and modern contraceptive favoring the rich. Met need for family planning was almost perfectly equitable across socioeconomic quintiles. The standardized concentration index was 0.352, 0.736, 0.471, and 0.035 for utilization of PNC, delivery by cesarean section, modern contraceptive use, and met need for family planning, respectively (see **Table 5**).

DISCUSSION

This study examined horizontal inequity in the utilization of maternal and reproductive health services in Nigeria. The study contributes to achieving equitable health system in Nigeria by informing policy decision-making toward improvement in coverage of maternal and reproductive health services for poor women who have greater need for care. The overall coverage levels of PNC, delivery by cesarean section, modern contraceptive use, and met need for family planning were 20.81, 2.97, 10.23, and 84.22%, respectively. Results show that there is inequity

TABLE 4 | Utilization of maternal and reproductive health service use by location.

Utilization of maternal and reproductive health services	Rural (%)	Urban (%)	Total (%)	Equity gap (%)	Equity ratio	*p*-value
Postnatal care checkup	16.39	28.89	20.81	12.50	1.76	<0.001*
Delivery by cesarean section	1.46	5.73	2.97	4.27	3.92	<0.001*
Modern contraceptive use	9.36	18.25	12.50	8.89	1.95	<0.001*
Met need for family planning	76.13	74.54	75.57	−1.59	0.98	0.001*

*$p < 0.05$ = *statistically significant.*

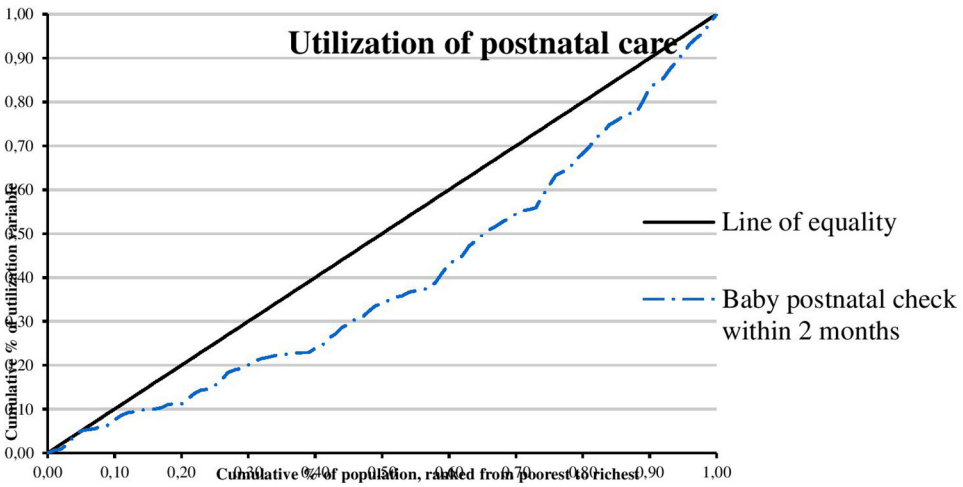

FIGURE 1 | Concentration curve of utilization of postnatal care.

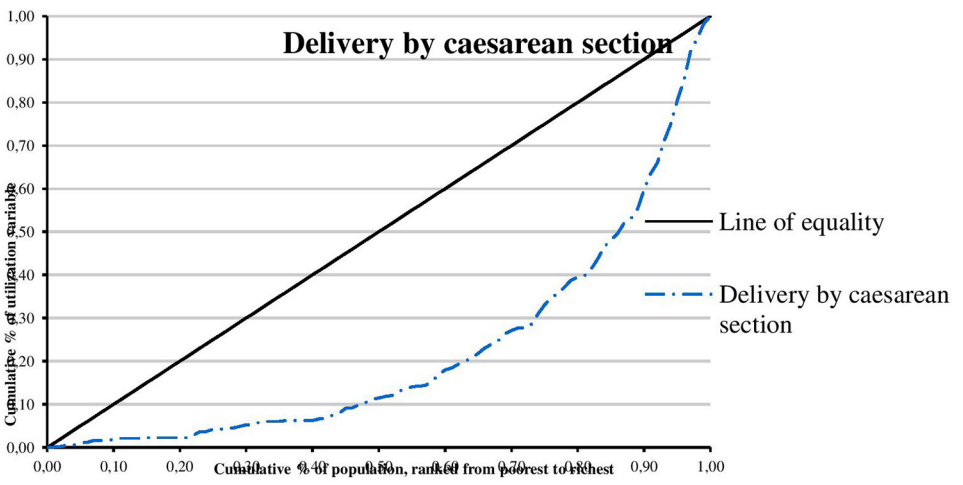

FIGURE 2 | Concentration curve of delivery by cesarean section.

in the utilization of PNC, delivery by cesarean section, and modern contraceptive favoring the rich. A possible explanation is that there is a high level of poverty in Nigeria with low purchasing power. This finding is consistent with results from previous studies that show socioeconomic inequities in the utilization of PNC (20, 27, 30, 39), delivery by cesarean section (22–24, 26, 29–32), and modern contraceptive use (21, 28, 40). Consistent with results from a similar study, the study revealed that met need for family planning was almost perfectly equitable across socioeconomic quintiles (25). Met need for family planning refers to a situation where women who want to reduce or delay childbearing are using contraception while

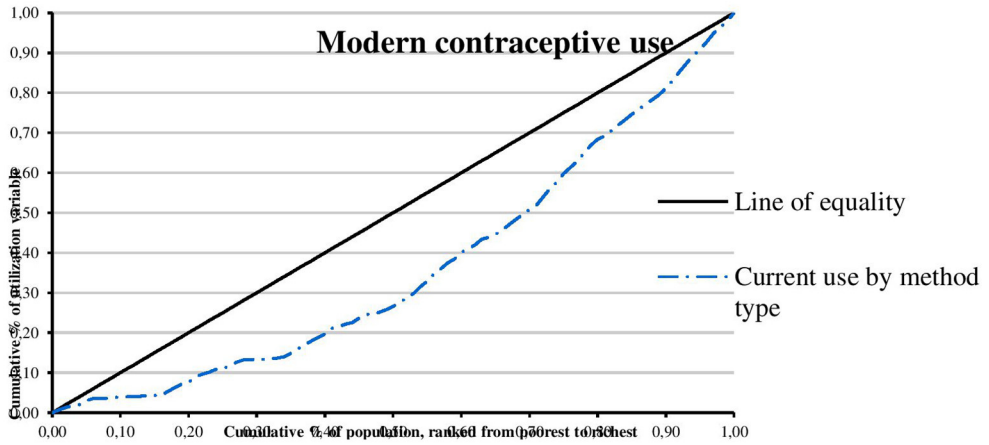

FIGURE 3 | Concentration curve of modern contraceptive use.

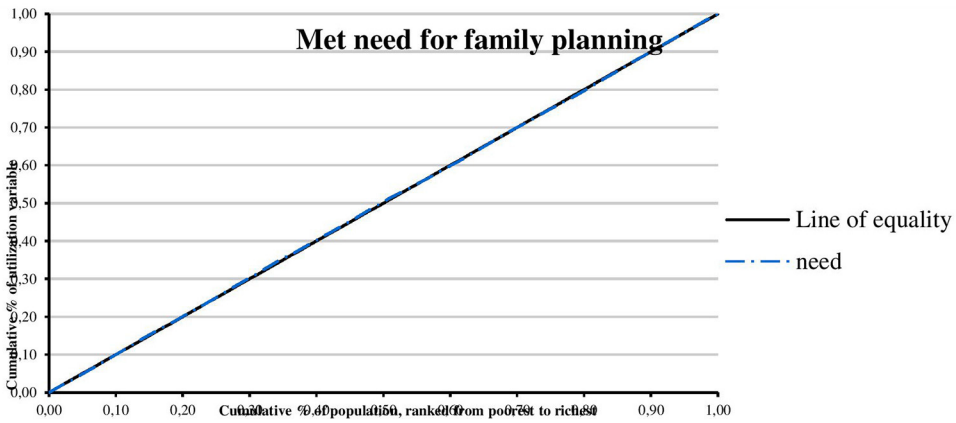

FIGURE 4 | Concentration curve of met need for family planning.

TABLE 5 | Horizontal inequity in the utilization of maternal and reproductive health service.

Maternal and reproductive health service use	CI	SE	95% Confidence Intervals
Postnatal care checkup	0.352	0.01	0.319–0.386
Delivery by cesarean section	0.736	0.02	0.705–0.768
Modern contraceptive use	0.471	0.01	0.437–0.504
Met need for family planning	0.035	0.00	0.005–0.066

CI is concentration index; SE, standard error.

unmet need for family planning refers to the condition where women want to avoid or postpone childbearing but are not using any method of contraception (41). Unmet need for family planning could also be described as the discrepancy between fertility preferences of women and use of contraception (41). However, unmet need for family planning is 22% among currently married women (36). The study also found that there is inequity in utilization of maternal and reproductive health services by education. Women with higher education utilize PNC, delivery by cesarean section, and modern contraceptive, and have met need for family planning more than women who had no education. A possible explanation is that there is poor girl child education and lack of knowledge of the advantages of maternal and reproductive health services. This finding is supported by similar studies (20, 23, 30). In this study, there is inequity in utilization of maternal and reproductive health services by location. Women residing in urban areas utilize PNC, delivery by cesarean section, and modern contraceptive more than women residing in rural areas. A possible explanation is that access to maternal and reproductive health services is poor in rural areas. This finding is consistent with results from other studies (23, 30, 42).

Policy Implication

Findings from this study have implications for policy and the achievement of SDG targets 3.1 and 3.7. The overall coverage levels of PNC, delivery by cesarean section, and modern

contraceptive use are low. Governments and policymakers should increase the coverage of maternal and reproductive health services to women of reproductive age. There is inequity in the utilization of PNC, delivery by cesarean section, and modern contraceptive favoring the rich. This implies that interventions aimed at reducing inequity in the utilization of maternal and reproductive health services are not effective. Therefore, there is a need to address the demand-side (lack of health insurance) and supply-side factors (early child marriage, low level of education, low SES, early childbearing, residing in rural areas, ethnicity, high fertility rate, and poor quality of primary healthcare) affecting the utilization of maternal and reproductive health services toward reducing the gap between the poor and the better-off. Despite the implementation of the National Health Insurance Scheme (NHIS) since 2005, health insurance coverage in Nigeria is <5% (43). Out-of-pocket (OOP) payment remains the major source of financing healthcare due to low health insurance coverage (44–48). A recent study shows that the poor bears the burden of OOP payments for healthcare in Nigeria (49). The economic empowerment of women will be critical. Inequity in the utilization of maternal and reproductive health services is also driven by education and location. Governments and policymakers should focus on women who are uneducated and living in rural areas.

Strength and Limitations of the Study

Findings from this study should be interpreted with caution. First, the study used cross-sectional secondary data rather than longitudinal data. Second, findings from this study are affected by recall bias due to self-reported information. The strength of the study is that the samples were nationally representative and the response rate of the survey interview was high (99%).

CONCLUSION

There is inequity in the utilization of maternal and reproductive health services in Nigeria. Inequity in the utilization of maternal and reproductive health services is driven by SES, education, and location. This implies that the Nigerian health system is not performing equitably. Therefore, governments and policymakers should give due attention to addressing inequities in the utilization of maternal and reproductive health services by economically empowering women, improving their level of education, and designing rural health interventions. Addressing inequities in the utilization of maternal and reproductive health services would also be important toward achieving SDG targets 3.1 and 3.7.

DATA AVAILABILITY STATEMENT

Publicly available datasets were analyzed in this study. This data can be found at: www.dhsprogram.org.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by in obtaining the micro data, a request was made on the DHS program website on October 14, 2020 and approval was granted to download the data on the same day, hence, there were no ethical issues of concern. The 2018 NDHS was approved by the National Health Research Ethics Committee of Nigeria (NHREC) and the ICF Institutional Review Board. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

BSA conceived and designed the study, acquired the data, performed data analysis, interpreted the data, and drafted the manuscript. BSA and OO revised the manuscript for important intellectual content. Both authors have read and approved the final manuscript.

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Realist Evaluation of the "Abiye" Safe Motherhood Initiative in Nigeria: Unveiling the Black-Box of Program Implementation and Health System Strengthening

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Introduction: Realist evaluation studies have spanned different aspects of medicine, especially in the field of public health. However, very few of these studies explicitly detailed how program implementation triggered outcomes that could strengthen understanding of its effect on Health System Strengthening in specific settings. In low- and middle-income countries, like Nigeria, there is a paucity of realist evaluation studies, despite the implementation of multiple intervention programs and projects in these countries. This article is aimed at unveiling the black-box of program implementation and Health System Strengthening of the "Abiye" Safe Motherhood Program in Ondo State, Nigeria. Specifically, it identified the role of contextual factors in the "Abiye" program in Ondo State, determined the mechanisms that facilitated or constrained outcomes of the "Abiye" program, and developed a Context Mechanism Outcome (CMO) Configuration from which a Middle Range Theory (MRT) can be framed.

