“Is there a way to do it better?”

Health Financing Allocative Efficiency Impact on Achieving Universal Health Coverage in Sudan

By

Khalid Saifeldin Elfadil Ibrahim

“Is there a way to do it better?” Health Financing Allocative Efficiency Impact on Achieving Universal Health Coverage in Sudan: Literature Review

A thesis submitted in partial fulfilment of the requirement for the degree of Master of Science in Public Health

by

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Sudan

Declaration

Where other people’s work has been used (from either a printed or virtual source, or any other source), this has been carefully acknowledged and referenced in accordance with academic requirements.

The thesis “Is there a way to do it better?” Health Financing Allocative Efficiency Impact on Achieving Universal Health Coverage, in presence of National Health Insurance in Sudan: Literature Review is my own work.

Signature 

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Abstract

Background: Sudan's deteriorating economy and political instability affects resources available for health. The high burden of disease and low financial protection, motivates the system to allocate its resources efficiently, in order to achieve Universal health coverage.

Objective: To analyze the influence of health financing allocative efficiency on Universal Health Coverage outcomes in Sudan and explore interventions that have worked to provide recommendations for policy makers in improving system efficiency for better outcomes.

Methodology: A review of literature on allocative efficiency for Sudan health system. Using the joint Learning Network analytical framework that looks at efficiency through the result chain of Inputs, outputs and Outcomes. Existing interventions in Sudan were explored, with lessons drawn from countries with similar context.

Results: The allocative efficiency of health financing influences the outcome of the UHC in Sudan. The performance of the system in comparison to the global average, reflects poor outcomes with gaps in allocated inputs. Financial protection, health status and utilization are disproportional, affecting the poor and rural population community. At input level; high fragmentation, poor coordination, inequitable distribution, and bias towards curative services lead to several allocative inefficiencies that incapacitate the outcomes, and again the poor and rural population suffer the more.

Conclusion: Allocative efficiency for health system and National Health Insurance Funds influences progress to universal health coverage. With poor performance of the health systems throughout the results chain, affects people's health status, in an inequitable manner. Government and stakeholders need to address these gaps, to serve and provide health for all in Sudan.

Key words: Allocative efficiency, Financing, Performance, Health system, Sudan

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List of Abbreviations and acronym

ANC	Antenatal Care
BCG	Bacillus Calmette–Guérin
BP	Benefit Package
COVID-19	Coronavirus disease
DHIS	District Health Information System
DPT	Diphtheria, pertussis, tetanus
DRC	Democratic Republic of Congo
EHBP	Essential Health Benefit Package
FHC	Family Health Centre
FHU	Family Health Unit
FMOH	Federal Ministry of Health
GAVI	Global Alliance for Vaccines and Immunizations
GDP	Gross Domestic Product
GGE	General Government Expenditure
GGHE-D	Domestic General Government Health Expenditure
HF	Health Facility
HIS	Health Information System
HNO	Humanitarian Needs Overview
HRH	Human Resources for Health
IMF	International Monetary Fund
JLN	Joint Learning Network
Km	Kilometer
MNCH	Maternal Neonatal and Child Health
MOF	Ministry of Finance
MSNA	Multisector Needs Assessment
NBHS	National Baseline Household Survey
NCDs	Non-communicable Diseases
NHIF	National Health Insurance Fund
NMSF	National Medical Supplies Fund
OOP	Out-Of-Pocket Expenditure
PHCPI	Primary Health Care Performance Initiative
PMU	Program Management Units
PPM	Provider Payment Mechanisms
RDF	Revolving Drug Fund
SDG	Sudanese Pound
SMOH	State Ministry of Health
THE	Total Health Expenditure
UHC	Universal Health Coverage
UN	United Nations
WASH	Water Sanitation and Hygiene
WB	World Bank
WHO	World Health Organization

Key terms

- **Universal health coverage** means that "all people have access to the health services they need, when and where they need them, without financial hardship. It includes the full range of essential health services, from health promotion to prevention, treatment, rehabilitation, and palliative care"(1).
- **Allocative Efficiency** "examines whether limited resources are directed towards producing the correct mix of health care outputs, given the relative value attached to each"(2).
- **Out of pocket expenditure** "is any direct outlay by households, including gratuities and in-kind payments, to health practitioners and suppliers of pharmaceuticals, therapeutic appliances, and other goods and services whose primary intent is to contribute to the restoration or enhancement of the health status of individuals or population groups. It is a part of private health expenditure"(3).
- **Benefit package** "is a core [and explicit] set of good-quality health services to which all eligible citizens are entitled regardless of their circumstances'&' an [affordable] benefit package includes not only the work of designing a technically sound benefits package, but also updating, monitoring, evaluating, and implementing it."(4)
- **Primary health care (PHC)** "is the first level of contact for individuals, the family, and the community with the national health system and addresses the main health problems in the community, providing health promotion, preventive, curative and rehabilitative services accordingly." (5)
- **Zakat** "is an Islamic finance term referring to the obligation that an individual has to donate a certain proportion of wealth each year to charitable causes. It is a mandatory process for Muslims and is regarded as a form of worship."

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In the name of Allah, the most gracious and the most merciful. I thank and praise Allah for taking care me and giving me strength, the ability and knowledge to complete this thesis, even through the hardest times.

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This thesis is dedicated to my family and my nephews, to my friend, Felani Tembo (late), and to the Martyrs of freedom in Sudan

1. Chapter one: background

1.1. Efficiency and Universal Health Coverage (UHC)

Universal Health Coverage (UHC) aims to provide people a full access to quality health services, without financial hardship, through all levels of promotion, prevention, treatment, and tertiary services(6). Countries around the world are working on strengthening their health systems especially with respect to health financing and spending on health services to achieve UHC(7).

There is a global trend of increase in demand for services, which requires countries to maintain growth in health spending. Population aging, increase in burden of chronic disease, and advances in technologies drive this demand, that requires countries to find more resources and increase fiscal space for health (8). Health expenditures is growing faster than economic growth in most countries, which impacts the sustainability of resources allocated for health. Although there are ways to increase resources for health, for example increasing domestic revenues and prioritizing healthcare; greater pressure is directed toward focusing on efficiency in using health resources to provide greater value for money (9).

Efficiency is about maximizing outcomes relative to inputs. It has two main types: technical and allocative. Technical efficiency is about doing things right by using the least mix of resources that will generate ultimate outcomes with least cost. For example, using the right mix of health workers to provide a service is more efficient than using poor quality workers that will likely cost more in unnecessary tests, visits, and procedures for the same, or worse, outcome (10). Allocative efficiency is about doing the right things by using the best mix of resources that will maximize the outcomes. An example of allocative efficiency is striking an optimal balance in choosing between educational outreach to reduce salt in the diet and building intensive care units. Together, this would decrease the overall burden of cardiovascular care, but reducing salt in the diet will have more impact with less cost (11).

The 2010 World Health Organization (WHO) report on health system financing, highlights that efficiency is important for sustainability and for achieving UHC. The report shows that globally, 20-40% of health resources are wasted. It estimated the savings that could be gained from efficient use of human resources, hospitals, and medicines are ~1.2 billion US$. The report identifies 10 sources of inefficiencies at both the health system level, in allocating resources and decisions on prioritizing services, and at the health facility level, which mostly related to technical issues like prescribing drugs and capacity of staff (12).

An Oxford Policy Management internal analysis report shows that African countries, including Sudan, have a low efficiency score of 67, which means that 33% of their health spending can be reduced and they will still have the same outcomes. Some countries, like Sierra Leone, which has a score of 19, they can reduce about 80% of their health spending with the same results. Furthermore, the international Monetary Fund (IMF), discussed the importance of efficiency on improving health outcomes for African countries. The IMF suggests that life expectancy after birth

in African countries could increase by five years on average, if they use health resources more efficiently(13).

Sudan and seven other east African countries were compared in a study examining the relationship between health expenditures and life expectancy at birth, along with infant mortality rates. The study showed that improved allocative efficiency in health expenditures has a positive impact on increasing life expectancy at birth and decreasing infant deaths. The study attributed these positive results to the allocation of more resources for Primary Health Care (PHC) and preventive services such as vaccination, Antenatal Care (ANC), and nutrition. The study concluded that the eight countries, including Sudan, should improve their allocative efficiency in health spending, to increase life expectancy and decrease infant mortality(14).

With this as background, this thesis tries to understand and analyze the concept of allocative efficiency of the health system, on moving toward achieving universal health coverage, in the context of Sudan.

1.2. Context of Sudan

1.2.1. Geographical location and population

Sudan is a low-income country located in the Northeastern part of Africa, strategically located between sub-Saharan and Arab league regions. Sudan has 18 states and more than 189 localities. Khartoum is its capital, and the most populated city is Omdourman(15). (map in Annex 1)

Sudan is the 16th largest country in the world with a land area of 1,886,068 km2 (728,215 square miles). The country has an estimated population of 43.58 million people, with a low density of 24 people per square kms. Almost two thirds 64% of the population lives in rural areas, and 36% of the population in urban areas(16,17). 50.4% of the population are males and 49.6% are females, with 60.1% of the population younger than the age of 25 years (18).

Figure 1.1 below shows the population pyramid for Sudan demography according to sex and different age groups.

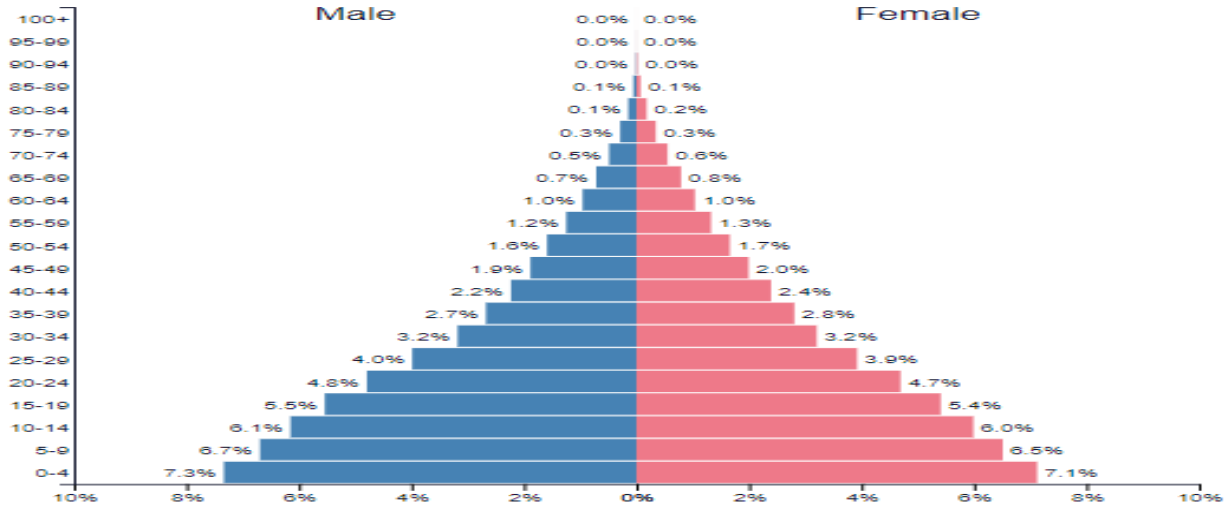

Figure 1.1 Sudan population pyramid, 2020

1.2.2. Economics and political landscape

After independence in 1956, Sudan experienced long periods of internal conflicts that affected political stability and national economic growth. In 1993, the United States of America had designated Sudan as a sponsor of terrorism, and imposed sanctions and trade embargos. In 2004, in response to human rights violations, the United Nations Security Council also imposed sanctions on Sudan (19,20). In 2011, after two of the longest lasting civil wars in Africa, and conflicts in Darfur, Blue Nile, and Kurdufan, South Sudan seceded from Sudan. The secession of South Sudan took away 75% of the oil revenues, which accounted for more than half of Sudan's governmental revenues and 95% of its exports(21).

Mass demonstrations that started in December 2018, culminated with the removal of then-President El-Bashir, from power in April 2019. This led to the formation of a Transitional Government in September 2019. In early January 2022, the Prime Minister stepped down, and the political crisis continues, along with demonstrations and paramilitary violence, impacting the stability, resilience, and strength of the national instituts including the health sector (22).

The Sudanese economy went through several crises, from high inflation rates to the devaluation of the national currency. The scarcity of hard currency, dropped the GDP to 764.3 US$ per capita in 2021, putting the country into the category of low-income countries. Figure 1.2 shows the recent trend of the GDP in Sudan since 2015 (23).