Methodology: This was qualitative research structured along with the realist domains (Context, Mechanism, and Outcome). The Initial Program Theory was validated by the qualitative study, after which a new MRT was developed. The study population comprised key stakeholders, secondary stakeholders, and primary stakeholders in the Abiye safe motherhood program. Data was collected through 10 key informant interviews, 28 in-depth interviews, and six focus group discussions sessions. Thematic analysis was used to analyze all the qualitative data collected, and seven themes with 19 subthemes emerged in the study.

Results: We identified 13 contextual factors under five principal areas, with most of the factors playing enabling roles, some playing inhibitory roles, while very few played both roles. We elicited eight mechanisms, and some of these facilitated the outcomes, while some constrained the outcomes of the program. Health system strengthening was a key feature of the outcome of the program. We developed a middle-range theory based on the 6 CMO configurations we elicited from the study.

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Conclusion and Policy Implications: Realist evaluation is an iterative process that looks beyond the surface to generate evidence. By applying the realist approach, we generated pieces of evidence that can be adapted for policymaking in public health interventions in LMIC.

Keywords: "Abiye", safe motherhood initiative, context, mechanism, outcome, health system strengthening, realist evaluation

INTRODUCTION

Realist evaluation is a form of theory-based evaluation and is unique because of the assumption that nothing works everywhere for everyone (1). It uses a social science paradigm (2) which recognizes the multiple intertwined factors in society, making it appropriate for evaluating programs and policies with complex social interaction. It focuses on what works for whom, why, how and under what circumstances (3). Context, mechanism, and outcome are the main domains in which it is implemented. Context is the setting, either internal or external, in which it is being implemented (4). The contextual factors have been classified into situational, structural, socio-cultural, or international using a simplified framework (5). Mechanisms have been described as reasoning or the process (that may be hidden) by which actors trigger an outcome (6). In realism, outcomes could be multiple, based on the mechanism activated and in a specific context. The context, mechanism, and outcome form a configuration; hereafter, the CMO configuration (1, 6).

Realist evaluation studies have spanned different aspects of medicine, especially in the field of public health. However, very few of these studies explicitly detailed how outcomes were triggered by program implementation, which led to health system strengthening in specific settings (6–8). In low and middle-income countries, like Nigeria, there is a paucity of realist evaluation studies with evidence of health system strengthening (9, 10), despite the implementation of multiple intervention programs and projects in the health systems of these countries. Consequently, the opportunities to derive critical lessons for policymaking from previous programs are lost, and replication, as well as scaling up of programs, becomes challenging. Previous realist evaluation publications from Africa have focused on the domains of the realist approach (11, 12) while related health system strengthening by such public health programs needs further evaluation (13).

The "*Abiye*" (Safe Motherhood in the Yoruba language) program was initiated in 2009 and stopped in early 2017 in Ondo State, Nigeria to address the challenges of poor maternal and child health outcomes in the state. The initiative sought to address the four levels of delay (14) associated with maternal mortality—(i) delay in seeking quality care, (ii) delay in reaching care, (iii) delay in receiving care, and (iv) delay in being referred for appropriate care. The "Abiye" program was initiated in 2009 and implemented in Ifedore LGA as a pilot, and then it was later extended to all the other 17 local government areas in the state by 2012 (15, 16). The program was implemented along demand and supply components to make definitive changes in the health system (15). The demand component focuses on increasing utilization at the health facilities by making all the services free, assigning each pregnant woman to a community health extension worker (Health Ranger), and strengthening referrals to the appropriate facilities. The supply component, on the other hand, focuses on renovating and equipping the health facilities with drugs and life-saving materials and supplying adequate human resources for health. Previous evaluative studies on the "Abiye" program have focused on different aspects of the program in specific parts of the state using the logic model concept but did not elicit the multi-dimensional interactions associated with the program (17–19).

This article is aimed at unveiling the black-box of program implementation and Health System Strengthening of the "Abiye" Safe Motherhood Program in Ondo State, Nigeria. Specifically, it identified the role of contextual factors in the "Abiye" program in Ondo State, determined the mechanisms that facilitated or constrained outcomes of the "Abiye" program, and developed a CMO Configuration from which a Middle-Range Theory (MRT) was framed.

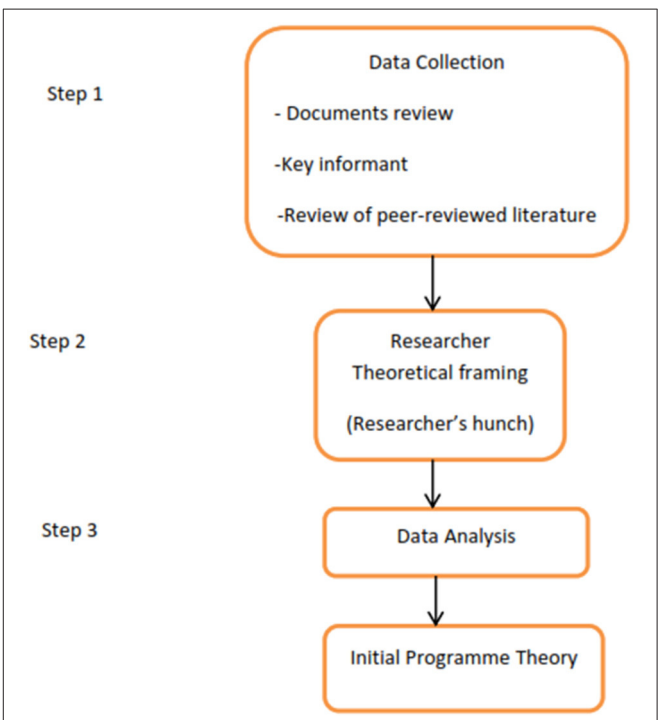

FIGURE 1 | Steps for developing the Initial Program Theory for the "Abiye" safe motherhood program.

TABLE 1 | Summary of the data sources for the development of the Initial Program Theory.

Documents reviewed	Key informant's interviewed	Peer-reviewed literature reviewed
Evaluation of Abiye safe motherhood program on Ondo. Reports. 2012 Speech on the introduction of "Abiye" program in Ondo State. 2009 Ondo State government 2015 "Abiye" safe motherhood. Ondo State Ministry of Health. 2015 Ondo State Primary Health Care Development Board 2013–2017. Reports	3 policymakers in Ondo State government 3 program developers in Ondo State 6 program implementers in Ondo State	Safe Motherhood Initiative. 2007 The Single Best Intervention: Thirty Years of Safe Motherhood Cost-effective safe motherhood interventions in low-income countries: a review Policy Trends in Advancing Safe Motherhood Safe Motherhood: a brief history of the global movement Thirty Years of the Safe Motherhood Initiative: Celebrating Progress and Charting the Way Forward

METHODS

Realist Approach

Three steps are involved in the realist evaluation approach (1, 6, 7): (i) development of the Initial Program Theory (IPT); (ii) testing and validation of the theory; and (iii) refining the theory from the CMO Configuration to develop the middle-range theory.

Initial Program Theory Development

Two initial program theories (demand and supply components) were developed. The initial program theories were framed around the core program strategies, which are the demand and supply components of the program. These theories were developed by adapting methods previously published in realist evaluation IPT development studies (20–24), and were broken down into three steps (**Figure 1**). The summary of the data sources for the development of the initial program theory is in **Table 1**. A logic model was also developed from the data sources to reflect the logic framework for the implementation of the program (**Figure 2**).

Demand Component—Initial Program Theory

"Community engagement strengthened referral, and an effective ambulance system without delay in reaching or receiving quality health care whenever or wherever it is needed would build trust, commitment, and participation of the community women (and their households) in the health system and translate into improved access and utilization of the health facilities, thereby improving maternal health and reducing maternal and infant mortality in Ondo State."

Supply Component—Initial Program Theory

The availability of highly motivated, skilled healthcare personnel with an appropriate service delivery environment and functional equipment that was previously unavailable would result in quality maternal care in Ondo State, thereby reducing maternal and child mortality. See **Table 2** for the matrix of the context, mechanism, and outcome for the demand and supply components of the IPT.

Validation by the Qualitative Method of the Study

The initial program theories developed were tested by the qualitative method which allowed the exploration of the context, mechanisms, and outcome of the study using Key Informant Interviews, In-Depth Interviews, and Focus Group Discussion sessions applied during the study. This method tested both the demand and supply components of the IPT along with the developed Logic Model. This was done by exploring the items listed under the IPT domains and the constructs in the Logic Model.

Refined Program Theory

The initially developed program theory was refined and remodeled after validation by the qualitative method applied to generate a CMO Configuration from which a new theory, the MRT, was developed.

Methodology

This is qualitative research that was conducted in Ondo State, South-West Nigeria. The state has three senatorial districts and eighteen local government areas (six in each senatorial district). The study population was comprised of (i) key stakeholders, who were policymakers, such as the "Immediate Past Governor" of the State, the Immediate Past Commissioner of Health in the State, Directors in the Ministry of Health, and relevant departments who were present during the implementation of the program. They were included because they were critical in the agenda-setting, design, decision-making, and implementation of the "Abiye" program in the state. (ii) Secondary stakeholders included service delivery personnel, such as Maternity In-Charges, Health Rangers (community health extension workers specifically engaged for the "Abiye" program and assigned 25 pregnant women in the community to each of them to follow-up until delivery), nurses, and midwives who were directly involved in the state's implementation of the "Abiye" program. They were included because of their experiences and perspectives on the role of contextual factors and mechanisms in the implementation process and the outcomes that occurred. (iii) primary stakeholders, who were the program beneficiaries, particularly mothers who delivered during the program. Mothers who delivered before and during the program period, as well as older women in the community, were also included. The mothers who delivered during the program had experiences of how contextual factors and mechanisms affected the outcomes, while the mothers who gave birth before and during the program

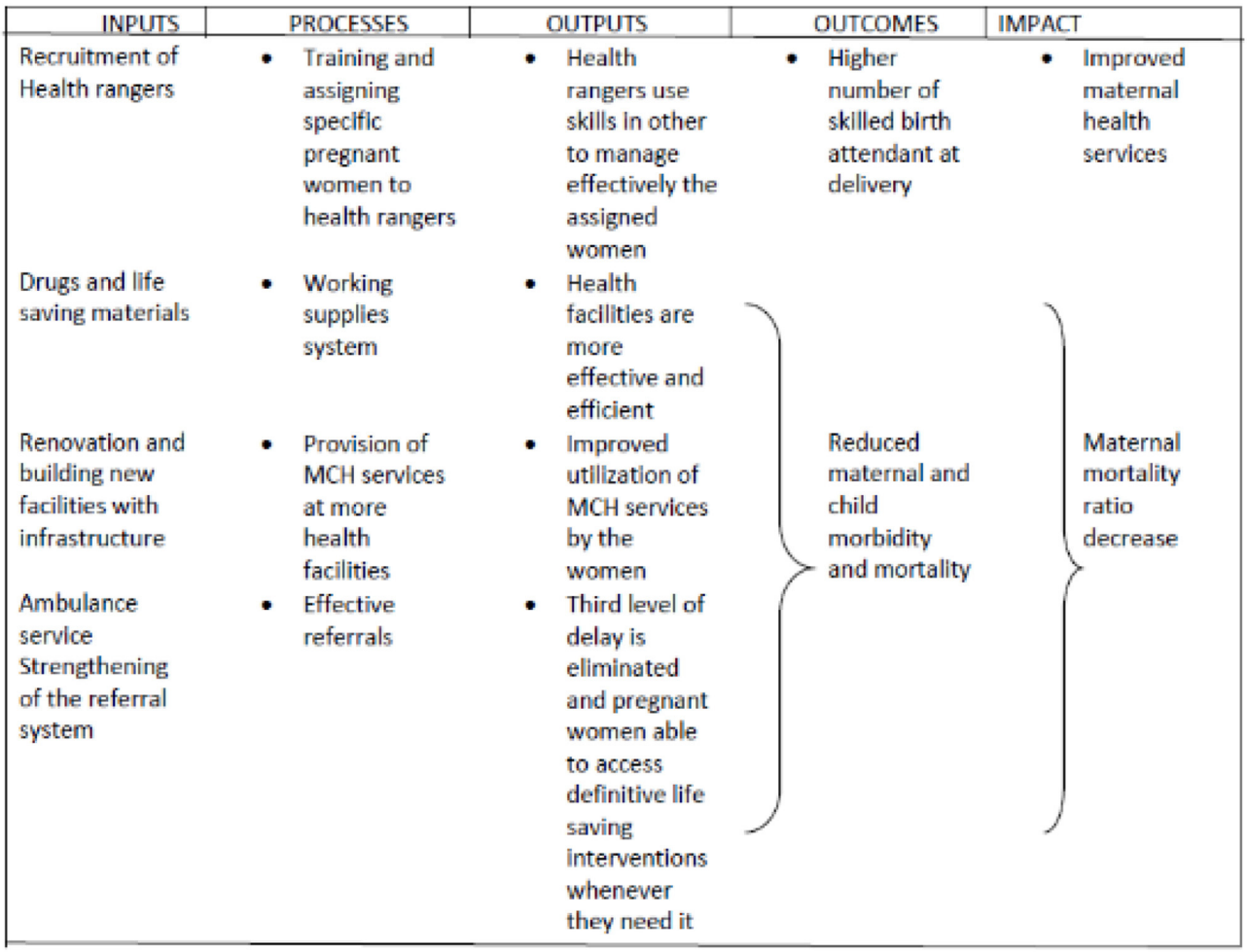

FIGURE 2 | The logic model of the "Abiye" safe motherhood program.

had broad perspectives on contextual factors and mechanisms that were different during their two delivery experiences. The older community women had experiences and perspectives regarding the pre-"Abiye" program period as well as witnessed the unfolding and implementation of the "Abiye" program and they provided insight into these periods.