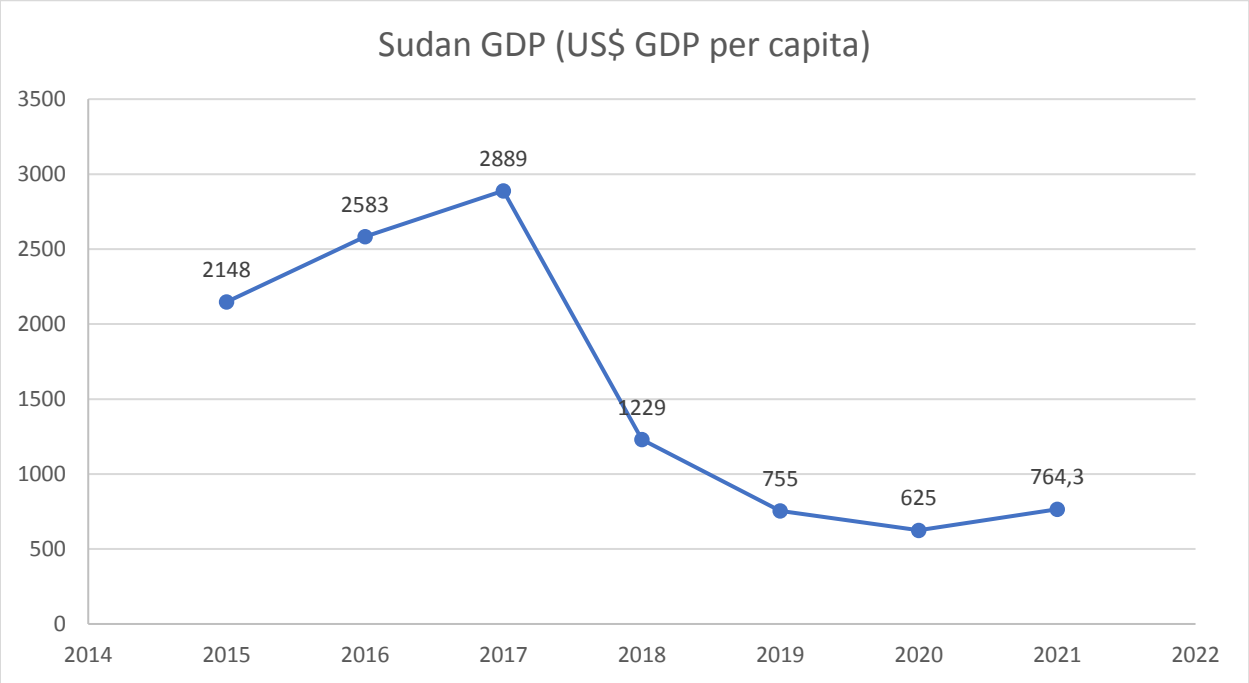

Figure 1.2 Changes in Sudan GDP between 2015-2021, World bank open data

The National Household Budget and Poverty Survey 2009 (NHBPS), shows that 46.5% of the population is under the national poverty line of 5,110 Sudanese pounds (SDG) per capita per year. The World Bank (WB) estimates that 16.2% of the population is deemed poor, as their expenditures are below $1.90 per day. The poverty rate shows disparities between rural and urban areas, with rural areas more affected. For example, the incidence of poverty in Northern Darfur (rural) was about three times higher than in the capital Khartoum (urban)(24). The country literacy rate is 60%, and 17.7% of the population are unemployed, with 77.3% of the population employed in the informal sector (25). Like other countries, Sudan is challenged by the social and economic impact of COVID-19 pandemic. The country was also impacted by record setting floods in 2020, which contributed to estimated damages in the billions of US dollars (22).

1.2.3. Burden of disease

Sudan is facing a double burden of disease from both communicable and Non-communicable Diseases (NCDs), with maternal and neonatal diseases on the top of the list of death causes. The list of top 10 causes of diseases has changed through the years as more NCDs are on the list than before with existence of communicable diseases on the list. Figure 1.3 illustrate the top 10 causes of death with the change from 2009 to 2019. (26).

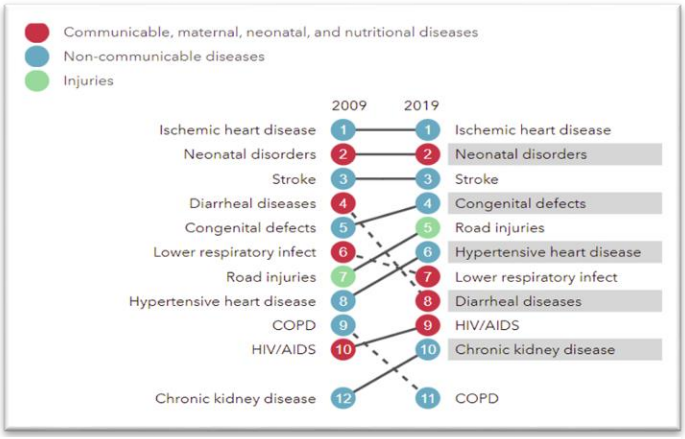

Figure 1.3 List of top 10 causes of death in Sudan 2019, GBD

1.2.4. Health system organization

Sudan puts health high on its agenda for social development. The continuing sanctions and trade embargos, conflicts, epidemics, disasters, and political instability diverted resources from healthcare and threatened the stability of the health system(27). The healthcare system provides services through the Federal Ministry of Health (FMOH), State Ministries of Health (SMOH), and Local Health Management Authority, along with the armed forces and private providers. Service delivery is at at three levels: primary, secondary, and tertiary. At the primary level, services are mainly provided by the Ministry of Health (MOH) and NGOs in areas of armed conflicts. PHC facilities include Family Healthcare Units (FHU), Family Healthcare Center (FHC), and rural hospitals, with FHU as the main facility that provides the full benefit package of the PHC(28).

According to a facility survey (mapping) conducted by FMOH in 2011, about 14% of the population lacks access to health facilities due to far distances, with disparities between states. FMOH identified five essential components of a PHC package. The survey found that only 24% of the PHC facilities provide this full package of services (29).

1.2.5. Health Financing

Sudan's Total Health Expenditure (THE) in 2018 was US$ 2.5 billion, representing 4.57% of GDP, with a THE of 46.9 US$ per capita. The budget for healthcare according to the General Government Health Expenditure from Domestic Sources (GGHE-D), was 5.6% of the General Government Expenditure (GGE). Main Sources of funding for health comes from public revenues (taxes, Zakat, Oil, state owned enterprises), donor funds, and other private sources (private insurance, community-based insurance, voluntary prepayments, out of pocket expenditures). The largest portion 67% of THE comes from direct payment from households which is known as Out-of-Pocket expenditure (OOP). Figure 1.4 illustrates the percentages of health financing revenues comprising the THE (30) (31).

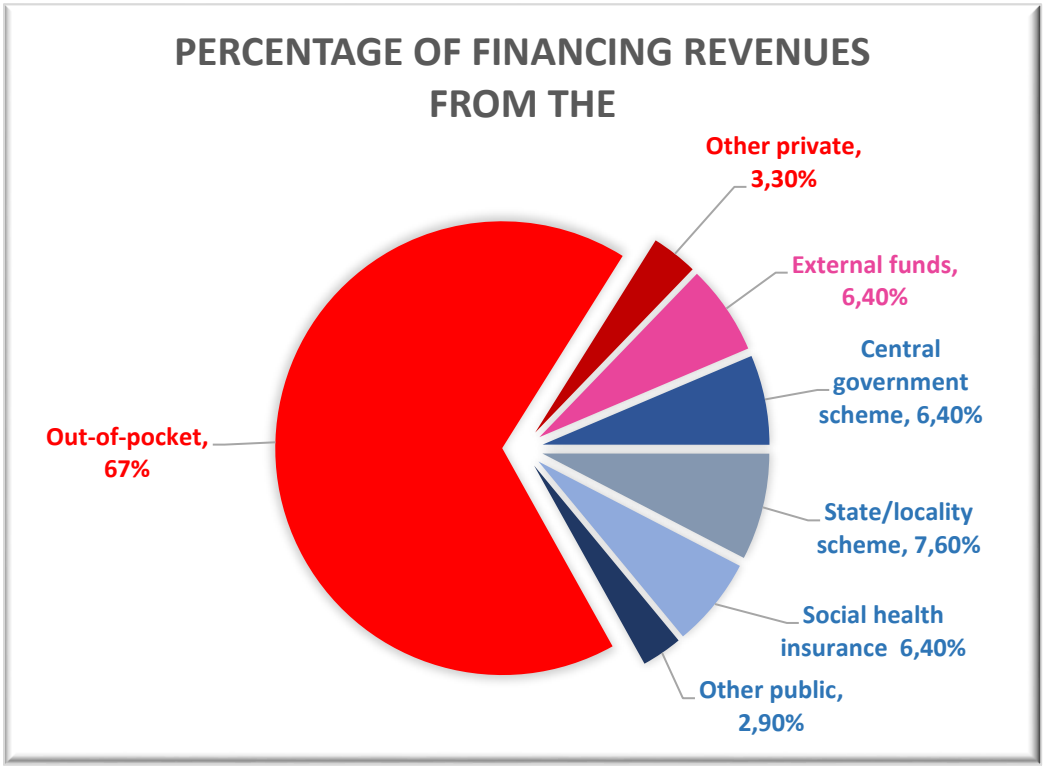

Figure 1.4 Sudan health financing revenues as percentage from Total Health Expenditure, SHA 2018

Besides OOP expenditures, schemes of financing include private insurance, ministries of health, the National Health Insurance Fund (NHIF), armed forces insurance and other parastate institutions schemes. User fees are the main payment mechanism for services in public health facilities, and are paid with OOP, co-payments, subsidized payments, or insurance (32).

1.2.6. National Health Insurance Fund (NHIF)

NHIF was introduced in 1995, with the family as a subscribing unit. NHIF is compulsory for the formal sector and a voluntary for informal sectors. Contributions from the formal sector are collected from salaries, consisting of 10% of the salaries, split with 6% from the employer and 4% from the employee. In the informal sector, flat rates are determined by actuarial studies. Zakat, the social security fund, and the student fund pay contributions on behalf of the poor, martyrs' families, pensioners, and students (32).The Ministry of Finance (MOF) contributions represent 72% of the total revenues of the NHIF, that goes to fund the premiums of poor families and pay the salaries for NHIF staff. The rest of the revenues for NHIF comes from state organizations 12.6%, subscribers' premiums and copayments 9%, and Zakat 6.4% (33).

The NHIF provides services to the subscribers through public and private providers and their own facilities. A comprehensive package including primary, secondary, and tertiary services is covered by the NHIF. Most of the services are free, some with co-payments, and subscriber pay 25% of the price of medications. NHIF uses 13% of its resources for administration, while the payment to pharmacies exceeds 53%; laboratories over 15%, hospitals over 18%, with a negligible 0.01% of the payment going to PHC services (30).

1.2.7. Priority setting

Rationing and priority setting are important components in the decision making for allocating scarce resources for health. The process of priority setting in Sudan is not well defined, yet the transitional government identified seven strategic priorities for health, in the National Health Sector Recovery and Reform Strategic Plan 2022-2024. Those priorities come in alignment with the transitional government priorities of peace, justice, and freedom. On top of these priorities comes improving access to integrated PHC services and strengthening health financing to improve UHC outcomes. The policy states efforts should be directed towards addressing these priorities, with efficient use of resources to improve outcomes of financial protection, health status, and public satisfaction on moving toward UHC(34).

2. Chapter Two: Problem statement, justification and research objectives

2.1. Problem statement and justification

Sudan is working to achieve UHC as one of the important goals for sustainable development (SDG 3.8), and to provide better health outcomes for all, especially the poor and vulnerable populations (35). However, the country is still far away from achieving UHC, and demonstrates low performance in health outcomes (36). For UHC service coverage index (SDG 3.8.1), Sudan has a score of 44 out of 100 for coverage of essential health services, which is low compared to the global average of 67 (37,38). For catastrophic health expenditures (SDG 3.8.2), 18.4% of the population is spending more than 10% of their income on OOP expenditures, compared to the global average of 11.3%(37,38). The average value of catastrophic health expenditures masks the disparity between rural and urban areas, as the percentage is higher in rural areas (19.7%) compared to urban areas (15.9%) (37).

Household OOP expenditures on health in Sudan remains one of the highest in the middle east and the African continent, pushing more people towards poverty (39). Households spend 99.5% of their OOP on curative care, and only 0.5% on preventive care. At the PHC level people spend 36% of their OOP on user fees and medicines. Although services at the PHC level are supposed to be free according to the constitution of provision (40). Households in rural areas tend to spend more on acute diseases, compared to households in urban areas, where more is spent on chronic diseases. This is explained by the expensive cost of services for chronic diseases that prevents the poor from accessing chronic care (39).

Access and utilization of health services, as an intermediate outcome for UHC, has several issues at the different levels of the healthcare delivery system. Households in urban areas have better access to health services compared to households in rural areas(39). The main identified barrier for utilization, besides the cost of services, is availability and distance to health facilities. On the other hand, most of those who did have access to health facilities, perceived the public services as of poor quality, reflecting on the better quality of services in private facilities, which, if they have the ability to pay for them, influences their choice of access(39).

Over time, to address gaps in health outcomes, Sudan instituted several schemes, including free emergency care; free Maternal, Neonatal and Child Health (MNCH) care, Social and National Health Insurance Schemes (SHIS, NHIF), which cover specific segments of the population (41). The SHIS includes schemes for armed forces, police, and parastatal institutes (Ministry of Higher Education, civil servants). The NHIF is the main health protection scheme for all, as it covers the formal and informal sectors, the poor and vulnerable populations, with total population coverage of 81% by year 2021 (42).

Sudan's Health Expenditure Survey revealed that insured people spend more OOP than non-insured people. Out of the insured people 56% utilized services covered by the NHIF during a 12-month period. In the survey found that the main reasons for not using insured services were that

far distance of insurance facilities, or that the insurance doesn't cover the needed services. These reasons for not using insured services, gives insight into the impact of non-optimal allocation of resources such as physical infrastructure. Beside the limited benefit package that affect financial insecurity of families, as subscribers will spend money on accessible, non-covered services from other providers(39).

The economic crisis and transitional health system in Sudan limits availability and sustainability of resources for healthcare. Given the limited resources, existing literature from other countries demonstrates that efficiency is important for improving system performance (7,43,44), yet in Sudan technical knowledge on efficiency is limited. This situation makes exploring issues around efficiency very important for improving the health outcomes for the country (45). On literature of efficiency for Sudan, researchers have written much about technical efficiency at the outcomes level, looking at the service delivery system performance to maximize health outcomes (46,47). That leaves the country with inadequate literature on allocative efficiency on comparing inputs to optimize outcomes (45,48).

Using the Efficiency framework; that explains the result chain of efficiency at three levels: Input, care delivery and outcomes, this thesis tries to explore allocative efficiency of health system from financing to outcomes (49). The analysis will include issues around revenues distribution according to health priorities, distribution and availability of inputs such as drugs, equipment, and health workforce, and availability and flow process of information. The thesis will further analyse the interventions directed towards addressing inefficiencies, along with lessons from countries that share similarities with Sudan context as to provide broader insight to understand the issue of allocative efficiency in Sudan.

2.2. Objectives

2.2.1. General objective

To analyse the influence of health financing allocative efficiency on Universal Health Coverage outcomes in Sudan and explore interventions that have worked to provide recommendations for policy makers in improving system efficiency for better outcomes.

2.2.2. Specific objectives

1- To demonstrate the performance of Sudan health system through the result chain of efficiency with focus on outcomes.
2- To analyse the allocation of health system inputs (financing, health workers, drugs, information, physical infrastructure, equipment, and medical supply) for service delivery and NHIF, in line with outcomes.
3- To explore interventions that have been implemented to improve allocative efficiency of the health system.
4- Provide evidence-informed recommendations to policy makers, that will help improve allocative efficiency of Sudan's Health System.

3. Chapter Three: Methods

3.1. Research philosophy and approach

The study is underpinned by interpretivism philosophy (which based on that science is subjective and accepts other models of reality) to understand the social interaction of allocative efficiency as a phenomenon given the context of Sudan. The search follows deductive approach looking to the different elements that influence allocative efficiency and develop a base knowledge for further analysis of health system efficiency.

3.2. Research type

This is a literature review study, that aims to analyse the health financing allocative efficiency in relation to UHC using data from different resources to answer research objectives.

3.3. Study Area

The study Focused on Sudan particularly the health system in general and NHIF as a scheme at the national level.

3.4. Analytical frameworks

The study adopts the Joint Learning Network (JLN) framework for analysing efficiency for universal health coverage in 2020(49). The JLN framework applies the simple definition of efficiency in maximizing outcomes relative to inputs. It allows analysis of efficiency throughout the result chain including inputs, processes, and intermediate outputs that transforms financing into outcomes. The framework is simple to perform and easy to interpret, helps in identifying and measuring efficiency in a practical way, and allows routine assessment of health system performance from an efficiency perspective(49).

As the focus is on allocative efficiency this study may highlight but will not focus on issues of technical efficiency in the service delivery indicators. Figure 3.1 below shows the JLN framework of efficiency that will be used for the analysis.

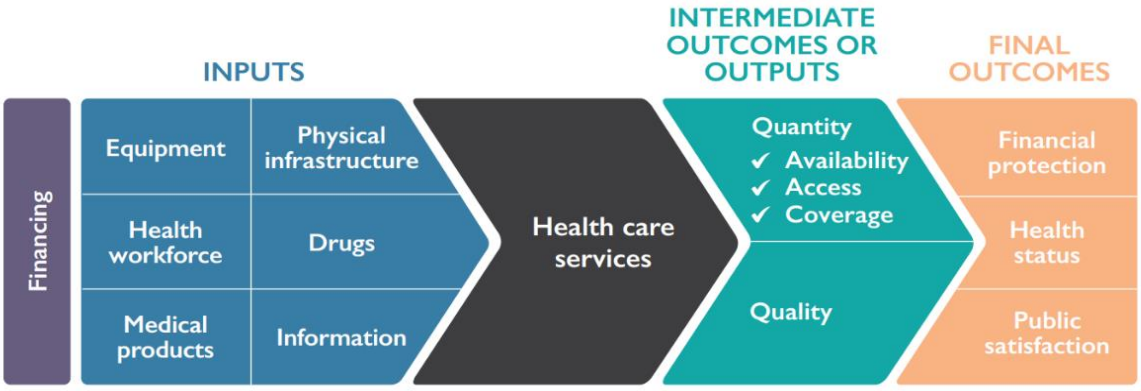

Figure 3.1 Efficiency framework for the result chain of the health system, JLN 2020

The analysis started with benchmarking mix of indicators to help visualize how the health system is performing throughout the efficiency chain and compare it to the global targets. A set of indicators wss used to visualize and compare the system. To minimize the bias, the study used systematic approach in selecting the set of indicators with alignment with country priorities to reflect on system performance. Criteria for selecting indicators with definitions of all indicators is explained in Annex (3) The set of indicators through Outcomes, outputs, inputs, and financing for the result chain is shown in Table 3.1 below.

Table 3.1 selected mix of indicators for the result chain of efficiency for benchmarking the performance of Sudan health system

Financing	Inputs	Outputs	Outcomes
• Percentage of OOP from THE • Proportion of OOP spent on PHC • NHIF population coverage	• Availability of essential drugs • Hospital bed density • Doctors' density	• Percentage of ANC coverage (at least 4 visits) • Immunization coverage of Diphtheria, pertussis, Tetanus (DPT) vaccine	• Catastrophic health expenditure (10% threshold) • UHC service index • Life expectancy at birth

The study used the framework to analyse allocation of inputs including health workers, drugs, information, physical infrastructure, equipment, and medical products. Which was linked to financial resources focusing on NHIF in line with the result chain of outcomes. The framework also helped to compare influence of the existing interventions to address efficiency by looking at the intended outcomes and proposed changes in inputs. Therefore, the analysis would help to pinpoint areas of inefficiency where more focus is needed and include experiences from other contexts to provide evidence informed recommendations for policy makers to improve Sudan health outcomes. Table 3.2 summarizes how the framework elements will be employed for answering the research questions.

Table 3.2 Research analysis matrix showing alignment between framework elements and research questions

Research questions (objective)	Main theme or domain	Subthemes
1. What is the performance of Sudan health system from efficiency perspective?	**Benchmarking of the system using selected set of indicators.**	
	System performance at the Outcomes level	- Financial protection - Health status - Public satisfaction (Utilization of healthcare will be used as a proxy)
2. Is the allocation of health system inputs for service delivery including NHIF in line with outcomes?	**Allocation of inputs**	- Medicines, equipment and supply - Health workforce - Physical infrastructure - Information - Financing
3. What are the interventions that have been implemented to improve allocative efficiency?	**Interventions**	- Revolving drugs fund - EHBP-PPM
4. What are the recommendations to policy makers, that will help improve allocative efficiency in Sudan's Health System.		

3.5. Search strategy

The search looked for online resources including peer-reviewed articles, dissertations, grey literature, MOH reports, NHIF reports, WHO reports, concept notes, assessment reports, and news releases. Both published and unpublished resources, that written in English and Arabic were included. The study focused on resources from 2011 till present as that was the time of the succession of South Sudan from Sudan, so studies before that might reflect relatively different context for the current health system. But the search did not entirely close the possible literature from before 2011 for areas that lacked recent data.

Resources were retrieved from search engines (Google Scholar PubMed, and Vrije Universiteit LibSearch), databases (Scopus, MIDLINE, Science Direct, Pub Med Central, and IRIS.WHO), and websites (Primary Health Care Performance Initiative (PHCPI), and Sudan Health Observatory). Using key terms including "efficiency" "allocative efficiency" "universal health coverage" "insurance" "Sudan" and Boolean operators (AND, OR) as described in Annex (4). Furthermore, articles from the reference list of the found resources are retrieved as a snowballing. Also, some of government reports and unpublished resources are received from officials in the health sector at the federal ministry of health, NHIF, and WHO office Sudan.

Selection process was followed by looking at the relevancy to the topic and the context based on the information that found in resource's Topic, Abstract, Research Questions, and then further filtering by looking to the full text. Articles and reports that focuses on technical efficiency, productivity, and vertical programs were excluded, as that beyond the focus of this study.

3.6. Methods limitations

Main limitation of the methods is around the framework, which has been used in Kenya and Bangladesh, with some limitations that have been highlighted (49,50). Such as it Doesn't give an empirical measurement for efficiency like other methods (e.g., Data Envelopment Analysis), which is not the aim of this study. Another point is that some emerging issues may need deeper analysis or adding other methods like key interviews for better understanding. So using literature review alone might not give as deep analysis as when triangulated with other methods like key informants interviews

4. Chapter Four: Results

4.1. Sudan Health System performance

This section demonstrates the situation of the outcomes on financial protection and service coverage in relation to the result chain of efficiency at the service delivery and system inputs. Benchmarking the set of indicators that relate to the priorities will help understand the areas where more focus is needed to improve efficient allocation of resources to maximize outcomes.

Figure 4.1 illustrates the findings for the chosen set of indicators for Sudan in comparison to the global average or indicator target, as a visualization of the dynamic relation across the financial protection and service delivery in a spider graph. Zero coverage is represented by the centre of the spider web, and 100% coverage is at the outer edge of the web(51–55).

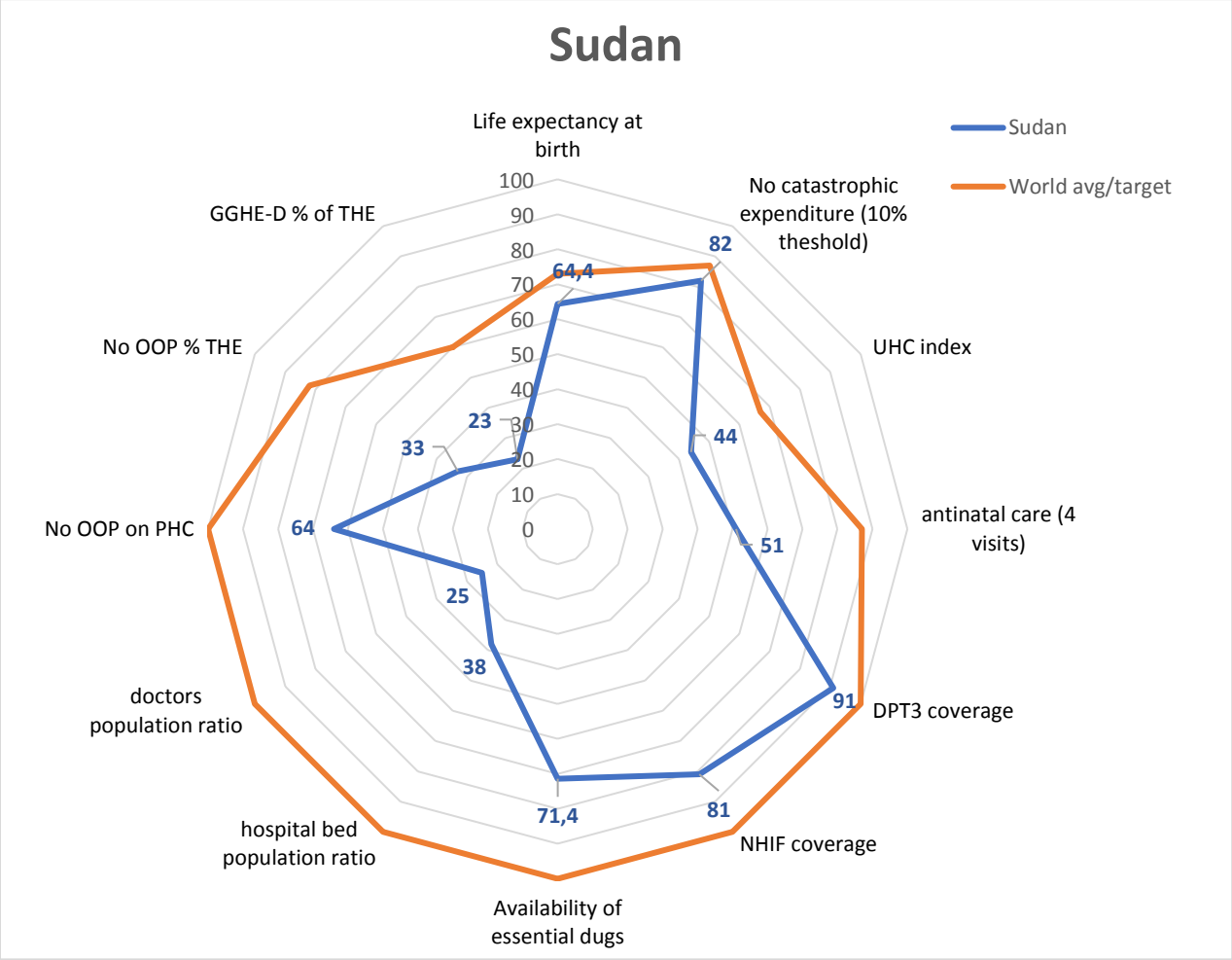

Figure 4.1 performance of Sudan health system on selected mix of indicators in comparison to the world average or indicator target, data from different sources (WB, WHO, PHCPI, NHIF, Sudan health observatory)