The qualitative data collection methods that were used in this study were focus group discussions (FGD) in which the primary stakeholders participated, in-depth interviews (IDI) in which the secondary stakeholders participated, and key informant interviews (KII) in which the key stakeholders were the interviewees. The participants for the FGD and IDI were selected through a probable sample procedure—multistage sampling with the senatorial districts, Local Governments Areas (LGAs), wards as the sampling frames, and then participants were selected purposively from the wards. Furthermore, three LGAs (one from each senatorial district in the state) were selected for the study and six wards (two from each selected local government) were selected for the study. The interviewees for the key informant interviews were purposely selected from the eligible directors and policymakers.

The study instruments were the FGD guide, the In-depth interview guide, and the KII guide, which was developed based on the contextual factors that influenced the agenda-setting, design, decision-making, and implementation of the program and on mechanisms that facilitated or constrained outcomes of the program.

Data Collection Methods

During the study, 10 KII sessions were held. Key informant interviews were held with the immediate past "governor" of Ondo State, the immediate past commissioner of health of Ondo State, five directors from relevant ministries, departments, and agencies in Ondo State, and the local government primary health care coordinators in the selected LGAs. Data collection for the key stakeholders was stopped when data saturation was reached, that is when a further interview with additional key stakeholders did not yield any new information for the study (25).

TABLE 2 | Matrix of the context, mechanism and outcome for demand and supply component of the IPT.

Context	Mechanism	Outcome
Demand component		
Community engagement	Community participation	Improved utilization
Strengthened referral	Trust	Improved access
Effective ambulance system	Commitment	Reduced maternal mortality
Supply component		
Skilled health personnel	Motivated	Quality maternal care
Functional equipment	Appropriate service delivery environment	Reduced maternal mortality

The KII sessions were conducted in the English language and tape-recorded after seeking permission from the respondents.

During the study, 28 IDI sessions were held. IDIs were held with six health rangers (one from each of the six selected wards) and six facility health workers (one from each of the selected wards). Also, in-depth interviews were held with 15 women (five in each LGA) who gave birth before and during the "Abiye" program. This was to help elicit the experiences and perspectives before and during the program, and this was in keeping with the logic of using a small sample in interview-based qualitative research (26). A traditional birth attendant who stopped practicing during the "Abiye" program was also interviewed to give further insight into the perspectives of non-implementing stakeholders. All the IDIs were tape-recorded after due consent was given by the interviewees. Some of the IDI were conducted in the English language but some were conducted in the Yoruba language for ease of communication, and then translated to English using a two-way translation approach. All translations were done by two postgraduate students in the Department of African Languages at Obafemi Awolowo University, Ile-Ife.

During the study, six focus group discussion sessions were held. In each of the selected LGAs, two FGD sessions were held, sessions for (i) mothers who had delivered in the "Abiye" program 2 years prior (2015–2016) to the end of the program and (ii) older women (age 60 years and above) in the community. Each FGD consisted of 6–12 participants. The pre-designed guide for FGD was translated into Yoruba, the predominant local language in the state, for ease of communication using a two-way translation approach and to ensure proper understanding. Each of the FGD sessions lasted about 30–45 min and was tape-recorded after seeking permission from the participants. The FGDs were conducted in the Yoruba language and the tape-recorded form was translated to English using a two-way translation approach. This was to ensure an accurate reflection of perspectives. All translations were done by two postgraduate students in the Department of African Languages at Obafemi Awolowo University, Ile-Ife (A student translated the tape-recorded Yoruba session to the English language while the other student translated it back to Yoruba, this was to ensure the information and perspectives from the interviews were retained). One of the authors (OJ) was the moderator in all the FGD sessions and made use of a trained note-taker who recorded key issues (through jottings and audio recording) during the sessions.

Outcome Measures

The measures for analyzing the role of contextual factors in the "Abiye" policy in Ondo State were derived from the perspective of key stakeholders, secondary stakeholders, and primary stakeholders on the role of contextual factors which were elicited during the KIIs, IDIs, and FGD sessions.

The measures for identifying the mechanisms that facilitated or constrained outcomes of the "Abiye" safe motherhood program were derived from the perspectives of the key stakeholders, health workers, mothers who delivered before and during the program, older women in the community, and TBA which were elicited from the KII, IDI, and FGD.

Data Analysis

Thematic analysis was carried out for all the data collected. Thematic analysis is a process of identifying patterns or themes within qualitative data (27). It is appropriate for realist approach studies because motivations, experiences, and meanings can be theorized from the themes (28). Deductive approach (29) was applied in this study. The themes were allowed to emerge freely from the collected data to reflect comprehensive perspectives of the "Abiye" Safe Motherhood program, then the deductive approach was also applied to map the three domains of realist evaluation (context, mechanisms, and outcome), which are central to the objectives of the study. The six-phase guideline of doing thematic analysis (27) was applied in the analysis of the qualitative data collected in this study. The application of this guideline was not linear but recursive, with movements along with the phases back and forth as needed.

Phase 1: Data Familiarization

The qualitative data collected in the Yoruba language from the FGDs and some of the IDIs were translated to the English language by a postgraduate student of the Department of African Studies of Obafemi Awolowo University and back to the Yoruba Language by another postgraduate student of the Department of African Studies using a two-way translation method to ensure the perspective and ideas in the collected data is not lost. All the qualitative data in English in this study were transcribed verbatim using a rigorous process that entailed listening multiple times to the recorded tapes thereby retaining the actual meaning in the verbal accounts which is essential in qualitative analysis (27). The transcription also ensured familiarization with the data and was critical in creating meaning for this thematic analysis. The transcribed data was read multiple times to further ensure adequate familiarization.

Phase 2: Initial Codes Generation

Initial codes were generated from the transcribed dataset of this study. Codes are the basic feature of data that can be

interpreted in a meaningful way concerning the topic in focus (30). The coding was influenced by the data and the entire data set in the qualitative method was coded. Coding was done for the KII sessions separately, then for the IDI sessions and the FGD sessions. The coding was done initially manually (31), by systematically working through the transcript giving attention to the details in each extract and noting them, using pens and highlighters for potential themes or patterns. Further coding was done for the data set using Microsoft excel (32) to generate more codes from the data set and help identify themes. This process of coding manually and recoding using Microsoft excel was to ensure all possible codes from the data extracts contained in the data set were generated because of the different data collection methods used in the study. A long list of codes that formed a code book was generated from the entire data set which was summarized into a tabular form to reflect the deductive approach from which the thematic matrix was developed.

Phase 3: Searching for Themes

The long list of codes generated was sorted into potential themes according to the different patterns in the different data extracts. Essentially, the different codes generated from the KII, IDI, and FGD sessions were combined together, organized, and reorganized to form a different pattern to enable themes to emerge from the data set. A visual representation (33), a thematic map, was used to sort the different codes into themes. A thematic map is used to show relationships and links between codes, themes, and subthemes. Some of the codes did not fit appropriately into a theme and were classified into a theme called "miscellaneous theme" (27), which was further reviewed later. The themes identified in this phase of the analysis represented the initial theme (candidate themes) (33) of the dataset.

Phase 4: Reviewing Themes

The candidate themes initially identified in this study were further reviewed to refine and assess their uniqueness. Internal homogeneity within the theme and external homogeneity among the different themes identified were assessed using a dual criterion judging category (31). Homogeneity was assessed by reading through the transcribed data coded for a specific theme. This was done to ensure coherence among all the data represented within a theme. Candidate themes that were not coherent were recoded, reorganized, and sorted again, causing new themes to emerge or some to be merged with others. This also caused new subthemes to emerge in the study. The external homogeneity was assessed by reading through the entire dataset to ensure that each theme was a separate entity (though with some overlap) and that they together reflected the concept of the data set. Some of the identified themes had overlapping concepts in the "Abiye" program, so their points of overlap were reviewed and related to the objectives of the study. This allowed for more themes to emerge, and the codes in the miscellaneous theme were merged into appropriate places. The coding and recoding processes in this phase of the thematic analysis of this study continued until further coding and refinements did not yield any additional distinctive themes related to the objectives of the study. The themes devised in this phase are called "developed themes" (27).

TABLE 3 | Themes and sub-themes that emerged from the thematic analysis of the study.

Themes	Sub-themes
Financing Abiye safe motherhood program in Ondo State	Multiple funding models
	Coordination
	Incentives
Politics and Abiye safe motherhood program	Policy entrepreneur/actor power
	Sustainability
	Abiye design and idea
	Background maternal mortality issue
Human resources for health in Abiye safe motherhood program	Facility workers
	Health rangers
Facility and service delivery in Abiye safe motherhood program	Facility
	Service delivery
Data management in Abiye safe motherhood program	Tracking
	CEMDOS
	Monitoring and evaluation
Traditional birth attendant and Agbebiye program in Abiye safe motherhood program	TBA
	"Agbebiye" (safe midwives)
Community-related factors in Abiye safe motherhood program	Culture
	Community engagement
	Location

Phase 5: Defining Themes

The developed themes were described by writing detail on what each theme captures in the data set. This was done to ensure that the details in the themes were within the scope of the objectives of this study. Appropriate subthemes were also developed for the themes where they were needed. The seven final themes that emerged from this thematic analysis were given appropriate titles that fully represent the details of their contents and how they fit into the study.

Phase 6: Report Writing

The findings that emerged from the analysis were shared with some of the participants to ensure the findings were credible and consistent with the perspectives of the study participants. This was to prevent the researchers' bias from influencing findings and the final report of the study. The themes with their subthemes that emerged in the thematic analysis of this study are shown in **Table 3** and described in the Results section in detail and framed as it relates to context, mechanisms, and outcome to align with the study objectives. The contexts and mechanisms identified in

TABLE 4 | Roles of contextual factors in "Abiye" safe motherhood program in Ondo State Nigeria.

Principal factors	Contextual factors	Roles	Power, politics, policy interplay
Situational	Poor background maternal health (Agenda setting event)	Enabling	Policy
	Political and policy entrepreneur	Enabling	Power, politics, and policy
Structural	Geographical	Enabling	Policy
	Health workforce	Enabling	Policy and power
	Health facilities	Enabling	Policy and power
Design	Financial	Enabling/inhibiting	Policy and power
	Community	Enabling	Policy and power
	Data management	Enabling	Policy
	Sustainability	Enabling	Policy and politics
Cultural	Cultural belief	Inhibiting	Policy
	Traditional birth attendant	Inhibiting	Policy
	Agbebiye program	Enabling	Policy and power
International community	International community	Enabling	Policy, politics and power

this study and the description of the concepts were shared with the participants.

RESULTS

We structured our findings along with the three domains of realist evaluation: context, mechanism, and outcome, and formed CMO Configurations that guided the development of the middle-range theory.

Context

We identified the roles of contextual factors in the "Abiye" safe motherhood program in Ondo State using a simplified framework (5). Thirteen contextual factors were identified under five principal areas. Cultural belief and traditional birth attendants both played inhibiting roles at some stages in the implementation of the "Abiye" program while the financial context inhibited the implementation of the program when the salary and incentives of the workers became irregular. All other contextual factors played enabling roles in the implementation of the program. **Table 4** shows the roles of the contextual factors.

Mechanisms

We determined mechanisms that facilitated or constrained the outcomes of the "Abiye" program. The mechanisms were grouped broadly into eight groups, each having a specific focus. Each of the mechanisms identified was justified based on the themes that emerged during the thematic analysis, and the relevance to the contextual factors which influenced the implementation of "the Abiye" program with the resulting outcomes. The lack of law for the sustainability of the "Abiye" program, demotivation due to irregular payment of salary and incentives, and poor health-seeking behavior, which was a mechanism within the community constrained the implementation of the program. Other identified mechanisms that facilitated the implementation of the program are policy entrepreneurship, commitment and will, legal nudge, central funding system, financial protection, knowledge acquisition, task shifting, health rangers' mechanisms, bonding, perceived trust, and good health-seeking behavior. **Table 5** shows mechanisms that facilitated or constrained the program.

Outcomes in the "Abiye" Safe Motherhood Program

Outcomes

Health System Strengthening

The "Abiye" safe motherhood program in Ondo State apart from achieving the set goals, also contributed to the strengthening of the Ondo State health system. It affected all the building blocks of the health system in the state. The health workforce, health financing, service delivery, information management system, medicine and technology, and leadership were all strengthened in the state during the implementation of the program. The supply and demand components of the IPT are related to the health system building blocks and this is specified in **Table 6**.