4.2. Performance at the outcomes level

The framework discuses system outcomes of financial protection, health status, and public satisfaction. For Sudan health system, the spider graph (Figure 4.1) illustrates the findings of outcome and outputs which include that life expectancy at birth is 64.4 years compared to world average of 73 years. High catastrophic health expenditure as 18% of the population spend more than 10% of their income on heath, in comparison to the world average of 13%(37). The UHC index in Sudan is 44, a score lower than the world average of 67 indicating low coverage of essential services for UHC(56). On outputs, the coverage of antenatal care of at least 4 visit is 51% when compared to the global average of 87%. Furthermore, with a target of 100% coverage of DPT vaccine Sudan has a coverage of 91%, while for availability of essential drugs the coverage is 77.1% which is below the target of 100%(57). This section will go deeper to explore and analyse issues around performance of the health system at outputs and outcomes.

4.2.1. Financial protection

High level OOP hinders the financial protection and access to health services of the Sudanese people. Literature proved that OOP increase catastrophic health expenditure for 10% and 25% thresholds of income. And rural areas -where poverty rate is higher, are more affected with catastrophic health expenditures compared to urban areas(58–60). Furthermore, OOP has a significant impact on poverty incidence in Sudan, as found that OOP health expenditure drives more people below the national poverty line (114 SDG) at all national, urban, and rural levels(61)

A study investigated determinants of OOP in five states using data from Sudanese National Baseline Household Surveys (NBHSs) of 2009 and 2014, revealed several factors that play roles in OOP. The study provided that, factors such as big household size, the presence of above 65 among household members, and the presence of household head attending secondary or tertiary school relate to higher OOP(62). Furthermore, OOP has different patterns among states as some are experiencing more risk of OOP, along with high burden of disease, poverty, and low insurance coverage specifically South Darfur, Sinnar, Red Sea, Kassala, and Gadarif(62,63). Figure 4.2 shows the shares of states in contribution to the total OOP. Illustrating Khartoum state on top of the OOP contributions with 17%, along with North Darfur 12%, East Darfur 12%, and North Kurdufan 11%. With least contributions from Central Darfur 2% and West Darfur 1%.(39)

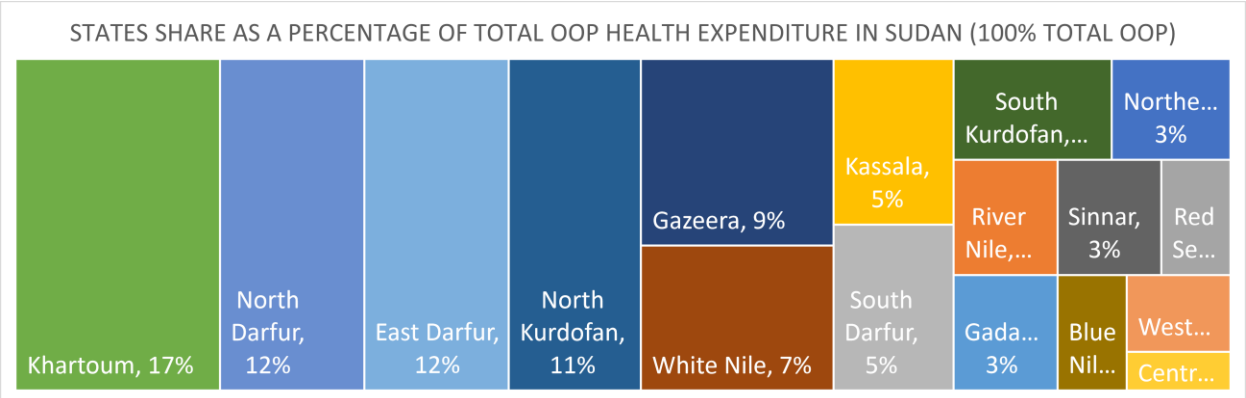

Figure 4.2 share of different Sudanese states on the total out of pocket expenditure, data from Sudan health utilization and expenditure survey 2012.

4.2.2. Health Status

Population health status gives indication on the performance of health system. Indicators of health status for Sudan is presented in Table 4.1. The performance is relatively poor for all indicators and these figures mask the variations between states at different indicators. neonatal mortality rate is 33 per 1000 live birth, while Under-Five Mortality rate is 65 per 1,000 live births, 55% of the deaths are related to malnutrition. Additionally, the Sudan Household Survey 2012 showed that 26.8% of under five children had diarrhea, while 18.7% were sick due to suspected pneumonia in the two weeks prior to the survey(39,64).

Table 4.1 Health Status indicators for Sudan 2019

Indicators	Values
Crude Birth Rate (%)	33.3
Crude Death Rate (%)	7.5
Total Fertility Rate (Per Woman)	4.4
Life Expectancy at Birth (Years)	64.4
Infant Mortality Rate (Per 1000 Live Births)	52
Under-Five Mortality Rate (Per 1,000 Live Births)	68
Maternal Mortality Ratio (Per 100,000 Live Births)	216

Death from the top 10 causes of death shows variation in between states as some has higher number of death than others. Figure 4.3 demonstrates percentage of deaths attributed to the top 10 causes from the total deaths within states. Showing that states like East Darfur has higher deaths from top 10 causes than North Kurdofan.(64)

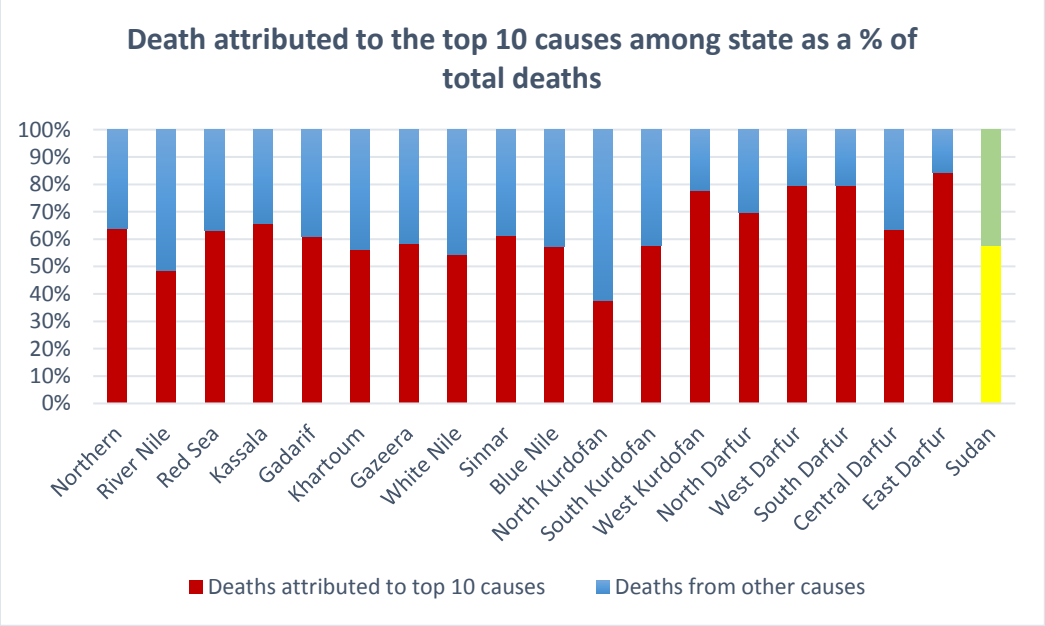

Figure 4.3 Deaths attributed to top 10 causes of death across states

4.2.3. Utilization of healthcare (Proxy for public satisfaction)

Utilization rate is the person average number of occurrences to the health services per given time period, it was found that average number of outpatient visits for the population is 1.937 occurrences per year. The rate is higher for population residing in urban (2.238) areas, in comparison to rural population (1.789). Between states, utilization rates also vary as in White Nile, Sinnar and Blue Nile, outpatient utilization is much higher of 2.5, along with Kassala state which has the highest rate of 3.266 occurrences per year. While some states like Central Darfur and especially Red Sea have the lowest rates. Furthermore, women have 19% higher utilization rate than men(39,65).

Utilization of private services represents 27% from total utilization, with 24% in rural areas and 32& in urban areas(39). Main reasons identified as drivers for non-utilizing services are distance of health facility, cost of services, and unavailability of staff, tests, and drugs(39,66,67). According to the Sudan Health Utilization Survey, 60% of the survey population had access to a health facility within a 5km radius. States' rates vary, for instance, just 15% of the population in Central Darfur having access to a facility within a 5km radius, compared to 70% of the population in Northern State. As the wealthy can travel further to facilities, and to pay for costs of services, these barriers mostly affect the poor, increasing inequities in the community(39).

One study identified lack of financial support as a main barrier from accessing family planning services among women of reproductive age in Sudan(68). Another article discussed that coverage of immunization highlighting that the economic level of household influenced the coverage of BCG vaccine(69). Utilization of primary care shows different rates between the states, Figure 4.4 illustrates the proportion of primary care and non-primary care utilization from the total rate of service utilization among states. Some states like Red Sea, South Darfur, and North Kurdofan have lower rate of utilization of primary care, in comparison to states like Gadarif and North Darfur which have higher rates of utilization for primary care. (39).

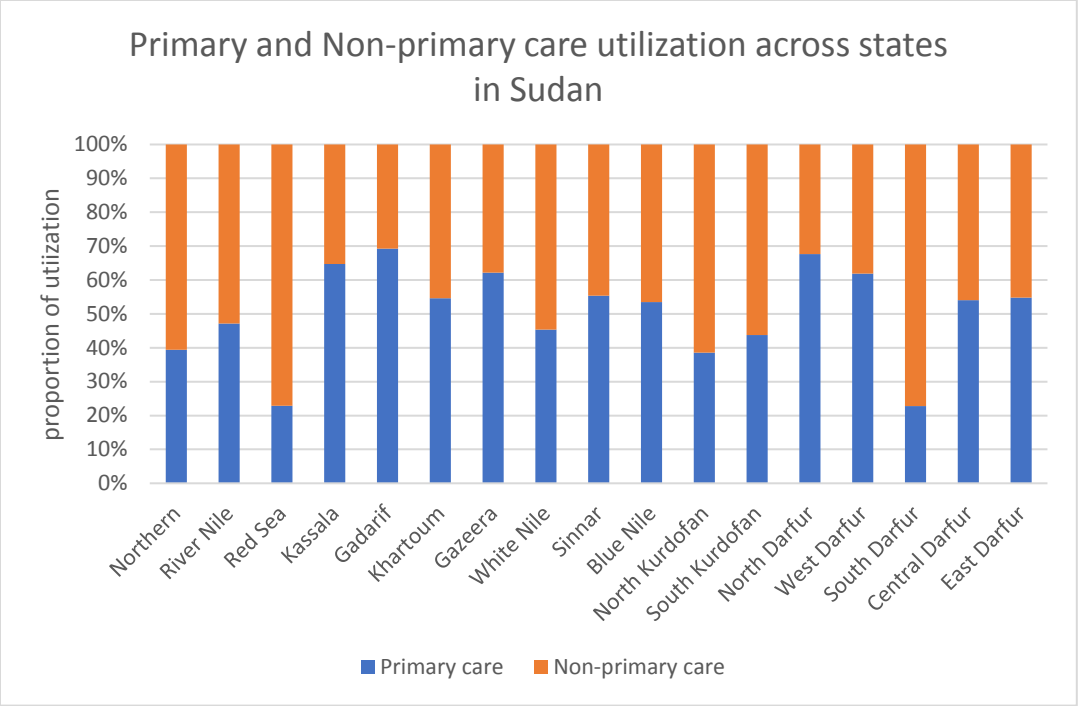

Figure 4.4 proportion of primary and non-primary care utilization from the total utilization rate across States, 2012

4.2.4. Outcomes under NHIF umbrella

It was proven that NHIF associates negatively with catastrophic health expenditure in Sudan. As being insured decreases citizens' probability of spending more than 10% of income in health (70). Nevertheless, insured people spend more OOP than non-insured people, relating this finding to higher utilization of insured compared to non-insured people, spending on payment as user fees and paying for medicines(39). Furthermore, insured people utilize health services 1.45 times more than non-insured, with 56.3% of the insured people utilized the services covered by the NHIF in 2020(32,71).

One of the determinants of OOP spending for insured citizens is out of network utilization, when insured people utilize services from providers out of the network of the insurance(72). A study explored out of network physician care utilization among insured people of the NHIF in Aljazeera state, revealed that 63.2% of the insured people utilized out of network physician care within six months of the interview. The study discussed that females are more than three times more likely to utilize out of network services, which supports the results of another study that suggested that females are two times more likely to utilize out of network services, and significantly prone to higher OOP compared to men(42,73). These findings are argued to be related with the positive female health seeking behaviour, the suggested evidence that women make more primary care visits, and the increased gender preference by females in Sudan(73).

poor quality of care and the complicated process of referral have been discussed as drivers for utilizing services from other providers(73). While insurers perceive the services provided by NHIF as of good quality, another study indicated that insured people perceive services provided by NHIF

as of poor quality (74,75). This finding is complemented by other study looked at determinants of NHIF drop-out, revealing that quality of care and satisfaction of services are important factors in preventing insured people from dropping out of the scheme(76). Worth mentioning the findings from a cross sectional survey that examined the wiliness to pay for quality services, as it found that 72% of the participants are willing to pay more fees or premiums for public service in return of improving quality(65). Furthermore, Sudan utilization survey report provided distance of facilities, and the limited package of services as main drivers for non-utilizing services of the NHIF(39).

Availability and adequacy of services are among the determinants that influence access to health services(62). beside the far distance of facilities as barrier for accessing NHIF health services, insured people revealed that services covered in NHIF facilities did not respond to their needs in term of the benefit package(39). Furthermore, limited availability of laboratory tests, prescribed drugs, and long waiting time within facilities covered by NHIF represent main barriers from utilizing services there. Acceptance and appropriateness of services were perceived as good by most of the insured people(75).

4.3. Allocation of health system Inputs

The Spider graph (Figure 4.1) shows the findings for health system inputs as follow, the density of hospital beds in Sudan is 38% (0.76 bed per 1000 population) in contrast to the least recommended ratio 100% (2 beds per 1000 population). Moreover, for the recommended doctor density (1 doctor per 1000 population), Sudan has 25% (0.25 doctor per 1000 population) doctor density for its population(64). The final part of the graph includes financial inputs indicators; percentage of OOP from THE which is 67% (33% no OOP) a high value compared to the global average of 18% (82% no OOP as % of THE). That comes with high population coverage of NHIF of 81% to the target of 100%, while still people spend 36% (64% no OOP on PHC) of their OOP on PHC which targeted to be free 0% (100% no OOP on PHC)(56,77). This section brings findings the analysis for the issues around allocative efficiency of the health system inputs.

4.3.1. Medicines, Equipment and Medical supply:

The Pharmaceutical sector including medical supply at the national level is managed through different bodies. Directorate General of Pharmacy within FMOH which is responsible for setting policies, and monitoring and evaluation at the federal level. the National Medicines and Poisons Board is the formal medicines regulatory authority. The National Medical Supplies Fund (NMSF) which is the body responsible for supplying of health products to the public sector to the last mile. And the Directorate General of Curative Medicine for managing medical equipment with NMSF. Lack of coordination between the three bodies and limited funding represent the main challenges in managing the resources for the pharmaceutical and medical supply sector which is further worsened by the economic crisis(41,78).

The Multisector needs assessment (MSNA) report confirmed that non-availability and high cost of drugs were the most reported barriers for accessing healthcare in Sudan in 2020(79). The most recent data on spending on medicines in 2008 showed that the system spends 39.7% of the revenues on drugs, with people spending 26% of the OOP on drugs(80). In 2020 the NHIF declared that 53% of the expenditure is directed to medicines(81). Nevertheless, medicines prices are dramatically increasing in relation to factors such as liberalization of prices, increased inflation rates and the abolition of customs charge which resulted in some medicine prices to increase by 1000%(82,83).

Sudan medicines availability is measured to reach levels below 50% in 2020(84).The Humanitarian Needs Overview (HNO) report stated that availability of emergency medicines declined steadily, reaching 43 per cent compared to 57 per cent during 2020(82). Another study assessed availability and affordability of drugs in Sudan in 2014 concluded that, with limited national availability, drugs are more available in the private sector than public. Beside that people pay higher prices than the international reference rate in both public and private sector. With prices in private sector are higher than public sector, and higher than those in Eastern Mediterranean Region Organization countries(83).

The NMSF is the responsible body of procuring, pricing, storing, and distributing all health products to the nearest mile. the NMSF declared that 53% of the national health products are imported, reflecting the low share of the local production. the HNO report added that Sudan has lost almost two-thirds of the local production capacity of essential medicines in 2020. The Government of Sudan imported about US$236 million worth of medicines and essential medical supplies which the highest amount since 2013. Figure 4.5 presents the worth of the imported medicines and essential medical supply(82).

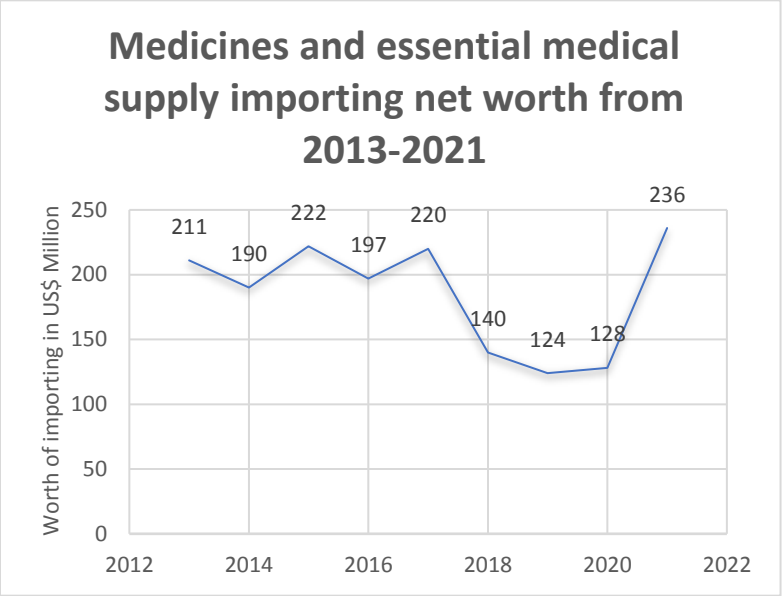

Figure 4.5 Sudan import of medicine worth (first of the year) in USD for the years 2013-2021, Source: Foreign Trade Statistical Digest 2013 - 2021, Central Bank.

On medicines procurement process, the public sector procured generic drugs at 2.5, and brand products at 3.24 times higher prices than the International Reference Price(85). the NMSF distribute drugs and medical products to different entities in the public sector, in 2020 most of the distributed products of the NMSF were medical equipment 20%, antimicrobial drugs 19%, and consumables 15%. The NHIF purchasing represents 43% from the NMSF total purchased health products including medicines and medical supply and equipment. The NMSF procures and distributes health products at first and later collects returns from purchasers after consumption. Although this process enhanced the availability of drugs and reduced the stock outs of health facilities, but the poor collection of returns resulted in great loss of money, as NMSF collects just 61% of the money expected from total distributed amount(81,86).

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4.3.2. Health workforce:

The health system profile report 2006 identified 20 categories of Health Resource for Health (HRH) in Sudan. Yet the country suffers from serious shortage of HRH resulted in poor performance of the health system in providing services especially at the lower level of the localities(84). HRH population density is considered to be low as the doctor population ratio is 0.26 per 1000 population, and nurses midwives population ratio is 0.69 per population. Figures are far from the recommended ration by the WHO of 4.45 doctor, nurse, midwives per 1000 population(56,64,84). The density is different across states as shows in figure 4.6, where states have different density of doctors, nurses, and midwives. The map reflects that darker colour is high density while lighter colour is for low density(64).

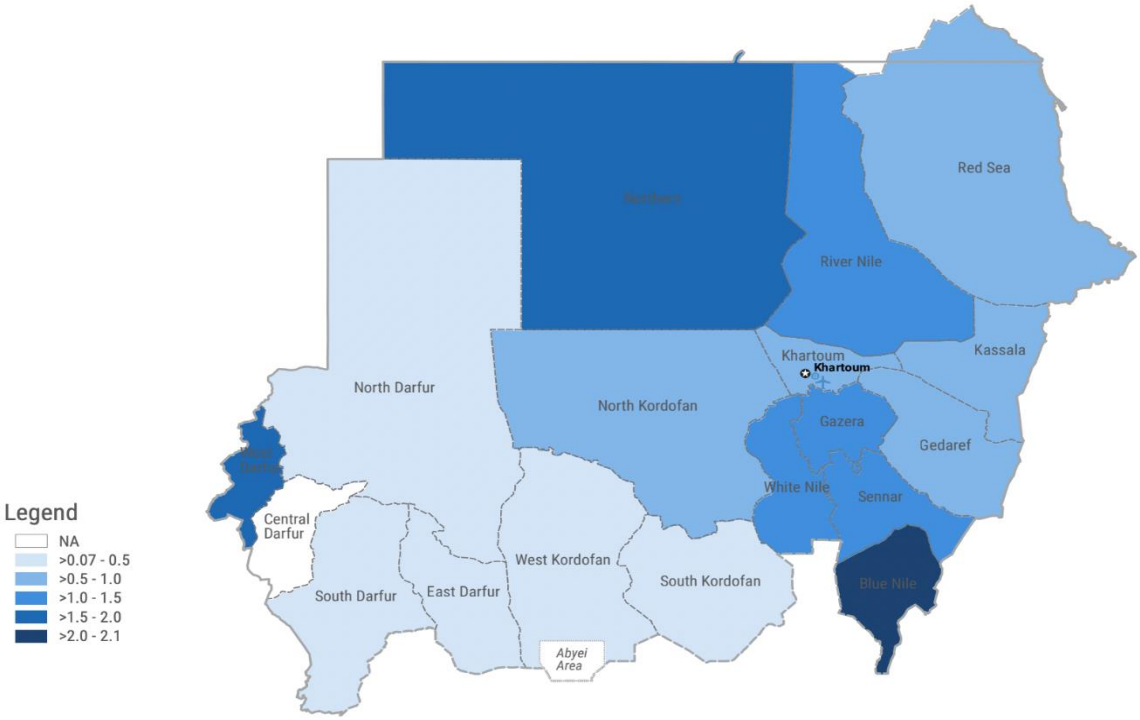

Figure 4.6 Sudan Map for doctors, nurses, midwifes population ratio per 1000 population for different states, OCHA 2019

While the HRH density (doctors, nurses, midwives) in Khartoum state is relatively low, but 38% of health workers are in Khartoum state this relates to the high number of populations residing in Khartoum(64). As well as for rural areas where 70% of the Sudanese population reside, 70% of the health workers are in urban areas. Furthermore, 67% of the health workers work in secondary and tertiary care services, leaving the primary care understaffed(87). Political instability resulting in security disturbance influence the HRH landscape as conflicts and wars in some areas affected the security affecting the availability of HRH in those area like Darfur and Kurdofan(82). Recently a study analysed the impact of military coup on Sudan health system, revealed that attacks of armed force and working under pressure after the coup, resulted in shortage and affected the availability of staff to address community health need(88).

Brain drain is one of the challenges facing availability of HRH in Sudan, with majority of out-migrations from the categories of medical doctors and nurses. Men out migration rates are higher than women out migration. drivers behind brain drain include economic status, low incentives, unemployment and seeking for career development. There is an uncoordinated production of health workers in terms of medical education. Poor planning and lack of linkage with health system needs resulted in imbalance, maldistribution and unemployment of health workers in Sudan(89).

4.3.3. Physical infrastructure:

Availability and distribution of Health Facilities (HF) is an important input for service delivery and access to health care. Sudan has 538 hospitals with a hospital bed ratio of 76.8 bed per 100,000 population, that below the recommended ratio of 2 beds per 1000 population. Distribution of hospital shows significant geographical variation 60% of hospitals were found to be in Khartoum State. In comparison, East Darfur has 1 general and 5 rural hospitals, and Central Darfur has no hospital according to Sudan statistical report 2020. At the primary level, Sudan has total of 5852 primary care facilities including Family Health Centres (FHC) and Family Health Units (FHU). Once more, geographical distribution of PHC facilities between states is different with large number of facilities based in Khartoum and Gazeera states. Figure 4.7 illustrates the variation in the distribution of PHC facilities both FHU and FHC for different states, as per data from the latest annual statistical report 2020.