Table 6 shows the strengthening of the health system in Ondo State through the "Abiye" program.

As a key policymaker, I knew I had to do something to reduce maternal mortality. The short period I spent in clinical practice exposed me to harrowing experiences of maternal mortality which I have never forgotten. These experiences made me take the bull by the horns when I had the mantle of leadership. I decided to make a change in maternal mortality in Ondo State.

Key Informant 01

Recruiting health professionals of different cadres was a priority for the implementation of the "Abiye" program. We recruited CHEWs, nurses, midwives, and doctors for the program in the various facilities. We employed eight obstetricians and six pediatricians in the two MCH hospitals specifically built for the "Abiye" program. The number of consultants in the state workforce increased from 4 in 2007 to 72 by 2016.

Key Informant 01

Skewed Prioritization and Funding

At the onset of the statewide implementation, the "Abiye" safe motherhood program in Ondo State was a priority of the state

TABLE 5 | Mechanisms that facilitated and constrained outcomes of the "Abiye" program.

Mechanism (interplaying factors)	Facilitating	Constraining
Political mechanisms—politics and Policy interplay	High-level policy entrepreneurship Commitment and Will that drove the program	No enabling law for a sustainability plan
	Nudge—Legal provisions that created CEMDOS and bill prohibiting TBAs from taking deliveries	
Funding mechanisms—policy and power interplay	Coordination by SPHCDB	
	Central funding system	
	Financial protection	Demotivation because of irregular payment of income
Human resource for health mechanisms—policy effect	Motivation and commitment by multiple incentives	
	Knowledge acquisition	
	Task shifting	
	Central pooling for human resources	
Health rangers mechanisms—policy effect	Bonding and perceived trust and support	
Facility and service delivery mechanisms—policy effect	Motivation	
	Service efficacy	
Data management mechanisms—policy effect	Accountability and data monitoring	
	Tracking	
Community mechanisms—power, politics and policy interplay	Mobilization and sensitization campaigns	Poor health seeking behavior
	WDC developmental activities	
	Good health-seeking behavior	
Traditional birth attendant/agbebiye—power, politics and policy interplay	Carrot and stick (Agbebiye)	

WDC, Ward Development Committee.

government. The political priority it generated in the state affected the focus and prioritization of some other programs within the health sector. Funding for the health sector was also skewed in favor of the "Abiye" program. The other non-"Abiye" facilities and non-maternal child health services were not well funded. This initial outcome was adjusted by the coordinating activities of the Ondo State Primary Health Care Development Board (SPHCDB), which ensured funds were appropriated to all units in primary health care in Ondo State.

The "Abiye" committee coordinated how funding was done from the SMOH. We had a few sources of funds and had to strategize according to our priorities. We had some periods of skewed funding in favor of the "Abiye" program at the expense of other areas and in favor of designated "Abiye" facilities in the wards. The committee tried to achieve balanced funding during this period, but it was challenging.

Key Informant 04

Community Engagement and Development

The "Abiye" program had a community engagement framework and power play in all the LGA which involved community participation in the program implementation and involved some community members in sensitization campaigns. The stakeholders' forum and Ward Health Development Committee (WHDC) formed during the "Abiye" program functioned for the development of the communities beyond just the "Abiye" program. For example, in the development of the sanitary system, water system, road and security networks in some of the communities.

Economic Empowerment and Development

The "Agbebiye" program (meaning "Safe Midwife" in the Yoruba language), a subsidiary of the "Abiye" safe motherhood program, had vocational skill training for Traditional Birth Attendants (TBAs) as part of the central plan of the policy when it was initiated. The TBAs were trained in a new specific vocational field for some time and were given start-up money for them to establish their new trade. They were economically empowered by this process, which led to some of them leaving the practice of delivering pregnant women. Furthermore, the recruitment of qualified health professionals like physicians, midwives, and nurses into the state as part of the policy of the intervention brought with it more socio-economic activities and investment opportunities into the state.

TABLE 6 | Health system strengthening in Ondo State through the "Abiye" program.

Health system building block	Achievements/effects
Human resources for health	Recruiting of qualified health professionals into the state healthcare system
	Training and retraining of health professionals in relevant maternal health themes
Service delivery	Provision of BEOC and CEOC services at the appropriate health facilities
	Availability of 24 h services at the health facilities
Financing	Increase from 2.9% in 2009 to 11% in 2014 of the state budget to healthcare
	Multiple models of funding: PBF, DFF, NHIS and donor grants
Medicines and technologies	Availability of all drugs and materials at no cost to the women
	Equipping of the health facilities with equipment needed for lifesaving interventions
Leadership	Provided leadership for the development of other thematic health areas in the state.
Information	The HMIS in Ondo State was repositioned by the data management system of the "Abiye" safe motherhood program
	Tracking was central to the program and for generating data

BEOC, Basic Emergency Obstetric Care; COC, Comprehensive Emergency Obstetric Care.

Increased State Health Wage Bill

The massive recruitment of health professionals into the state healthcare sector increased the health wage bill in the state resulting in an unintended outcome for the state government.

CMO Configuration

Politics in CMO Configuration

A new government that prioritized reducing maternal mortality in Ondo State gave a window of opportunity for the implementation of the "Abiye" safe motherhood program. This favorable policy environment further ensured the enactment of the Confidential Enquiries in Maternal Deaths in Ondo State (CEMDOS) law in Ondo State. The commitment and will of the political actors (the State governor and the Commissioner of Health) to the program and the nudge by the legal system in the state facilitated the "Abiye" safe motherhood program that ensured the full implementation of the program. However, the lack of a definite legal sustainability plan for the "Abiye" program was a constraining mechanism that affected its implementation of the program.

The data on maternal deaths in the state was an embarrassment to South-West Nigeria. This drove us to action. We also knew from different pieces of evidence that these deaths were highly preventable if we did the right things in our setting, and that is what we did.

Key Informant 02

We actually had plans to sustain "Abiye" in the state through the social protection bill but it never worked out. Also, the residential card, ("Kaadi Igbeayo") we implemented had some challenges which affected sustainability funding plans for the "Abiye" program.

Key Informant 01

The burden of neighboring state patients at the later stage of the program made us include "kaadi Igbeayo" (residency card) as a requirement to access free maternal health. We treated every pregnant woman but discharged them after presenting the card or full payment.

Key Informant 03

Human Resources for Health in CMO Configuration

The recruitment of qualified health professionals, training and retraining of in-service staff, initiating the Health Ranger scheme, and multiple incentives for the specific service delivery rendered by the health care workers were the context of the program. The motivation from the multiple incentives was a mechanism that facilitated the implementation of the program making the workers always available and ready to ensure the pregnant women were delivered safely. Continuous improvement and development of the knowledge and skills of the health workers was another facilitating mechanism in Human Resources for Health in the implementation of the "Abiye" program. Another mechanism was the task shifting process during the "Abiye" safe motherhood program which was initially resisted, but when it was accepted and implemented, ensured more skilled attendants were at the delivery of pregnant women in the state. The state also used the mechanism of the pooling system for human resources for health within the state when the midwives of the Midwives Service Scheme (MSS) from the Federal government were integrated into the "Abiye" program.

Health Rangers (CHEWs) were a game-changer in "Abiye" program. They were recruited and were tasked with ensuring safe delivery for all pregnant women. We did a task-shifting process to equip them to be skilled attendants proficient at managing pregnancies, but this became a battleground for some time with our midwives and nurses. We had 5 midwives and 23 nurses in a local government with over 10,000 pregnant women. There was an obvious need for task shifting and equipping of these CHEWs to help reduce maternal deaths.

Key Informant 02

Funding in CMO Configuration

The "Abiye" safe motherhood program was implemented in the context of multiple sources of funding, different funding models (state government funding, performance-based financing, donor funds, and decentralized facility funding), and financial risk protection for pregnant women and their children. This removal of financial risk facilitated facility delivery among the women. The central funding system mechanism was an interplay of power

and policy which facilitated the implementation and ensured effective use of resources in the state to achieve their outcomes.

We partly funded the program from the state fund. This showed development partners our commitment and sincerity of purpose to reduce maternal mortality within the state. We had limited funds available for this but we consistently increased our total health financing from 2.9% of the state budget in 2009 to 11% by 2014.

Key Informant 01

State funding declined during the national economic recession period. This affected our implementation during this period, and state full ownership of the program.

Key Informant 04

Facility and Service Delivery in CMO Configuration

The renovation, equipping, and building of facilities specifically for the "Abiye" program motivated health workers to be committed and ensured availability of needed life-saving interventions and effectiveness in service delivery The referral ambulance service of the program ensured pregnant women requiring lifesaving interventions get to the health facilities immediately, while the use of Toll-free Closed User Group (CUG) in the "Abiye" program by the different participants ensured utilization of the program and thereby facilitated its implementation.

Data Management in CMO Configuration

Accountability and monitoring in the "Abiye" program were mechanisms that facilitated the outcome achieved because of regular data collection, monitoring, and review of the activities of the health rangers in the communities. The tracking system in the program by the State Primary Health Care Development Board and performance-based financing, which required data to measure performance, also facilitated its outcome.

A word that describes "Abiye" is tracking. Tracking of pregnant women in the communities, keep tracking them during their period of pregnancy and track them in labor to delivery, and keep track of them to the postnatal period.

Key Informant 07

PBF (performance-based financing) is very good. It helped our facility to grow and render better maternal services. We employed temporary staff, including a medical doctor through it, which helped improve the utilization of our services. We did not have to go through the bureaucracy of the SPHCDB in Akure (the state capital) to make decisions on some funding and recruitment issues.

IDI 01

PBF is a strict funding system. Our funders are results-driven. We had to put in our best to achieve these results or we might lose our funding. We also needed to collect accurate data like phone numbers, house addresses (description to the house), and names (called at home), which we did not routinely do formerly. Falsified or unverifiable data is not accepted and I know some facilities lost their funding because of this.

IDI 02

Community in CMO Configuration

The mobilization campaign in the communities was a mechanism that facilitated the implementation of the program in the state. The community members and engaged before the implementation started and were involved in the decision-making process at the community level through the activities of the WHDC, which was another mechanism at the community level. The TBAs within the communities were also motivated by incentives to bring pregnant women to the health facilities to deliver thereby further reducing maternal mortality. The "carrot and stick" approach was used for the TBAs in the communities initiated by the Agbebiye program. This facilitated the outcome of the "Abiye" program in Ondo State. Discouragement of some community members because of the bad road terrain in their communities was a constraining mechanism that affected the implementation of the "Abiye" safe motherhood program in such communities. See **Figure 3** for CMO Configurations of the study.

New Program Theory

"Provision of sustainable free quality maternal care to all pregnant women by motivated health professionals within a comprehensive health design in fully engaged communities, with a background of strong political will and prioritization, would improve utilization of the health facilities and skilled delivery thereby sustainably reducing maternal mortality in Ondo State."

Based on this new program theory, a Framework for maternal mortality reduction program was developed, which can be adopted in LMIC where maternal mortality is a challenge (**Figure 4**).

DISCUSSION

The gap between policymaking and evidence generated from studies in LMIC is a challenge. Multiple evaluations of intervention programs have focused on the effectiveness and not on "what works for whom, how, why and under what circumstances". The realist approach, which we applied in this study, explicitly explored the implementation of the "Abiye" safe motherhood program in Ondo State identifying the roles of contextual factors, the effects of mechanisms that triggered various outcomes. Furthermore, we unveiled the "black-box" of program implementation and Health System Strengthening.

The contextual factors of the implementation of the "Abiye" safe motherhood program in Ondo State that emerged in this study are situational factors (agenda-setting event, political and policy entrepreneur), structural factors (geographical, health workforce, and health facilities), design factors (financial, community, data management, and sustainability), cultural factors (cultural belief, traditional birth attendant, "Agbebiye" program), and international community factor (International community). Most of these factors with their context have been described as contextual factors in previous realist evaluation studies. Marchal et al. (10) focused on hospital management and performance in Ghana, as well as reported health workforce, data management, and health facilities structure as found in this study were contextual factors that influence hospital management and performance in their setting. Similarly, Marchal et al. reported that in Morocco political entrepreneurs, community and finance were contextual factors that influenced fee exemption

Thematic Area	Contexts (C)	Mechanisms (M)	Outcomes (O)
Political			
	Political prioritisation	Commitment and Will	Full program implementation
	New Government (CEMDOS)	Legal nudge	Quality data and safe deliveries
	New government	No enabling law	No sustainability
Human Resources for Health			
	Multiple incentives	Motivation/ Commitment	Safe deliveries increased
	In-service training and retraining	Knowledge acquisition	Lifesaving interventions were performed and excellent maternal health services offered
	Few nurses and midwives	Task shifting	More skilled attendant at delivery
	Recruitment of health professionals and MSS	The central system of Human Resources	More skilled attendant at delivery
	Health Rangers Unit (Visits and Phone calls)	Bonding and perceived support, trust	Facility delivery/ utilization increased
	Stopped income and incentives	Demotivated	Industrial action
Funding			
	Different funding models	Coordination	Full program implementation
	Multiple sources of funding	Central funding system	Health financing strengthened
	Financial risk protection/ Safety net	Removal of financial barriers	Facility utilization increased
Facility and Service delivery			
	Renovated and equipped facilities	Motivation/ Commitment	Lifesaving intervention available
	EOC and Family planning services	Service efficacy	Safe deliveries increased
	Strengthened Referral system	Service efficacy/ inefficacy	Safe deliveries
Data Management			
	Health Rangers Unit	Tracking	Coverage for pregnant women
	Performance-Based Financing	Accountability	Quality data generated and effective management of funds
	State Board	Data-driven	Quality data generated
	CEMDOS	Surveillance	Quality data and safe deliveries
Community			
	Engagement: Stakeholders forum/ Ward Development Committee	Awareness, sensitisation	Community acceptance
	Location (Riverine)	Poor access, discouragement	Poor utilization of the program
	Culture	Good/ Poor health-seeking behaviour	Increased facility delivery/ Low utilization of the program
	Conditional Cast Transfer (TBAs)	Motivated	Reduced unskilled deliveries
	Vocational training (TBAs)	Motivated (Carrot and stick)	Reduced unskilled deliveries

FIGURE 3 | Context, mechanism, and outcome configuration in Abiye safe motherhood program.

policies (34). Other realist studies which have spanned over a decade in low, middle, and high-income countries (8, 9, 35, 36) reveal agenda-setting events, geographical, cultural, and international community as contextual factors that influence program implementation as found in this study. These factors have been recurring for over a decade and have been reported across various economic settings. They are therefore important factors to be considered to ensure the success of any program irrespective of the socioeconomic pedigree.

However, the "Agbebiye", sustainability, and financial context reported in this study have not been reported in previous realist evaluation studies. This might be because the "Agbebiye" program was specific to the "Abiye" safe motherhood program, and the sustainability context reported in this study was also specific to the program. Nonetheless, we propose that for similar safe motherhood projects, program implementers could adapt the concept of Agbebiye into their setting, as this study shows it to be a program enabler.

The financial context reported in this study is different from the previously reported financial context in realist studies because of the multiple funding models, central funding system, and coordination system of the financial context in the "Abiye" program. The multiple sources of funds coupled with good coordination probably contributed to the good outcomes of the Abiye safe motherhood program.

In this current study, several facilitating and constraining mechanisms were identified to have affected the Abiye safe motherhood program implementation/outcomes. As found in this study, motivation and knowledge acquisition by health workers as program facilitating mechanisms has been previously reported by a prior realist evaluation study in Nigeria on the use of neonatal and pediatric pulse oximeters in 12 hospitals

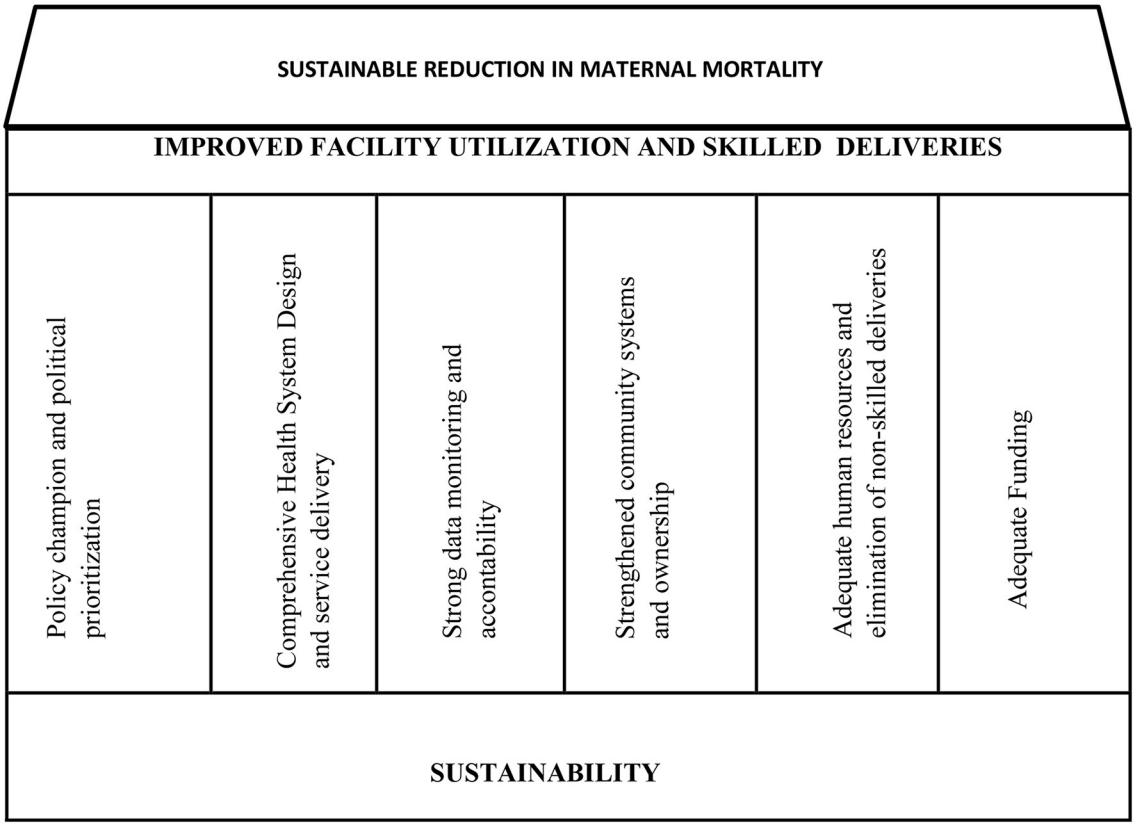

FIGURE 4 | Framework for maternal mortality reduction programs.

(37). Similarly, Marchal et al. (10) in Ghana and Makumbang et al. (35) in South Africa also reported these mechanisms as program implementation/outcome facilitators. Also, bonding and perceived support, trust, removal of financial barriers, commitment, and service efficacy as found in this study were previously reported by Makumbang et al. to be facilitating mechanisms for successful program implementation. These mechanisms should thus be given careful consideration and properly woven into the planning and implementation of the subsequent health-related program as they have been shown to facilitate program success.

The policy entrepreneur's commitment and nudge by legal provisions were facilitating mechanisms identified in the political theme that emerged in this study. Similar facilitating mechanisms have been reported in a London realist evaluation study on modernizing health service (8). The awareness, engagement, and good health-seeking behavior were the facilitating mechanisms identified in the community theme that emerged in this study, which are similar to findings in a realist evaluation of Community Health Committees in Nigeria (38) which identified community connectors as a facilitating mechanism. Another realist evaluation in Bangladesh (9) on maternal and newborn health programming identified participating in health facility activities as a facilitating mechanism for the community women. The facilitating mechanisms identified in the data management theme of this study are accountability and data monitoring which are similar to some of the facilitating mechanisms in the realist evaluation study in Ghana (10) and Bangladesh (9).

There are three facilitating mechanisms identified in this study that were not reported in previous realist evaluation studies to the best of the authors' knowledge. These are the task-shifting mechanism, central funding system mechanism, and tracking mechanism. However, they have been identified as forms of causal/ actor process mechanisms (39–41) which facilitate program implementation as found in this study.

The constraining mechanisms identified in this study were demotivation of the health workers when program funds dwindled and the health workers' payments were adversely affected, and poor health-seeking behavior which was a cultural factor in certain riverine communities with poor road access. Demotivation and poor health-seeking behavior have been reported as constraining mechanisms in some realist evaluation studies in Nigeria (37), Ghana (10), South Africa (35), Bangladesh (9), and London (8). Hence, more attention should be paid to the vulnerable populations and ways to improve their health-seeking behavior to access lifesaving interventions at the planning and implementation stages of such programs.

The lack of legal nudge for sustainability identified in this study as a constraining mechanism in this study was not reported in previous realist evaluation studies. This is possibly why the

successful implementation of some programs starts to dwindle with time as found in this study. It is thus imperative that legal nudges for sustainability and identified and incorporated at the planning stage of intervention programs. Limited literature exists on the interplay of power, politics, and policy in the health system (42, 43). Institutionalization has been described as a vehicle for the interplay of these three concepts (44), which was also evident in this study. The interplay of these concepts facilitated the provision of a safety net in this study which is similar to existing knowledge on the effects of these concepts on health equity, though the evidence varies in different studies (45, 46). The influence of the international community was similar to documented evidence from Millennium Development Goals (MDG) implementation (47, 48) and funding in developing countries (49, 50).

The framework for maternal mortality reduction programs developed in this study could be applied in different settings. This framework is a guide around which maternal mortality reduction programs and also other public health interventions can be built. The key elements of this framework are: (a) policy championing and political prioritization, (b) comprehensive health system design, (c) strong data monitoring, (d) strengthened community systems and ownership, (e) elimination of non-skilled deliveries, and (f) adequate funding.

Policy championing and sustainable political prioritization in maternal health programs have been reported in previous studies in Nigeria and sub-Saharan Africa (51). Similar to this, policy championing and political prioritization have also been reported as vital in other public health intervention (52) and reported in multiple studies as being central to the achievement of Universal Health Coverage in any society (53, 54). A comprehensive health system design that is sustainable is necessary for maternal programs. It comprises the health system and the building blocks which have been reported as needed for development in healthcare services (55). The community's engagement and participation in maternal health programs have been reported to promote the acceptability and sustainability of such programs (56). Public health intervention programs have also been reported strengthened by community ownership (57). Elimination of non-skilled deliveries was also a component of the framework developed in this study. Some studies in Nigeria (58) and Ethiopia (59) have reported collaboration with TBAs while the National Reproductive Health Policy 2017 has eliminated non-skilled deliveries as a strategy for reducing maternal mortality in Nigeria (60). However, phasing out non-skilled deliveries might be a challenge, but a well-designed maternal health program would reduce their effect and may make them extinct gradually. Sustainable adequate funding is important in maternal mortality reduction programs and health system strengthening (61) as shown in this study. To sustain the free maternal health services provided from antenatal to the postnatal period, contributory Community Based Health Insurance (62) in which every adult pays a token annually and the government subsidizes it or the Social Health Insurance system (63) has been reported in the literature. In Nigeria, the "Investment Case" 2017–2030 of the Federal Ministry of Health for reproductive health, maternal, newborn, child, adolescent health and nutrition (64) also highlighted the need for adequate funding of maternal health programs and has also been reported in some studies in sub-Saharan (65) Africa and globally (66).

This study helps in filling some of the research gaps in the realist evaluation approach. It used a realist approach to evaluate the implementation and possible outcome of a safe motherhood initiative in a low-middle income. It has brought to the fore how specific contextual factors, their mechanisms, and outcomes influence program implementation. In addition, a framework for maternal mortality reduction programs was developed which could be applied in different settings, and also for other public health intervention programs. Thus, findings from this study are useful for government at all levels, policymakers, and program managers in public health programming in Sub-Saharan Africa and other LMICs.

Limitations of the Study

The realist evaluation approach of the study did not allow for any causal relationship/ inferences to be made but it showed the different factors (context and mechanisms) that potentially influenced the outcome of the program. Analyzing a public policy intervention program like the "Abiye" safe motherhood program is prone to social desirability bias. However, a detailed explanation of the objectives of the study to the participants, highlighting the possible benefits to Ondo State and reassurance of confidentiality is believed to have sufficiently encouraged the participants to give valid responses. Thematic analysis was used for qualitative analysis, and it is prone to the researchers' subjective views but this was addressed by reviewing every phase of the thematic analysis process with the recorded audiotape of the data set, thereby ensuring all the detail in the themes that emerged represent the data collected in the study.

CONCLUSION

Realist evaluation is an iterative process that looks beyond the surface to generate evidence. By applying the realist approach, we generated pieces of evidence that can be adapted for policymaking in public health interventions in LMIC, especially for maternal mortality reduction programs.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Health Research and Ethics Committee of the Institute of Public Health, Obafemi Awolowo University, Ile-Ife, Osun State and its HREC Number is IPHOAU/12/830;

Health Research and Ethics Committee of Ondo State Ministry of Health and its HREC Number is OSHREC/25/09/2017/019. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

OO developed the concept of the study, co-designed the proposal and methodology, analyzed the data, interpreted the data, drafted the article, and approved the final version. AF reviewed the concept of the study, co-designed the proposal and methodology, reviewed and interpreted data, repeatedly reviewed the draft article, and approved the final version. All authors contributed to the article and approved the submitted version.

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Factors Associated With Coverage of Health Insurance Among Women in Malawi

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Introduction: Access to healthcare for the vulnerable groups including women has long been a theme encouraged worldwide from the first general assembly on health to the current sustainable development goals. Despite many countries having a free public healthcare system, there are inequalities in access to care and significant out-of-pocket spending, pushing most women into poverty against the principles of universal health coverage. Coverage of Malawian women with health insurance is poor; thus, there is limited cushioning and high risk of poverty, as women bear costs of care as primary caregivers. There is need to explore determinants of coverage of health insurance among women in Malawi to inform health policy.

Methodology: This study was quantitative in nature, using cross-sectional secondary data from the 2015 to 2016 Malawi Demographic and Health Survey involving women aged between 15 and 49 years. We assessed factors associated with insurance coverage by comparing women with and without insurance schemes using binary logistic regression. Analysis was done using STATA statistical package version 13.

Results: The analysis included a total of 24,562 women with a mean age of 28 SD (9.3). Of these cases, 1.5% had health insurance. High education attainment, occupation, and wealth were significantly associated with health insurance ownership, with all having p-values of < 0.01. On the other hand, a woman's residence, marital status, and who heads a household were not associated with ownership of health insurance significantly.

Conclusion: Education, occupation, and wealth have a key role in influencing a woman's choice in owning health insurance. This informs policymakers and health insurance providers on how best to approach women's health financing and factors to target in social security programs and health insurance products that speak to women's needs and capacity.

Keywords: health insurance, women, health care equity, gender disparities, Malawi

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INTRODUCTION

Universal health coverage (UHC) is fundamental to healthy living of citizens in any country (1). Increased coverage of health services has been shown to improve health indicators and contribute to stronger economic development (1). As per the Alma Ata Declaration, all the citizens should have equal access to healthcare as a right not a privilege (2). Universal health coverage ensures that

people access quality healthcare they need without suffering from financial hardships (3). This is significant because a country without healthy citizens loses out on a healthy productive labor force to propel its development activities. Essential health coverage for women is vital because women play a crucial role in development. Bloom et al. attest that healthier women are more likely to participate in the formal labor market and, thus, they face higher opportunity costs of having children (4). As a result, investments in women's health lead to a substitution away from having many children toward having fewer, better-educated children (4), which translate to productive demographic dividends. In addition, investments in women's quality healthcare improve child survival, as women are able to access pre- and postnatal care timely, as well as necessary vaccines, which improve survival rates of children (5). This ensures continuity in future development dividends.

Health insurance is one strategy promoted by the WHO to minimize catastrophic financial hardships when accessing healthcare and ensuring UHC. Global health insurance coverage data often shows that women are disadvantaged. Although women often have greater health needs through their life cycle than men, they are less likely to have insurance, due to economic inequalities and, therefore, have lower ability to pay for services (6). Witter et al. argue that in fact women ought to be the beneficiaries of cross-subsidies from the more privileged groups in society in accessing health services because of all the social cultural, social economic discrimination, and other inequalities that hinder them from accessing quality healthcare (7). Nevertheless, one would argue that with the economic downturn across the globe, the "privileged" is getting fewer and it is unsustainable to work on such a principle for subsidizing healthcare for women considering the methods used such as increased taxation and aid. It is, therefore, important to critically look at health financing alternatives, especially health insurance coverage to ensure that women have access to quality healthcare without risk of incurring heavy financial losses.

SUB-SAHARAN AFRICA CONTEXT

In the case of sub-Saharan Africa, most systems be it political, economic, and health were inherited based on colonial operations. For example, health systems inherited by many countries are organized and financed by governments, which provide facilities, personnel, and other inputs (8). By the 1980's, however, many sub-Saharan countries were highly indebted, which led to economic downturn in many of the countries (9). As part of structural adjustment programs, many governments had to cut public spending on infrastructure and services, including healthcare and education (10). Consequently, many African governments ceased subsidies to public services and began implementing various cost-recovery measures in public services (10), which, in turn, led to introduction of out-of-pocket (OOP) expenditures for healthcare (8). Since then, out-of-pocket expenditures have remained high in many sub-Saharan countries (8). With gender disparities in education, economic opportunities, and wages across sub-Saharan Africa (11–13), it has been shown that women's ability to pay for healthcare and make informed decisions affecting their health are heavily compromised (14–16). Amu et al. (17) argue that access to health insurance for women in this region correlates with education. Education enables women to protect their own health and to seek appropriate healthcare when they are ill (17). Thus, being covered by health insurance enables them to avoid catastrophic health expenditures that they may, otherwise, have faced had they made huge out-of-pocket payments when they fell ill in the absence of health insurance (17).

In addition, Gysels et al. (18) and other studies bring another important aspect in healthcare that women shoulder. They present that caring for patients does not only bring financial burden, but it also has a physical, emotional, and social burden for carers (18–20). Having insurance at the point of sickness provides an opportunity for care for the patient, but also cushions the caregivers and family, as they contribute toward transport and providing appropriate food. In addition, there is evidence of psychological impacts of caring for patients such as loneliness, depression, and isolation, which are lessened by reducing the pressure of out-of-pocket payments, especially for women caregivers, who were found to be among the group that often provides care (18–20). With a high burden of chronic diseases such as HIV, malaria, TB, and high rates of maternal mortality coupled with poverty as a hindrance to access healthcare, the need for health insurance as a means of granting access to healthcare for vulnerable women populations cannot be overstated (8).

MALAWI CONTEXT

In the Malawian context, the health sector is disaggregated into three tiers, namely, primary, secondary, and tertiary (21). This is a system adopted from colonial times and has been undergoing reforms with time. Health services are provided by public, private for-profit (PFP), and private non-profit organizations, with government providing most (63%) health services (21). The PFP sector is small, but growing, and includes a range of private hospitals and clinics that vary from group to solo practices (21). The major faith-based providers are organized under the Christian Health Association of Malawi (CHAM), which provides ∼37% of all the health services and charge service fees (22). Despite its dominance in providing free healthcare, government's increasingly insufficient health expenditure allocation to the health system has led to failure in state service delivery, shifting the burden of access to effective healthcare to the private healthcare providers (8). Although per capita total expenditure on health is better than most low-income countries in the sub-Saharan region at US$39 (23), it is still lower than what is required for Malawi to provide essential healthcare as outlined in the national Essential Healthcare Package (23). Consequently, only 44% of health facilities in the country are able to comprehensively deliver the health services under this package (23). Failure to provide adequate medicines and health workers, insufficient equipment, and poor access to emergency services (22) have necessitated the use of out-of-pocket expenditure to

access quality healthcare. As a result, household's contribution to total health expenditure has consistently increased over the past decade, currently standing at 11.2% (24) and likely to continue on this trend, which has implications for equity of access to healthcare if the increased spending is borne by poor households and especially women who constitute the majority of the poor, lag in economic productivity, and face wage inequalities (25). Furthermore, Abiiro et al. (22) found that despite having free services, Malawians are having to spend out-of-pocket on illegal and informal payment to access medical services, which put people in financial risk that most often prevent them from access to care (22).

Currently, Malawi has no social medical insurance in place. However, with increasing pressure to provide adequate healthcare, introduction of a social health insurance has been a theme of reform by the Malawi government as an alternative to health financing (26). Learning from other forerunners in the region, introducing a tiered system that provides health insurance products according to affordability and sectors would help to increase access to quality care by most of the population (17). Having a formal system would also help households plan their income better as opposed to random charges from illegal and illicit dealings. Although still under discussion, it is worth considering as the population is already under strain from OOP expenditure and illicit payments in accessing healthcare in government facilities and it is estimated that over half of the population is being pushed into poverty due to these catastrophic financial outlays (27). As indicated above, having health insurance at the point of access reduces the dilemma of whether to spend on healthcare and get further impoverished or forgo the care, prolonging the illness and risk being unproductive or able to work. In addition, insurance provision introduces competition in healthcare service provision with government operating majority of facilities, which may lead to lowering the costs of providing care for individual patients with resultant positive effect on household income (28).

The private medical insurance industry is relatively small covering 2% of the male population and only 1% of the female population (29). These are mostly from formal labor market as it is easier to collect premiums vs. the informal sector where wages are low, with unorganized structures, which makes it challenging to collect premiums (30). Nevertheless, most of the population belong to this sector particularly women and are more vulnerable to financial shocks; hence, we cannot continue to ignore the need for medical insurance for the vast majority of the country.

Although statistically the difference in coverage for men and women is small, study has shown that it is mostly women who bear the most burden of disease and suffer the effects of ill health and as such are more vulnerable without health insurance (31). In particular, it has been noted that poverty, economic inequalities, education, and culture impede women in ownership of health insurance (17, 31, 32). The recent Integrated Household Survey (IHS) shows that although there are less female-headed households in Malawi (25%), female-headed households have more household members and a higher dependency ratio (1.6) than male-headed households (1.1) (33). With the high levels of poverty, it can be implied that women have a high burden of managing family members' welfare, health inclusive. In many sub-Saharan countries, women (mothers in particular) are critical because they bear most of household responsibilities and it is their health and wellbeing that largely determine the child survival and wellbeing (34) underscoring how beneficial health insurance would be in improving not only access to quality health for mothers, but also their children.

Evidence exists on willingness-to-pay for health insurance even from rural communities and preferences for microhealth insurance, as well as on private demand (16, 22, 35, 36). Abiiro has shown that formulating products that speak to the context of Malawi, such as co-payments, transport facility, and reproductive health just to mention a few, would increase enrollment into a social health insurance scheme (SHI) and suit affordability of households (22, 36). Similarly, the WHO encourages low-income countries such as Malawi to cover "essential health services" and key infectious diseases according to the cultural contexts and economic realities to ensure fairness and equity (37). Although there have been such studies, there is limited focus on women coverage specifically despite that they are in majority and face extreme inequalities in health; hence, this study builds on this pool of knowledge with a focus on insurance coverage for women. The aim of this study is to explore demographic and socioeconomic factors associated with coverage of health insurance among women in Malawi that will provide lessons and knowledge that address women's needs toward improved financing alternatives in the health system.

CONCEPTUAL FRAMEWORK

This study dealt with two subject matter where individuals exercise choice to have health insurance or not and factors enabling or impeding that choice. The choice to have health insurance or not is embedded in welfare economics. Welfare economics theory tries to answer if we can derive a social preference from the preferences of individuals (38). This is a theory of uncertainty, which predicts that individuals are generally risk averse and where faced with risk, individuals would like to insure against all the perceived forms of risks (39). The theory also explains that everyone strives to maximize the expected value of a utility function that is how much benefits will be derived from spending on health insurance in the case of this study. Risk aversion entails that individuals have a diminishing marginal utility of income. Since health risks for different individuals are basically independent, pooling them reduces the risk to the insurer to relatively small proportions (39) **Figure 1** shows a graphic model of the theory.

On the other hand, welfare economics cannot fully explain enabling and impeding factors for this choice, which bring us to the social ecological model (40, 41). This model helps to understand factors affecting behavior and also provides guidance for developing successful programs through social environments (40, 41). Social ecological models emphasize multiple levels of influence (such as individual, interpersonal, organizational, community, and public policy) and the idea that behaviors both shape and are shaped by the social environment. For this study,

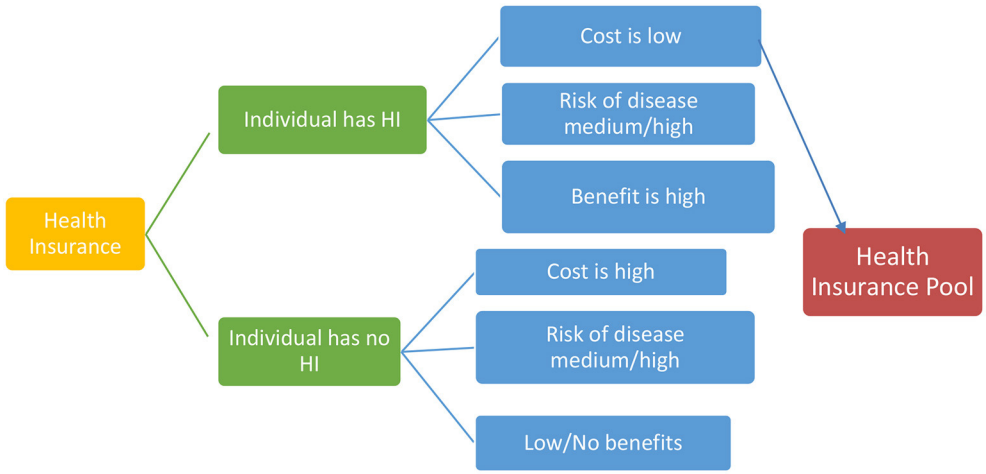

FIGURE 1 | A simple representation of utility choice in pooling resources for health insurance choice (adapted from LSF Microeconomic Policy Analysis, New York: McGraw-Hill; 1986).

FIGURE 2 | A representation of the social ecological model (adapted from centers for disease control. Available from the Centers for Disease Control and Prevention (CDC) (42).

we look at individual behavior, environmental, economic, and social factors as independent variables and their interaction with the choice an individual make, i.e., to purchase a health insurance or not. **Figure 2** shows a representation of the social ecological model.

METHODOLOGY

This study used cross-sectional secondary data from the 2015 to 2016 Malawi Demographic and Health Survey collected from all the 28 districts of Malawi (29). It is an internationally recognized survey conducted every 5 years on health indicators in Malawi with an excellent track record in robust methodologies used. Full details of methods can be accessed at DHS Methodological Report series. Looking at the subject matter, ownership of health insurance, the literature informed selection of independent variables. As mentioned above, a woman's education, the area she resides in, her age, marital status, the work she does, and her level of wealth are shown to be associated with ownership of health insurance (17, 31, 32, 43, 44). In addition, selection of the variables also looked at the context relevant to the sub-Saharan region and Malawi in particular, since we used secondary data; the final variables entered into analysis were also based on data available in the DHS data set. The variables and their definitions are shown in **Table 1**.

Study Population

All the women aged 15–49 years who were either permanent residents of the selected households or visitors who stayed in

the household the night before the survey were eligible to be interviewed.

Sample Size

The DHS surveys collect data on marriage, fertility, mortality, family planning, reproductive health, child health, nutrition, and HIV/AIDS just to mention a few. Due to the subject matter of the survey, women of reproductive age (15–49 years) were the focus of the survey. Apart from these subjects, the Malawi DHS has other additional modules of interest such as health insurance and in this study, we focus on the sample of women who reported to have health insurance, be it commercial-, institutional-, or employment-linked health insurance. In selecting study population, sample was stratified and selected in two stages. Each district was stratified into the urban and rural areas; this yielded 56 sampling strata. Stratifying is important to reduce bias in outcomes (29). Thirty households per urban cluster and 33 households per rural cluster were selected with an equal probability systematic selection from the newly created household listing. A total of 26,361 women were identified as eligible and out of these, 24,562 women were interviewed and responded to the questions in this module making the total sample size of this study.

Data were collected by trained enumerators using structured questionnaires. **Figure 3** illustrates the sampling process used in the Malawi Demographic and Health Survey.

TABLE 1 | Dependent and independent variables, their definitions, and measurements.

Independent variables	Definition and measurements
Age	Age is a continuous variable from 15 to 49 years
Residence	Place of residence categorized as 1 if respondent resides in urban,0 if in rural
Education	Categorical variable, defined as 0 if no education, primary, 1 if secondary, higher
Occupation	A womans occupation defined as 0 if informal and 1 if formal
Marital status	A womans marital state defined as 0 if not in union (widowed, divorced, separated), 1 if married (living with a partner)
Household head	Household head position defined as 1 if female headed and 0 if male headed
Wealth	Wealth status defined as 1 if poorer;2 if middle class, 3 if richest

Data Collection

Data were collected on women's background characteristics (age, education, religion, etc.), reproduction, contraception, pregnancy, and postnatal care immunization. In addition, the questionnaire gathered information on women's health practices and health expenditure. Data were collected electronically to improve on human error and stored in password protected laptops. For this study, we used the household questionnaire and the women's questionnaire as our data tools with the women's questionnaire as the central focus in this study from the Malawi demographic health survey tools.

Data Analysis

This study evaluated women in terms of ownership of health, showing percentages of the two categories (ownership or not) entered as a dichotomized variable in the model. The outcomes of interest were weighted and frequencies of each variable conducted to show the characteristics within the variables using two-way tables with measures of association such as the chi-squared test. A detailed process of weighting of variables

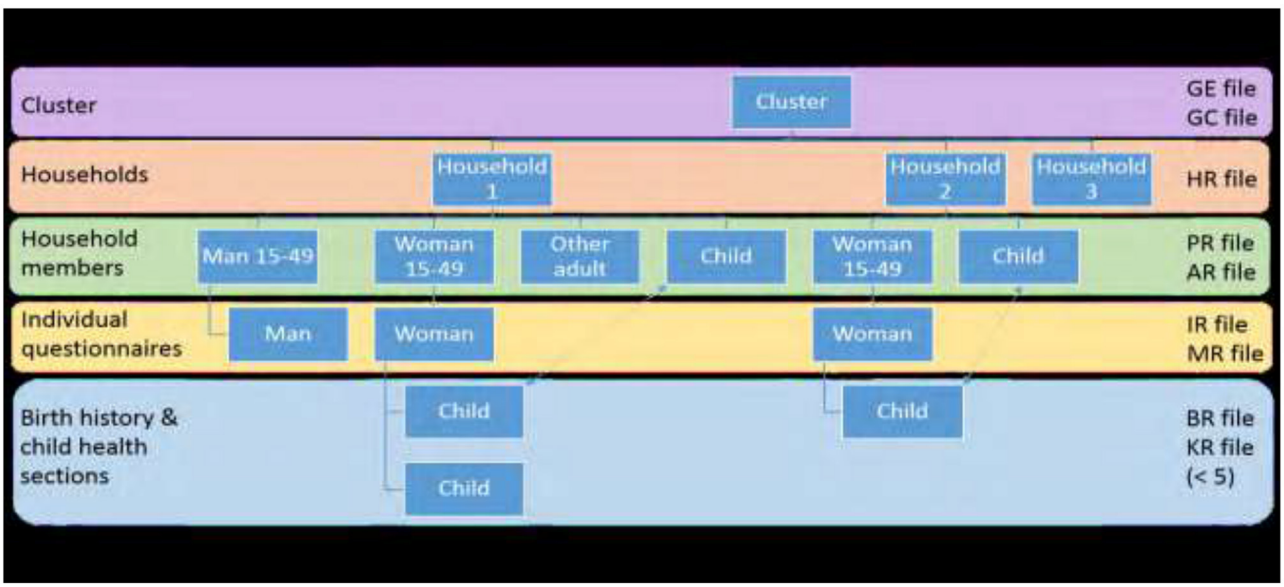

FIGURE 3 | A summary of sampling method for the demographic health survey (Adapted from the Guide _to DHS_statistics DHS-7).

can be found in the Methodological Report series (DHS) Methodological Report series.

A woman's age was included as a continuous variable in the final module and categorical in the bivariate analysis because the association between age and health insurance may be non-linear. Household head and residence were a dichotomized variables (1, 0), whether head was male or female and rural and urban, respectively. Education for a woman is a self-reported measure reflecting the highest education level at the time of the survey and grade within that level. In this analysis, we used a recoded variable of a woman's education categorized into the two groups: primary education and higher education. Marital status at the time of the survey was coded as never married, currently married, living with partner, widowed, divorced, and separated; however, for this analysis, the categories were collapsed into not in union and married. Occupation included all the occupations, paid and unpaid at the time of survey defined as formal and informal for this analysis. Wealth quintile index was constructed based on data collected in the Household Questionnaire. This questionnaire included questions concerning the household's ownership of a number of consumer items such as a television and car, dwelling characteristics such as flooring material, type of drinking water source, toilet facilities, and other characteristics that related to wealth status. From this information, women were assigned to the various categories of poorest, poorer, middle class, richer, and richest (45). In this analysis, we used the categories of 1 if poorest, poorer, 2 if middle class, and 3 if richest class.

To analyze the overall model, we used the logistic regression method in STATA version 13. This model allows us to evaluate multiple explanatory variables by extension of the basic principles. All the variables were entered as continuous variables using a backward elimination process, removing variables that did not contribute to the regression equation. We used the Pearson's chi-squared test to show goodness of fit of the model. *p*-values were used to present significance of covariates. In addition, the odds ratio (OR) shows the likelihood or probability of occurrence given a value. In this case, likelihood of having health insurance given the various independent variables. The model is expressed as:

$$P = \frac{e^{a+bX}}{1 + e^{a+bX}} \quad (1)$$

Table 1 shows the summary of independent variables, their definitions, and measurements.

RESULTS

Out of 24,562 cases in the dataset, 1.5% (380) of women had health insurance as **Figure 4** illustrates. Of these 380 women, 87% had employee linked coverage and the remainder accessed commercial health insurance products. As Wang et al. (46) echoes this result is congruent with many low middle income countries. It is a common trend to see low levels of health insurance ownership; it was, therefore, imperative to focus on this aspect due to the lack of empirical data demonstrating the state of health insurance coverage and women in particular and its potential effects on the use of healthcare services in the country. It was also important to shed light on the 97% of women excluded. It provides a basis for further study qualitatively, targeting more than women available at home at the time of survey as was the case in the DHS, including those in formal and informal workplaces to get a true reflection of the problem. The women in this analysis had a mean age of 28 (SD 9.25) years, 65.7% were married, and most (81.7%) were from rural areas. Predominantly, households were male headed (70.5%) compared to 29.5% headed by women. Most women fell in the poorer (38.4%), middle class (31.92%) compared to 23.6% in the richest category, respectively. More sociodemographic features of the participants are given in **Tables 2**, **3**.

TABLE 2 | Demographics of the sampled population.

Variable	Frequencies
Age	24,562 (SD 9.3)
15–19	5,273 (21.47%)
20–24	5,094 (20.7%)
25–29	3,976 (16.2%)
30–34	3,648 (14.9%)
35–39	2,988 (12.17%)
40–44	2,022 (8.23%)
45–49	1,561 (6.36%)
Occupation	
Informal	21,600 (87.9 %)
Formal	2,962 (12.1 %)
Household head	
Male	17,316 (70.5%)
Female	5,810 (29.5%)
Residence	
Urban	4,495 (18.3%)
Rural	20,066 (81.7%)
Education	
Primary	23,820 (96.98%)
Higher	741 (3.02%)
Wealth	
Poorer	9,437 (38.42%)
Middle	9,314 (31.92%)
Richest	5,810 (23.66%)
Marital status	
Not in union	8,431 (34.3%)
Married	16,130 (65.67%)

Table 2 gives the demographics of the sample and their frequencies.

Table 3 describes weighted frequencies and percentages of independent variables in relation to the dependent variable. It shows that younger women aged 15–19 and 20–24 years had less likelihood of being covered by health insurance with only 7 and 1.1% coverage, respectively. However, those aged between 25–29 and 40–44 years had similar coverage with 1.7% of women in both the age groups covered by health insurance. Those between the ages of 30–35 years had the highest coverage of 2.1% and

TABLE 3 | Relationship between health insurance and covariates.

	Covered by health insurance (*N* = 24,561)			
	No (*N* = 24,181)	**Yes (*N* = 380)**	**Chi-square**	***P*-value**
Residence				
Urban	5,039 (96%)	208 (4%)	0.000	0.18
Rural	19,186 (99.3%)	129 (0.7%)		
Education			0.000	0.00
Primary	23,658 (96.98%)	54 (3.02%)		
Higher	567 (81.7%)	127 (18.3%)		
Household head				
Male	17,026 (98.6%)	247 (1.4%)	0.230	0.23
Female	7,199 (98.8%)	90 (1.2%)		
Wealth				
Poorer	8,697 (99.87%)	11 (0.13%)	0.000	0.00
Middle	9,364 (99.56%)	41 (0.44%)		
Richest	6,164 (95.6%)	285 (4.4%)		
Marital status				
Not in union	8,502 (98.5%)	108 (15%)	0.082	0.24
Married	15,723 (98.6%)	229 (1.4%)		
Occupation	24,225 (77%)	337 (23%)		0.00
Informal	21,444 (99.3 %)	156 (0.72 %)		
Formal	2,781 (93.89 %)	181 (6.1 %)		
Age				0.00
15–19	5,235 (99.28%)	38 (0.72%)		
20–24	5,038 (98.9%)	65 (1.10%)		
25–29	3,909 (98.3%)	67 (1.69%)		
30–34	3,573 (97.9%)	75 (2.1%)		
35–39	2,945 (98.6%)	43 (1.44%)		
40–44	1,987 (98.3%)	35 (1.73%)		
45–49	1,538 (98.5%)	23 (1.47%)		

finally those in the final bracket of 45–49 years had a coverage of 1.5%. Predominantly, living in the urban area, a woman had a higher chance of being covered by health insurance at 4% coverage than women in the rural area. In addition, women with no education and a primary education had the lowest coverage 3% and compared to those who had attained higher education who had the highest coverage of 18.3% both showing a positive association with owning health insurance.

Coverage of health insurance in male-headed households was 1.4% points higher than for female-headed households. The result also showed that the more money a woman had, the more likely she would own health insurance with the poorest and poorer wealth categories having the least coverage at 0.1% compared to the richest class (4.4%). Although over 98% of women reported to have been in some form of occupation, only 6.8% were covered by health insurance. Finally, those that were not in any union had the higher coverage than married, widowed, and divorced combined. The results showed that household head is not associated with a woman owning health insurance.

Table 4 shows the results using logistic regression model. The odds ratio was used to show likelihood of having health insurance given the independent variables. For every year of age, the odds of owning health insurance increases by a factor of 1.02, as shown in **Table 4**. Nevertheless, moving to an urban area of residence increased the odds of having health insurance compared to rural areas (95% CI: 0.5770–0.9645). Similarly, wealthy women had a positive likelihood to own health insurance; therefore, improving wealth level would increase the chances of a woman having insurance for healthcare. High education attainment also increased positively association with health insurance ownership. A male household head is likely to own health insurance than a female and those married also stand better odds of having health insurance than those not married (1.4 more times). Having an occupation gave a woman twice the odds of having health insurance. Education, wealth, and occupation were significant at 95% CI, while age, residence, marital status, and household head were not significant.

DISCUSSION

This article explored demographic and socioeconomic factors that are associated with ownership of health insurance among women in Malawi. It shows that demographically there is a youthful population of women most of whom are in the rural

TABLE 4 | Results of the logistic regression analysis model.

***N* = 24,562**
Prob > chi^2 = 0.0000
Pseudo R^2 = 0.2345
Pearson Chi^2 (1,541) = 1,461.89

Health insurance ownership	Odds ratio	Std. Err.	*z*	*P*>|*z*	[95% Conf. Interval]
Age	1.00839	0.0073803	1.14	0.254	0.9940287 – 1.02296
Residence	0.7936482	0.104363	−1.76	0.079	0.6133339 – 1.026973
Education	5.606138	0.7868402	12.28	0.000*	4.257894 – 7.381299
HH Head	0.9270029	0.1365027	−0.51	0.607	0.6946088 – 1.237149
Wealth					
Middle	3.03394	1.033773	3.26	0.001*	1.555865 – 5.916192
Richest	15.97973	5.190536	8.53	0.000*	8.454384 – 30.20346
Marital status	15.97973	0.1900378	1.70	0.089	0.9624323 – 1.717829
Occupation	2.398547	0.3202295	6.55	0.000*	1.846309 – 3.115961
_cons |	0.0010086	0.0003848	−18.09	0.000	0.0004776 – 0.0021304

**represents significance of the variables.*

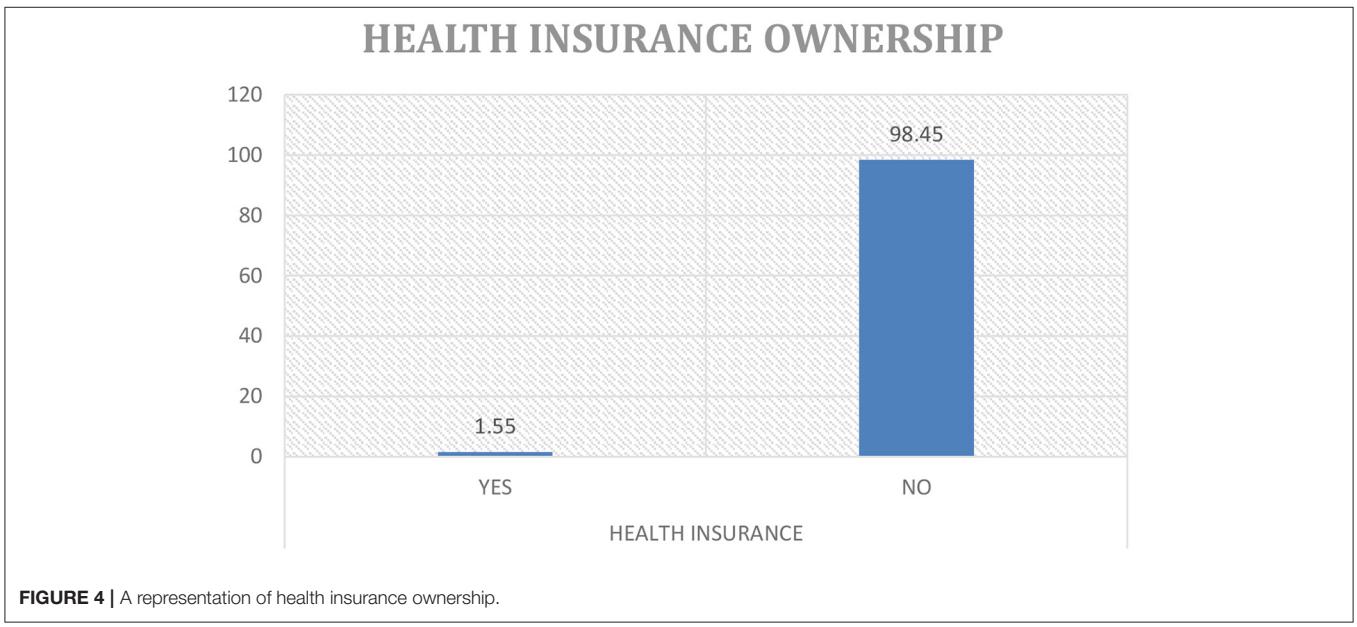

FIGURE 4 | A representation of health insurance ownership.

areas. Predominantly, most women have either a primary or secondary education, but are not educated for high technical skills and, hence, are unemployed or working in the informal sector contributing to the higher percentages in poorest, poorer, and middle class categories. As aforementioned, a woman's decision to own health insurance is not only influenced by the health risks. As the social ecological model describes, we see that there are individual and systemic factors influencing this choice. For example, most women have primary or no education, which is a result of individual choice, but also systemic in cultural nuances and access to education facilities. We note that occupation and wealth are not just a function of an individual's choice, but also on the economic environment of a society and equality in provision of opportunities just to mention a few. We explain these factors in detail.

Demographic Variables

Age was not a significant variable in the analysis. It is interesting to note, however, that women in the ages of 30 to 45 years have higher health insurance coverage as compared to those below 30 years despite the under 30's being a majority. This speaks to demographic disparities in the country, especially in the context where youths, including young women, are unemployed and vulnerable to poverty. However, this result varies with findings of age significance from Kirigia et al., Wang et al., and Aregbeshola et al. arguing that it is a common state in many African countries such as Nigeria, Namibia, Rwanda, and South Africa just to mention a few (32, 43, 46).

It was also important to note that women living in the urban areas were more likely to own health insurance than those in the rural areas. The literature on this is mixed: while a study in South

Africa showed that there were no significant differences (32), others have argued that it is a significant determinant (47–49), noting that in many African countries majority of the population reside in the rural area with low incomes and lower levels of education, which could explain the likelihood of those in the urban areas to own HI than those in the rural areas.

In terms of who heads a household, we found that the relationship is not significant in owning health insurance similar to findings by Kimani et al. (48), but unlike the findings by Aregbeshola et al. (43). Possible reason for this could be the fact that both the men and women appreciate the need for health insurance for their households irrespective of who heads the household.

Marital status was not a significant determinant of a woman's choice to own health insurance in the multivariate analysis. Those who were not in any union had more likelihood to have health insurance than those married. Nevertheless, other studies (32, 47) show an association between married women and owning health insurance arguing that married women are beneficiaries from their partners and also the combined income increases disposable income in the household to afford health insurance. In our context, more women were unemployed and predominantly in low paying work and this might explain our results.

Socioeconomic Variables

Education was significantly associated with health insurance ownership. Those with higher education were the most reported to have health insurance (18%) compared to those with primary or no education who were a tiny fraction in the categories with only 3% reported to have health insurance. As Wang et al. and others (32, 48, 50) have found, education was a key determinant in health insurance in many developing countries, especially for women. In view of this, investments in education not only have to improve, but also target women, especially in the rural areas providing the necessary infrastructure and resources while ensuring systemic and cultural gender barriers are minimized for young women to attain education. Wealth was also significant in determining a woman's choice in owning healthcare. Those in the richest category were more likely to own health insurance than those in the poorest, poorer, and middle-income categories a result which is consistent with other literature (17, 50) suggesting that the design of health insurance systems works in favor of the rich and not necessarily the poor. The implication is that in our context, government needs to be more meticulous in the design of a social health insurance system that will respond to the needs of the poor, for example, disaggregating premiums with the rich paying more for select services to subsidize lower premiums for those in the poor categories.

In addition, a woman's occupation showed significance in determining health insurance ownership in the analysis. Women in highly skilled jobs such as administrative and commercial managers science and engineering professionals, teaching, health professionals, and information technology technicians had a more likelihood of having health insurance than those in low-skilled jobs such as farmers, sales, and personal care workers a finding resonating with a study in Namibia (51).

It is interesting to note that although women in high-skilled jobs had higher likelihood to health insurance ownership, there are variations especially in sectors dominated by men such as legal, corporate heads, and armed forces. Women in such areas showed lower insurance coverage probably because they are few. In addition, for those in low-skilled jobs, it is surprising that women working in unskilled but risky jobs such as production, protective services, construction, and machinery operations just to mention a few have low health insurance coverage. Government can ensure policies set on gender equality are well-mainstreamed and enforced at all the levels to create environments where women get equal opportunities and equal pay in the formal sector. The current Malawi Growth and Development Strategy (MGDS) and national gender policies all have set strategies to achieve gender equality and improve womens' access to healthcare though both require political will and financial investments to materialize. Furthermore, policymakers can take advantage of cooperatives, associations of various sections in the informal sector such as the National Association of Business Women (NABW), Malawi Union for the Informal Sector (MUFIS), and the Small and Medium Enterprises Development Institute (SMEDI) just to cite a few, to disseminate information on health insurance, introduce mode of payments, and ensure accountability to ensure that more women are reached in the informal sector.

CONCLUSION AND CONTRIBUTION TO FIELD

Universal health coverage is a right not a privilege and in order to achieve inclusive universal health coverage, aspects of how healthcare is financed must be critically addressed, especially for vulnerable populations such as women. As presented above, health insurance provides a cushion for women to access healthcare without suffering from financial loss or being driven into poverty (8). It is important to analyze what determines this choice in order to provide women with the right products, but also policies that will support the underlying factors driving this choice such as education, wealth, and place of residence as the results have shown.

As considerations are made for a national health insurance policy, it would be important to address levels of education of women, especially in attaining tertiary education, as this has been shown to be a key determinant for the choice of health insurance. Deliberate efforts need to be made in this area because as much as education is important in economic development, it can only be meaningful where women are healthy and empowered to access quality healthcare.

In addition, looking at the results, there are policy implications in terms of creation of economic growth opportunities and how they are distributed. Currently, most factories and private businesses are concentrated in the urban areas, which limit opportunities for women in the rural areas. Expanding such productive opportunities to the rural areas extends the opportunities to women increasing their ability to earn. This is important in 2-fold, as government, they increase their tax

base that can, in turn, provide resources to fund a social health insurance system, considering that a small tax base is one of the challenges in establishing social health insurance (52). On the other hand, with improved incomes, women would be able to afford health insurance premiums and education for their children mainly young women who are disadvantaged from low household income (53, 54) addressing the key factors prohibiting women's ability to have health insurance.

All in all, as part of health systems strengthening, policymakers and stakeholders in health might want to consider building collaborations with other ministries such as economic development, gender, and education to have holistic strategies that address systemic gender inequalities in healthcare and other social determinants of health. As the famous saying goes, a healthy nation is a wealthy nation and we should all strive to attain that state.

Limitations

The major limitations of this study are that it is based on cross-sectional data from the Demographic and Health Surveys and as such can only infer association. Second, despite having a robust and large sample in the analysis, the findings are not powered to make inferences at district level; hence, generalization at local levels must be done with caution. Nevertheless, the strengths of findings are premised on the robust study design, sampling, and data collected using standard methodologies.

DATA AVAILABILITY STATEMENT

Publicly available datasets were analyzed in this study. This data can be found at: https://dhsprogram.com/Data/terms-of-use.cfm; https://dhsprogram.com/publications/publication-search.cfm?type=6.

ETHICS STATEMENT

Permission to use the 2015–2016 MDHS data was obtained from the DHS program. There were no other ethical considerations on the part of the researchers, as the dataset is completely anonymized and all the other pertinent ethical issues were handled by the DHS program before and during the survey. This study was also approved by the College of Medicine Research and Ethics Committee (COMREC).

AUTHOR CONTRIBUTIONS

MC contributed to concept direction, mentorship, refining, and editing manuscript from BU and JC. All authors contributed to the article and approved the submitted version.

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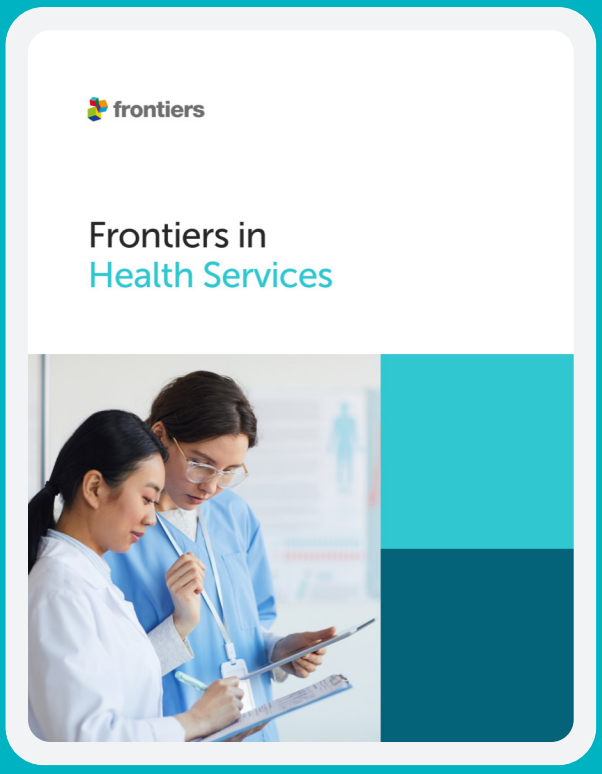

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