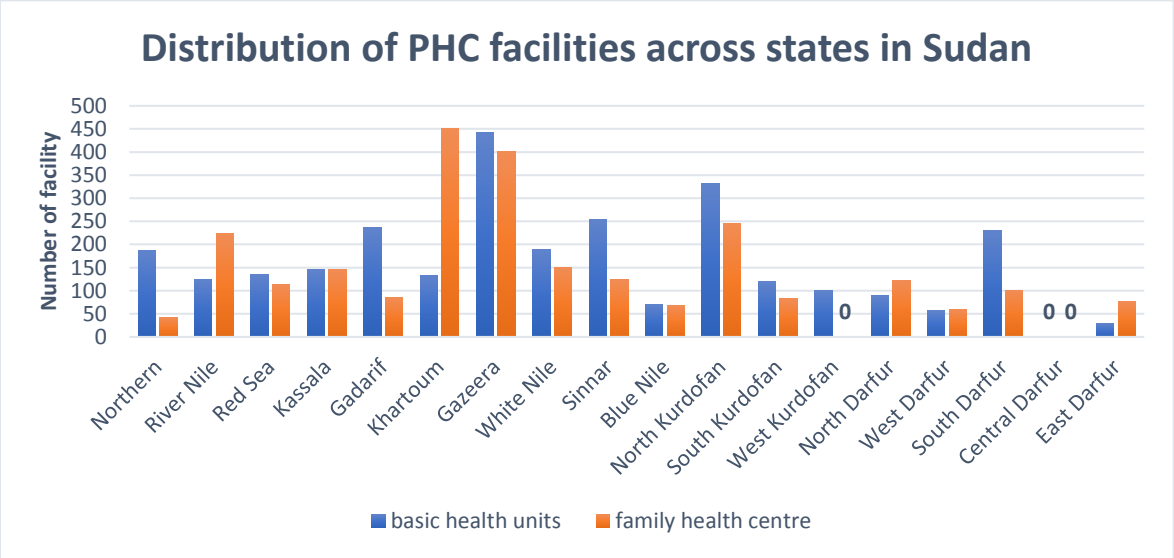

Figure 4.7 Distribution of PHC facilities among Sudanese states 2020, statistical annual report

4.3.4. Information

Information about population health status and performance of the health system is an important element for decision making especially for resource allocation and priority setting(90). Sudan Health Information System (HIS) assessment report identified several deficiencies that need to be addressed in the system. Fragmentation of the HIS, lack of coordination, and limited integration of vertical systems, create gaps in getting the full picture of the health system which in turn reduce the overall system efficiency(91). Nevertheless, availability of updated data is a challenge as many population figures are relatively old dated, Table 4.2 presents list of survey with the year of the most recent conduction of the survey(79,91,92).

Table 4.2 Surveys with most recent date of conduction in Sudan

Survey	Year of most recent survey
Census	2008
Multiple indicator cluster Survey (MICS)	2014
National baseline household survey (NBHS)	2014
Sudan health Utilization and Expenditure Survey SHI	2012
Malaria Indicator Survey (MIS)	2016
Simple Spatial Survey method (health, nutrition, WASH)	2018

For the infrastructure and readiness of the HIS, a study targeting HIS units at state level, revealed that 28% of states have inadequate HIS infrastructure, and one third of states doesn't have data analysis units. Power instability and poor connectivity of internet were main barriers for functionality of the units within states(93). In 2014 Sudan adopted the District Health Information System (DHIS2) platform and implemented it in 2016 to enhance expansion and integration of the HIS. Out of 189 localities, DHIS2 is covering 144 localities in 17 states. The reporting rate showed improvement from 30% in 2016 to 65% In 2020, with variation among states. While some states have 100% reporting rate (Blue Nile, Aljazeera, Gadarif), other states have less and sometimes 0% reporting rate, as in May 2020 only 122 out of 144 reported to the system. The assessment confirmed that HIS is underfinanced and the national HIS budget line items are limited and do not allow for adequate function of all data sources(91).

4.3.5. Financing:

Financial resources for health come from three main sources: public revenues, private, and external funding. The funds flow through different channels to the various health care providers. The household OOP goes into either to the various pools of private insurance or as OOP payment for providers. As well as households pay for private providers, user fee is applied to all public facilities(29).

The revenues from loans and grants flow either through the MOF as on-budget fund, or through the international NGOs and UN agencies as off-budget fund. Management of funds for health is shared with relevant ministries, and humanitarian assistance is managed with Sudan Humanitarian Aid Commission. Funds received from international NGOs (GAVI, Global Fund) flow to the MOH through program management Units (PMU). While funds from UN agencies is managed by the entitled agency with an agreed plan with the FMOH(41,84). Nevertheless, fragmentation and lack of coordination between MOH and partners, and in-between partners represent major source of allocative inefficiency in terms of duplication of efforts, beside misalignment of different plans and priorities(41). Furthermore, Osman study found that allocation of GAVI grant resources was inefficient at the implementation level by usage of higher cost-benefit activities, such as renting cars with higher prices apart from repairing the existing ones(94). On the other hand, the MOH has no clear accountability system and active coordination mechanisms to manage efforts of different stakeholders, affecting the governance role that the ministry expected to play(95).

Public funds for health flow through the MOF at the national, state, and local levels. For the MOH budget, MOF uses budgetary system that doesn't apply any sort of cash forecasts based on operational needs, which affects FMOH performance. As adjustment of budget allocated for FMOH is usually done by changing the budget as a whole without considering areas where more financing is needed or where better performance is needed(41).

Lack of knowledge about estimates of the national budget represents a source of disconnect between MOH budget plan and the financing from the MOF as sometimes budget plans claimed to be unrealistic to what the MOF offers. This affects the planning and allocation process at all levels of the MOH particularly at the local level. Furthermore, from the MOH side there is a deficiency in the alignment between national strategic plans and sub-national plans, which affects the distribution of resources from national to sub-national levels, as there is no tool to link all plans together for better coordination of resources(41).

The allocation of MOF to the subsystems of FMOH, states, police and army does not align with strategic priorities, pre assessed need, and biased toward caritive services. Most of public spending goes toward covering curative services which is more utilized by the rich increasing inequities(32). FMOH policy of free treatment (emergency care, maternal and under 5 children care, renal dialysis) is not properly costed and services are underfinanced because of poor management of resources directed to the facilities that provide services. Number of studies investigated on issues of efficiency around free care confirming that both poor and rich benefit from the policy. Costing and financing have geographical variation which increase the inequities, and the package of services is not clear(96–99). Beside that one study emphasized on the impact of poor referral system on reducing the efficiency, as non-emergency cases are mis included under the policy(97).

The MOF subsidizes the poor to through the NHIF by paying premiums and give direct support. but the process failed to include targeted population as subsidies represents more than 60% of the revenues for NHIF. This affect the efficiency and hinder the gains from NHIF as a risk pool, as found that the rich are benefiting the most. FMOH free treatment and NHIF poor subsides are contradicting and represent source of allocative inefficiency with duplication on targeting beneficiaries(29,32,100). Furthermore, the MOF through Zakat supports beneficiaries directly to pay for services and treatments, which is found to be encouraging for utilizing curative services. A study found that Zakat can make much better impact on the health status if allocated towards promoting health on demand side and strengthening the system, apart from directing it to treatment support(101).

The purchasing process in the public sector is fragmented between FMOH, military, police, and NHIF, which affects efficiency in providing services along with negatively impacting the quality. The purchasing is input oriented through budget line but not according to the needs or performance and counted as not strategic(41,100). Costing of services is not unified, and pricing is different from area to another affecting utilization of services. FMOH, NHIF, with NMSF conducted an exercise of national pricing list, but the economic crisis and increasing inflation rates made an obstacle for the implementation. The NHIF has a bulk purchasing strategy with the NMSF to secure efficient supply of medical products which represent 87% of NHIF expenditure. Yet because of increased inflation rates availability of medical products become limited despite the bulk budget(84).

Furthermore, the Benefit Package (BP) is not well identified, costed and skewed toward curative care which led to variation in provision of BP between HFs, different states, rural and urban, and different wealth quantiles(29). As the national facility survey found that only 24% of the facilities provide the full benefit package(102). The BP of the MOH and the NHIF is not unified, yet recent efforts are ongoing by the FMOH, NHIF and different stakeholders on designing EHBP for all people. The main provider payment mechanism for the FMOH and NHIF is user fees which significantly affects efficiency and has negative impact on incentivising overprovision and supply induced demand. Along with EHBP design, a project for introducing different PPM system is underway of development after piloting it in one state(29,41).

4.4. Interventions for improving Allocative efficiency

This section presents the relevant interventions implemented by Sudan government as in MOH and/or NHIF to improve allocative efficiency. The search came across number of interventions including health mapping project, NHIF payer split, revolving drugs fund, and benefit package-provider payment mechanisms project. nothing was found on the NHIF split policy apart from mentioning, and little was found on health mapping in form of a concept note draft(103,104). So, the analysis focused on the two other interventions with the available literature found.

4.4.1. Revolving Drug Fund

Sudan started the Revolving Drugs Fund (RDF) in 1989, with financial and technical assistance from Save the Children (United Kingdom)(105). RDF is a scheme used to increase availability and affordability of medicines by allocating funds from government, donors, or community to purchase drugs and sell them at cost-price. The revenues collected are used only to purchase drugs(106). The RDF in Sudan is managed through mixed approach from national to state level. Essential drug list is usually used to select drugs, and at the state level a well identified supply process is employed, as the supply manual (a document for guiding drug procurement and supply) is followed by most of the states. Furthermore, the RDF applies ABC analysis for quantifying needs, and standard operating procedures (SOPs) for procurement(107).

It was found that RDF increased the availability of drugs in the implementing states. a study revealed that 85% of respondents in Khartoum state got their prescribed medicines from RDF pharmacy. The study also showed an increase in the geographical distribution of pharmacy outlets and hospital pharmacies, as most of MOH facilities are covered by RDF in 2009(105). Although some improvement is achieved for affordability but still some people reported limited access to drugs for financial reasons. Another study reflected on RDF positive impact on improving public satisfaction and utilization of services as more people are utilizing services at health centre level apart from referral hospital(107).

A study on assessing sustainability of RDFs identified several success factors that improved efficiency of drug supply. The political commitment that the RDF enjoys, secured sustainability by providing strong laws and regulations that support directing and maintaining needed resources for RDF. For instance, exemption from treasury cycle at the state level and currency agreement to provide within the national rate. Another factor is restricting the funds toward purchasing drugs without including revenues in the MOF budget, served the continuity of drug supply. On leadership for improving allocative efficiency at facility level, RDF has a good supervision mechanism as teams redistribute drugs from over stocked facilities to under stocked based on the need(108).

On the other hand, RDF lacks available data on consumption as no reports are received from facilities(108). On searching the literature there was no information found in relation to the position of RDF from other related entities like NMSF and NHIF, with no clarity on the coordination mechanisms. Furthermore, explicit information about financing and flow of fund were also missing, as well as the situation of the distribution among different states. Nevertheless, literature about RDF lacks recent reviews or evaluation of impact and most recent national data found was from 2009(106).

4.4.2. Benefit Package Design and Provider Payment Mechanisms project for NHIF

In 2019 with technical guidance from Sudan WHO office, FMOH and NHIF started two interconnected projects of designing Essential Health Benefit Package (EHBP) and new provider payment mechanisms (PPM) to improve UHC outcomes(109). The designing project proposed three packages, Essential for primary care services, Comprehensive for core services like emergency care, and Additional for other secondary and tertiary services. The new payment mechanisms were based on organizing principles including need, capacity, activity, performance, and outcomes. Based on those principles several payment mechanisms were proposed which are capitation, global and line-item budget, fee for services, case and performance-based payment. The project applies unique framework with changes along the result chain of the health finance system. The proposed map for the health system applying EHBP and PPM for the NHIF is attached in Annex (5). the impact of using the new PPMs was assessed through a pilot study conducted in North Kurdufan in 2016(110,111).

The objective of the pilot was to improve health outcomes and utilization for children under 5 in North Kurdufan. the problem assessment revealed high mortality rates, low utilization of services, and low insurance coverage among under 5s. The project defined the benefit packages focusing on vaccination and nutrition, covering services from promotion, prevention, diagnosis, treatment to rehabilitation. To apply PPMs, the project designed a framework for flow of funds from national payers through unified pool of NHIF to different providers. Figure 3.6 demonstrates the framework of funds flow for North Kurdufan Pilot(109).

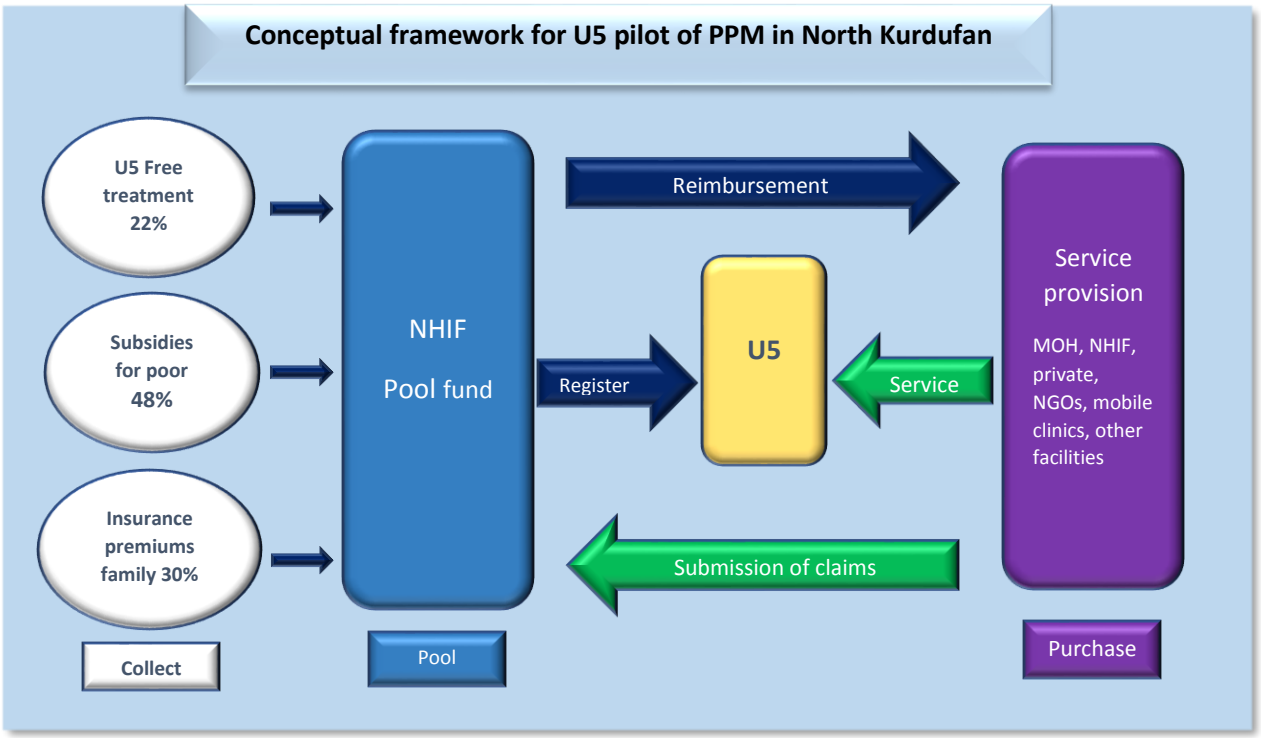

Figure 4.8 conceptual framework of funds flow for PPM in North Kurdufan pilot, WHO EHBP-PPM 2020

The project allocated funds as follow, 27% of the fund were allocated to PHC through capitation, 12% to hospitals by global budget and fee for services, 50% for medicines, 2% for referral and the rest 9% for administration and rehabilitation costs. The changes in outcomes from 2016 to 2017 were including enhance PHC population coverage from 29.3% (2016) to 43% (2017), improved availability of medicines from 45% (2016) to 93% (2017). Furthermore, the evaluation showed better distribution and retention of health workers, enhance immunization coverage, and decrease in malnutrition among under 5 children in North Kurdufan(112).

5. Chapter Five: Discussion

This study analysed allocative efficiency in light of join learning network framework that looks at efficiency through the chain of outcome, output and input. The study found that Sudan health system including NHIF allocative efficiency in all these three levels is influencing the performance on achieving Universal Health Coverage.

5.1. Sudan Health system performance

Benchmarking of the selected set of indicators for Sudan health system gives a setting on the performance of the system in comparison to the rest of the world averages or targets. The spider graph which comparing the set of indicators for Sudan and the rest of the world shows that the performance of the outcomes (e.g., UHC index) is below the targets and relatively poor. On looking to the inputs side, the graph shows huge gaps on the allocated inputs for health system. This visualization gives basis for analysis to be directed toward areas of gaps that influence the outcomes. In Tanzania such visualization helped to understand that low catastrophic expenditure is likely related to low utilization as found that people don't use available services to avoid the financial burden(113).

5.2. Outcomes

Sudan health system provides low levels of financial protection for its population, represented in high OOP and catastrophic health expenditure. The economic crisis and inflation rate play a role as the value of the allocated budget for public sector is decreasing and costs of services are increasingly compensated through OOP. It's also important to unmask the effect of OOP for different population especially the poor. This study found that the effect of OOP is mostly affecting the poor and population in rural areas, expressing different rate between states. This reflects on that the health system is not rightfully targeting the poor, not equitable in distributing resources and doesn't consider various contexts of the population. Another driver of the variation in OOP could be the differences in social determinants of health between people in influencing various health outcomes as populations have different settings from area to another. This finding is contradicting what was found in Nigeria as we as Egypt and Cambodia, in that catastrophic expenditure is affecting the better-off population more. Relating it to that the rich bypass PHC to private sector where they spend more and the low utilization of the poor with the high reliance on self-treatment(114).

Health of the population in Sudan is double burdened by communicable and non-communicable diseases. Apart from the low performance at this level, the study found that data on burden of disease is outdated as the most recent national data was from 2012. Current situation of the population is most likely different from that time. This indicates the low priority placed by the health system toward providing timely information about population health. Burden of disease across states differs, with rural states bearing the greater burden. This relates to the better utilization and health seeking behaviour of different populations e.g., urban populations tend to seek services and have the capability to travel to get care as availability of services and physical distance of facilities is better in urban areas. This support the results of a study conducted in Ghana that found disproportionate burden of disease between rural and urban areas is due to inequitable and inadequate availability of health services in the rural areas(115).

The study used utilization of services as an indicator for system outputs and a proxy for public satisfaction on the health system. Utilization in Sudan is skewed toward curative care with the urban population utilizing more services. States express different rates of utilization especially for primary care services. These variations are influenced by availability, affordability, quality, and adequacy of services which are different across states. This could be exacerbated by poor planning at the national level and the limited capacity at the state level to improve infrastructure, inputs and financing to provide services that accessible for populations. This finding comes in line with a study examined utilization barrios of PHC in low-income setting. The study found that multiple factors including availability and affordability services affects utilization relating it to the impact of the national planning and the alignment of national policies in considering those barriers(116).

Looking at the system outcomes for people covered by NHIF gives insight on the efficiency of NHIF in using its resources to achieve UHC. Subscribers of NHIF still not protected from spending OOP on health services. which could be related to the increased utilization of services which are not adequate, that makes them prone for user fees and medicines payments. Another aspect the service coverage of NHIF is relatively poor in terms of quantity and quality which influence subscribers to continue seeking services from private sector or not seeking at all. The low capability of NHIF to provide full access to quality services could be partly explained by the limited fiscal space and resources that NHIF receives especially with low premiums, beside the poor management of those resources. This effect is contradicting the outcomes of insurance in India, as found that insured people showed reduction and lower OOP compared to the non-insured. The study related that to the increase of utilizing insured services (117).

5.3. Inputs

Sudan spends great share of its expenditure on medical commodities including drugs, medical supply and equipment. Still availability and affordability are challenged affecting service delivery and utilization and increases OOP at the outcomes level. On looking at the allocation of resources it was found that resources are directed toward importing medical commodities apart from supporting local production. This with economic crisis means that more money will be directed to compensate the currency change, as same money will not get the same number of drugs with time and yet availability will not improve. Another issue is that more money can be saved at the procurement process as the procurement price is higher than international reference. And in collecting money of the distributed commodities, as barely two third of the money is collected back from purchasers. This can be argued by the low level of coordination between different responsible bodies and lack of regulations and laws that ensure transparent and strong supply system. In 1994 South Africa had similar problem as drugs were with high prices and low availability related to that procurement was not evidence-based, with inefficient distribution. After establishing essential drugs program in 1995, that targeted selection, procurement, distribution, and use of drugs, the country succeeded to improve access to drugs(50).

The system is lacking sufficient health workers to ensure functionality, derived by uncoordinated production by educational institutes and high rate of brain drain. Health workers out-migration could be justified by the economic situation of the country and the weak incentives provided specially by the public sector. Apart from sufficiency, inefficient distribution of health workers

represents a problem expressing inequitable distribution with bias toward urban areas and *curative* services. The inefficient distribution will likely influence the utilization following the pattern of distribution and consequently financial protection. Arguments for the biased distribution toward urban areas might include the higher renumerations, availability and adequacy of physical infrastructure in urban areas, chance of career development, and availability of general services. In 2005 Ethiopia had a challenge of severe shortage and inefficient allocation of health workforce especially at the PHC level. So new health extension cadre was deployed saddled with the responsibility of providing 16 health interventions at the PHC posts. In 2012 the program was evaluated as fulfilling targets of improving access to PHC(50). such experience from a country that has some similarity with Sudan might help in highlighting the gains a system can get from allocating health workforce efficiently.

The study found that availability and distance to health facility is an important factor in utilizing health services. Yet hospital sector is showing significant inequity and maldistribution of facilities at all levels. Urban areas and big cities take the bigger share of allocated physical infrastructure, leaving people at rural areas with barriers to access services. This finding could be related to the poor planning and coordination of physical infrastructure. On looking to the information as one of the inputs, the analysis identifies that availability of data as main challenge. The system has limited information about the performance at different level. This affects tracking progress, planning and implementing policies, and identifying the gaps. The system has the opportunity of DHIS2 platform, but fragmentation and lack of coordination are negatively impacting functionality of the platform. It's likely that weak political and financial commitment stands behind poor efficiency of information. The experience from Tanzania health intervention project, gives a good example on the impact of HIS on improving allocative efficiency. That the country adopted several interventions to enhance HIS at different level and provide needed information for better allocation, which comes with a positive impact on all outcomes(118).

Limited financial resources for health in Sudan increase the need to improve efficient use of existing resources. The health system in is highly dependent on household OOP. although dependency on external aids is low, still the fund entering the system from external aid is not used with optimal efficiency. As the fund is fragmented between different actors working without coordination. This led to misaligned priorities, duplication of efforts and reduced gains from allocated resources. Weak governance by the MOH, with absence of clear accountability framework and active coordination mechanisms lay behind uncoordinated external resources. This could be related to the political instability the country going through with high leadership turnover affecting system governance block.

Democratic Republic of Congo (DRC) could be a good example for addressing the coordination problem. With high dependency on OOP and external aids, poor coordination led to misaligned priorities, duplication, and wastage of resources. In 2005 the country adopted health system strengthening strategy with major reforms including adopting one coordination mechanism, one manual for financial resource management, centralizing leadership to MOH. The reform decreased the management costs by 19%, provided coordination savings of US$ 65 million, and improve

health outcomes(50). As much as other factors might have influenced the change, but still DRC experience can suggest the positive impact of governance and coordination to improve efficiency.

The budgetary processes between MOF and MOH at different levels shows inefficiency in term of relying on historical budget, lack of directed budgeting to the different needs, and unclarity of estimates. This could be related to the lack of proper involvement of MOH as well as other ministries in the national budgeting process, which leads to the disconnect of ministries proposals and national budget.

Pooling of funds suffers from fragmentation that leads to inefficient allocation of funds. Duplication of targeted beneficiaries and services covered by NHIF and FMOH is a manifestation of such fragmentation. Moreover, policies that are created to cover the poor are not well targeted to benefit the poor, but the rich as well, which is a great inefficiency as the pool is exhausted by spending on the needs of the rich. This is more related to the weak capacity and performance of the government and MOH on formulating evidence-informed policies with poor tracking for the change and evaluating outcomes from implemented policies. Although the context is not similar to Sudan, but experience from republic of Korea might give some lessons. The country had fragmented risk pool under three insurances for different population segments. In 2000 Korea merged all the schemes under one risk pool, which increased the coverage, reduced the administrative costs, increase the efficiency in targeting the poor, and enhanced quality and so the utilization of services(50).

The purchasing function of the health financing system and particularly for NHIF in Sudan is fragmented and not strategic with relaying on historical budget and fee for service. It's hard to make strategic purchasing when the benefit package that should be purchased is not well designed and identified. So, MOF and NHIF do not have well defined and comprehensive package that fulfil population needs. this can be strongly linked to poor priority setting that is not evidence based and does not reflect population needs to allocate resources on that base. However, Zimbabwe case gives an example on the influence of priority setting for efficiency. with poor health outcomes and high OOP, the country adopted the World Bank Health Intervention Prioritization Tool, that helped in prioritizing areas of interventions and allocating resources. The tool resulted on the system gaining 1.6 million DALYs, with 67% of the gains coming from interventions at PHC level(50). The experience supports the importance and the positive impact that good prioritization can make on improving UHC outcomes.

5.4. Interventions

The study included exploring the interventions that have been established to improve allocative efficiency in Sudan. Although the search came across number of interventions, but the analysis focuses on two interventions that presented clear information. The first intervention is the establishment of RDF in allocating funds toward essential medicines to improve access and efficiency. The experience with RDF so far showed good results in improving availability and preventing most facilities from drugs stock out. RDF presented some strengths that could help improve the system in other aspects, through political commitment, clear laws and regulations, accountability on allocating resources. Yet RDF has some areas for improvement, as the coordination with other bodies is not clear which would act as a source of duplication and so

allocative inefficiency. Although RDF in Sudan is old, still most of the gains that have been explained in the literature were for Khartoum state, which reflects on the limited knowledge on the impact of RDF on other states and rural areas.

RDF has a good opportunity to improve allocative efficiency for pharmaceutical sector in Sudan, but with putting more efforts in aligning it with the big picture of other players in the sector and improving the gains for areas of more need. This comes in line with the supportive evidence on that RDF showed positive impact on increasing access to drugs especially in low-income settings(119).

The second intervention of EHBP-PPM has shown a strong relevance to the problem of allocative efficiency in Sudan. The proposed changes promise great impact for NHIF on allocating resources toward a well-defined package that will be purchased strategically from different providers using proper mix of payment mechanisms. The pilot of North Kurdufan has given a good indication on the success of introducing PPMs with BP that align with population needs. As upon targeting under 5 in that state the project has improved utilization, service coverage and outcomes after time of implementation. The framework that has been used addressed several inefficiencies such as aligning revenues to the need, using unified pool through NHIF, and reduced fragmentation on purchasing at all levels (national, state, local). The pilot gives a strong recommendation to proceed on applying such changes on other states. With consideration of difference between contexts and understanding that change needs time, this project might significantly impact on improving efficiency of the system in Sudan. From different experiences from other 15 countries, the application of PPMs has shown to improve access to PHC and enhance moving toward UHC as per JLN report on the payment models for PHC report(120).

5.5. Relevance of the JNL Framework

Using the JLN framework helped the objective of this study on analysing allocative efficiency. The clear link between inputs, outputs, and outcomes as presented by the framework helped put thig into perspective for Sudan health system as it benchmarked the indicators. Furthermore, analysing allocative efficiency of the inputs was done following the framework on linking different inputs to the outputs and income. The framework also helped to put intervention under the lens of efficiency and explore gains and lessons to improve efficiency. Moreover, using JLN framework helped on learning lessons from other contexts by following the changes that has been introduced through the results chain. Yet some areas the framework has not cover, as in the inputs part the element of governance is not showing strong apart from a repetitive issue comes under other included inputs. So adapting element of governance might give better results on analysing efficiency.

5.6. Limitations and strength of the study

Using literature review and desk review only is one of the weaknesses of this study as triangulation of data with other methods like key-informants' interviews would have improved the results. The JLN framework is a strength point, as it was relevant to the objectives and simple to use and interpret. However, the choice of indicator to apply he first objective following the framework represent a source of bias. As much as criteria and recommendation were followed but the selection was biased, where some indicators were excluded for lack of data.

Some of the data especially for interventions part, was from the government side in form of reports. In turn, independent research or reviews would have reflected more on the issues from community perspective. Data under issues of financing were not found, such as amount of spending (in numbers), and estimates among wealth quantiles. political situation and economic development of the country were not analysed in this study. This might have reflected more on the efficiency problem, as in reality the two factors are clearly affecting people's lives. Comprehensive search of published, and unpublished is a strength point of this study, along with clearly stated objectives and presented findings.

6. Chapter Six: Conclusion and Recommendations

6.1. Conclusion

This study found that outcomes of Universal Health Coverage in Sudan are influenced by the performance of allocative efficiency for both the health financing system as well as NHIF. The health system as a whole demonstrated that the outcomes are below the targets and the allocated inputs have huge gaps from global average.

The performance of the system outcomes revealed low financial protection with impact of high OOP on increasing catastrophic health expenditure and pushing people towards poverty. The health status of the people is squeezed by double burden of diseases affecting states differently, which evidently indicated unfulfillment of people's different needs. Health utilization rate presented to be poor, with disparities of geographical location and wealth quantile, that unfavourable for the poor and those living in rural areas. Insured population were presented to have relatively higher OOP expenditure than their counterparts. Which shows poor adequacy of services cover by NHIF that leads people to seek services from the private sector. People not utilizing services of the NHIF was found to be related to reduced availability of services, low quality and satisfaction, and poor coverage of needed services.

The low availability and affordability of medical commodities across the country, push people to spend more money on health. And limit facilities from providing adequate services of good quality which in term will affect the utilization rates. Shortage of health workers and poor distribution of existing workforce are worsening the situation in Sudan on providing adequate and quality services. On physical infrastructure, Sudan has low density of hospital, with most facilities based in urban areas negatively impacting utilization of services in areas. Information system suffers from poor coordination and limited infrastructure, that led to unavailability of time sensitive data that inform about system performance.

Financing as an input presented inefficient allocation with high fragmentation, poor coordination, poor targeting through the functions of collecting, pooling and purchasing of resources. This led to disproportionate funding of services and in supporting the poor with duplication and week accountability of allocating resources. That negatively affects the availability of services and so utilization and financial protection. The impact of inflation and economic situation of the country was coming repetitively as a factor for reducing allocative efficiency on putting constrains of losing value of money overtime.

With some interventions underway this thesis calls for more action from policy makers and other partners advocating for universal health coverage to take more action on allocative efficiency for maximizing gains of health resources.

6.2. Recommendations

- Rural states and the poor populations were recuring as the most affected by poor allocative efficiency, therefore the FMOH and NHIF should apply equity model for allocating resources. The model should look on multi criteria to analyze decision for directing inputs to maximize gains for poor and rural populations in different states. This could include burden of disease, utilization of services, poverty rate, availability of services and infrastructure. By looking at those elements, decision on allocating resources will ensure equity and improve gains from directing the resources towards the right use. FMOH and NHIF should take the mandate of designing and establishing the model using the data available in the HIS. Furthermore, the model should be proposed to the MOF to incorporate it with the existing allocation process, to apply the model through the decentralized system for states and localities.
- Fragmentation on pooling revenues and purchasing services comes as a key feature of inefficiency in financing, so this study recommends and supports that NHIF should be the unified pool and the only purchasing agency for public sector. This reform should be followed by dividing NHIF into two management agencies one for pooling and revenue collection, and another for purchasing services with designing BP and paying providers. Transitioning towards one pool needs to be done in phases, as the NHIF needs to build administrative and managerial capacity for such reform. So, the implementation can start with piloting and phase of capacity building, then unifying pools, to ensure success.
- The NHIF should develop new targeting mechanisms for subsidizing the poor, as it seems with the current mechanisms, subsidies are benefiting the rich more than the intended population. The targeting mechanisms should be done in collaboration with ministry of social welfare, local authorities and national NGOs that serving at the community level, to identify poor households in need for support. The exercise should come out with criteria that can be piloted and implemented given a period of time, to save more resources and direct it to the poor. The starting point could include revising the current list of included population and check for their eligibility.
- There is a need for coordination and aligning efforts, so the MOH should take the lead with other stakeholders (NHIF, SMOH, NGOs, INGOs, UN agencies, and relevant Ministries) to establish a multisectoral accountability framework that will be aligned and managed with one coordination mechanism. To reduce duplication and track efficient utilization of resources in moving toward UHC.

For further research

- As the research focused on supply side there is a need for more research from the demand side for better understanding of the problem (Allocative efficiency) and the impact of implemented interventions.
- Research on the impact of inflation dynamics and economic situations on allocative efficiency is needed to inform policy makers for formulation of context-oriented policies and strategies.
- Further research is needed on the effect of both technical and allocative efficiency on impacting UHC outcomes give for broader understanding to improve system performance.

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Annexes

Annex (1): Map of Sudan(121)

Annex (2): population distribution per state(64)

Name	Population number	Area (Km2)	Population density (person/km2)
Northern	967.005	348.697	2,8
Nahr Alnil	1.441.140	124.000	11,6
Red Sea	1.825.180	212.800	8,6
Kassala	2.164.514	36.710	59,0
Algedarif	1.837.506	33.622	54,7
Khartoum	7.286.523	28.165	258,7
Algezira	4.799.393	23.373	205,3
White Nile	2.297.076	39.701	57,9
Sinnar	1.718.259	40.680	42,2
Blue Nile	1.161.258	45.844	25,3
N Kordofan	2.760.441	190.840	14,5
.Kordofan	1.193.095	82.000	14,5
W .Kordofan	1.730.934	111.373	15,5
N.Darfur	2.827.153	390.000	7,2
W. Darfur	1.018.581	796.460	1,3
S.Darfur	3.747.786	137.800	27,2
C.Darfur	757.408	37.114	20,4
E.Darfur	1.605.653	53.000	30,3

Annex (3): Selection process and definitions of indicators:

The selection process for indicators started with defining the pool of indicators which is done by referring to the list of recommended indicators by WHO on UHC report 2015. Then from that pool the author referred to the National Health Sector Reform Strategy 2021-2024 to select indicators based on the priorities of the country which resulted in set of 12 indicators that reflect on UHC performance in line with Sudan strategic priorities. As one of the priorities is strengthening PHC, indicators selected that have relation to PHC were compared to the set of indicators in the PHCPI framework, and they were aligning as well with PHCPI indicators(84,122,123).

- **Percentage of OOP from THE**: "Out of pocket expenditure is any direct outlay by households, including gratuities and in-kind payments, to health practitioners and suppliers of pharmaceuticals, therapeutic appliances, and other goods and services whose primary intent is to contribute to the restoration or enhancement of the health status of individuals or population groups. It is a part of private health expenditure"(124).
- **Availability of essential drugs**: "Essential drug availability measures the number of unexpired drugs in a health facility compared to the total expected number of drugs on the list defined by the World Health Organization. To effectively provide essential health services, facilities must have available a minimum level of essential drugs"(123).
- **Hospital bed density**: Total number of hospital beds per 10 000 population"(123).
- **Doctors' density:** "Medical density is the ratio of medical personnel (general practitioners and specialists) to the total population of a given area. Medical density is expressed in terms of number of doctors (for example) per 100,000 inhabitants"(125).
- **Percentage of antenatal care coverage** : "The percentage of women aged 15-49 with a live birth in a given time period that received antenatal care four or more times"(126).
- **Immunization coverage of Diphtheria, pertussis, Tetanus (DPT) vaccine** The percentage of one-year-olds who have received three doses of the combined diphtheria, tetanus toxoid and pertussis (DTP3) vaccine in a given year (127).
- **Catastrophic health expenditure**: Proportion of the population with household expenditure on health exceeding 10% of total household expenditure or income (128).
- **UHC service coverage index:** Coverage of essential health services (defined as the average coverage of essential services based on tracer interventions that include reproductive, maternal, newborn and child health, infectious diseases, non-communicable diseases and service capacity and access, among the general and the most disadvantaged population). The indicator is an index reported on a unitless scale of 0 to 100, which is computed as the geometric mean of 14 tracer indicators of health service coverage. The tracer indicators are as follows, organized by four components of service coverage: 1. Reproductive, maternal, newborn and child health 2. Infectious diseases 3. Noncommunicable diseases 4. Service capacity and access" (129).
- **Life expectancy at birth:** "the average number of years that a newborn could expect to live, if he or she were to pass through life exposed to the sex- and age-specific death rates prevailing at the time of his or her birth, for a specific year, in a given country, territory, or geographic area"(130)
- **Proportion of OOP spent on PHC:** is the amount of spending for m household OOP that on PHC services as a percentage from the total OOP(30).
- **NHIF population coverage**: the proportion of the population covered by NHIF services in term of enrollment either compulsory or voluntary as a percentage from total population(131).

Annex (4): Search strategy

	AND		
OR	Sudan	MOH	Efficiency
	Republic of Sudan	FMOH	Gains
	Northern Sudan	SMOH	Allocative efficiency
	East African countries	NHIF	Resource allocation
	Sub-Saharan African countries	Insurance	Performance
		Risk pool	OOP
	Low-income country	Purchaser	Utilization
		Payer	Financial protection
		Provider	Public satisfaction
			Health status
			Burden of disease
			Drugs
			Medicines
			Equipment
			Medical supply
			Health workers
			Facilities
			Hospitals
			Health centers
			Information
			Financing
			Revenues
			Pooling
			Purchasing
			Cost
			Budget

Annex (5): Health system map -EHBP & PPM: