

Analysing Staffing Needs Using Workload Tools in Humanitarian Settings

Application of WISN method in Lankien, South Sudan

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Analysing Staffing Needs Using Workload Tools in Humanitarian Settings: Application of WSIN method in Lankien, South Sudan

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


by

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LIST OF ABBREVIATIONS

ART	Antiretroviral treatment
ATFC	Ambulatory therapeutic feeding center
AWT	Available working time
CAF	Category allowance factor
CAS	Category allowance standard
ER	Emergency room
HCW	Healthcare worker/s
HIV	Human immunodeficiency virus
HR	Human resource
HSAS	Health service activity standards
IAS	Individual allowance standard
IAF	Individual allowance factor
ICU	Intensive care unit
IECC	Information-Education-Communication-Counselling
IPD	Inpatient department
LIC	Low-income country
LMIC	Low-middle-income country
MoH	Ministry of health
NGO	Non-governmental organization/s
OPD	Outpatient department
SGVB	Sexual and gender-based violence
TB	Tuberculosis
WISN	Workload indicator of staffing needs
WHO	World Health Organization

DEFINITION OF TERMS

Acute crises/crises: a sudden and unexpected situation that can be dangerous or cause instability which needs timely intervention to alleviate sufferings. Examples are pandemics, natural disasters wars, and genocides (1).

Chronic crises/crisis: crisis/crises that occur over decades with little change producing water and food insecurities, displacements, and life-threatening diseases (1).

Cyclic disasters: similar to chronic crisis but it is recurring and not continuous (1).

Healthcare worker: individuals engaged in activities with primary aim of improving health. It includes doctors, nurses, midwives, public health professionals, laboratory technician, traditional healers, etc.(2)

Human resource: a person regarded as an asset that can be utilised by a company or organisation.

Humanitarian aid: delivering assistance or services during crises with goal of preserving lives, upholding human dignity, ensuring public safety, reducing health consequences, and meet the fundamental needs of people affected (3).

Humanitarian crisis: A situation that causes severe disruption in health, safety, or well-being of a community or society and their inability to cope with the situation using its own resources, necessitating urgent action (3). It can be acute crises, chronic crises, or cyclic disasters.

Humanitarian organisation: “any governmental agency, non- governmental agency or other not-for-profit organisation that has as one of its bona fide missions to address the public health needs of underserved populations on a not-for-profit basis“(4)

Humanitarian settings: “is an event (e.g., armed conflict, natural disaster, epidemic, famine) or series of events that has resulted in a critical threat to the health, safety, security and well-being of a community or other large group of people”(5).

Vertical project: range of activities provided by an organisation in response to humanitarian crises. The project is solely run by an organisation itself without support from other partners or government.

Workload: amount of work activities a healthcare professional is engaged or expected to perform

Workload indicator for staffing need (WISN) method: use to calculate the number of staffing requirements to meet the need of the population. It is based on workload of healthcare workers and the time needed to perform their task (6).

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“When you want something, all the universe conspires to help you achieve it” -Paulo Coelho

ABSTRACT

Background: Humanitarian needs globally have surged in recent years, straining the response systems and budget. South Sudan, undergoing chronic crises of armed conflicts, disease outbreaks, food insecurity, and flooding, needs humanitarian aid for 76% of its population. With one of the lowest health indicators, their health system cannot function properly without external aids. The cornerstone of a resilient health system is human resources, but it's the second barrier in the country's implementation of health strategies. An evidence-based resource planning tool is essential that accounts for complexities the humanitarian context.

Objective: It aims to analyse the workload of doctors, nurses, and midwives in humanitarian settings to provide insights and recommendations to health planners and policy makers.

Methods: A quantitative analysis was employed using the workload indicator of staffing need (WISN) methodology for doctors, nurses, and midwives. Data required were taken from integrating literature sources of different activity standards and existing secondary data of a humanitarian hospital in Lankien, South Sudan, from June 2022 to May 2023.

Findings: After feasibly integrating health service activity standards from different literatures to calculate the WISN method in humanitarian settings, the study identified shortages for the three cadres in the outpatient department while the Emergency-intensive care department requires more doctors and nurses.

Conclusion: In humanitarian settings, doctors and nurses are confronted with a very high workload pressure, while midwives occur only in the outpatient department. The WISN method can effectively be used in calculating staff in humanitarian settings to improve healthcare delivery.

Keywords: Healthcare worker, Humanitarian aid, Human resources, South Sudan, Workload

Word Count:

CHAPTER 1: INTRODUCTION AND BACKGROUND

1.1. Introduction

Writing a thesis is an essential journey in every student's life. My name is Anna Kathrina P. De Jesus, a paediatrician from the Philippines. I worked for more than six years in humanitarian settings before doing this master's in public health program. During this program, I have found a topic not only of my interest but an area close to my heart. As a humanitarian aid worker, I have struggled to decipher the solutions to the challenging nature of human resources (HR). There were times I felt that I was being too lenient, and other times I was being too stern to the limited staff we had in projects where we provide health services. Nobody taught me this part of the job during my medical school and specialist training. I have to learn on the job, and I always question whether I am doing it right. Humanitarian settings are such a unique field, particularly in HR, because most of your staff are also part of the beneficiaries; this is mostly forgotten. They suffer the same unfortunate situation whilst serving their community. Their position can often lead to low performance or can be on the other spectrum of high motivation. It made me decide to focus on my master's thesis to help me better understand HR in the humanitarian context and contribute to the evolution of the humanitarian response geared towards sustainability.

1.2. Background

A humanitarian crisis is an event or series of events that cause severe disruption in a community's health, safety, or well-being, surpassing its capacity to cope using its resources, and necessitating urgent action. The scale and complexity of the humanitarian needs are large to demand coordinated aid from various international humanitarian actors (1).

According to World Health Organization (WHO), the different types of hazardous events that lead to humanitarian crises are natural, human-induced, and environmental seen in Table 1 (4). These crises can present as acute, chronic, or cyclical disasters that need specific emergency responses. Acute crises are sudden unexpected events that cause instability, risk, and harm. On the other hand, chronic crises or cyclic disasters occur over decades or generations with minimal change in the situation (5). One of the countries that suffers from a chronic crisis is South Sudan, a low-income country (LIC) in East Africa. It is a landlocked country bordered by six other countries shown in Figure 1, and home to 64 ethnic groups (6,7). It has an estimated 12.4 million population in 2023.

Table 1. WHO classification of hazards (4)

GENERIC GROUPS ¹	1. NATURAL				2. HUMAN-INDUCED ^{2,3}		3. ENVIRONMENTAL		
GROUPS	1.1 GEOPHYSICAL ⁴	1.2 HYDRO-METEOROLOGICAL			1.3 BIOLOGICAL ⁵	1.4 EXTRATERRESTRIAL ⁴	2.1 TECHNOLOGICAL	2.2 SOCIETAL	3.1 ENVIRONMENTAL DEGRADATION ¹⁷
SUBGROUPS	Earthquake: - ground-shaking	1.2.1 HYDROLOGICAL ⁴	1.2.2 METEOROLOGICAL ⁴	1.2.3 CLIMATOLOGICAL ⁴	Airborne diseases	Impact: - airburst - meteorite	Industrial hazards: ⁸ - chemical spill - gas leak - radiation [radiological, nuclear]	Acts of violence	Erosion
Main types - subtypes [sub-subtypes]	Tsunami	Flood: - riverine flood - flash flood - coastal flood - ice jam flood Mass movement (hydro-meteorological trigger): - landslide - avalanche (snow) - mudflow - debris flow Wave action: - rogue wave - seiche	Storm: - extratropical storm - tropical cyclone [cyclonic wind, cyclonic rain, cyclone (storm) surge] - convective storm [tornado, wind, rain, winter storm, blizzard, derecho, lightning, thunderstorm, hail, sand/dust storm]	Drought Wild fire: - land fire [e.g. brush, bush, pasture] - forest fire Glacial lake outburst (flood)	Waterborne diseases	Space weather: - energetic particles - geomagnetic storms - shockwave	Structural collapse: - building collapse ^{8,9} - dam/bridge failures	Armed conflicts: ¹⁴ - international - non-international	Deforestation
	Mass movement (geophysical trigger): - landslide - rock fall - subsidence				Foodborne outbreaks ⁷				Occupational hazards - mining
	Liquefaction				Insect infestation: ⁴ - grasshopper - locust		Transportation: ^{8,11} - air, road, rail, water, space	Civil unrest	Wetland loss/ degradation
	Volcanic activity: - ash fall - lahar - pyroclastic flow - lava flow				Animal diseases		Explosions	Stampede	Glacier retreat/ melting
					Plant diseases		Fire ⁸	Terrorism: - chemical, biological, radiological, nuclear, and explosives ^{15,16}	Sand encroachment
					Aeroallergens		Air pollution: ⁹ - haze ¹⁰	Financial crises: - hyper-inflation - currency crisis	
					Antimicrobial resistant microorganisms		Infrastructure disruption: - power outage ¹¹ - water supply - solid waste, waste water - telecommunication		
					Animal-human contact - venomous		Cybersecurity		
							Hazardous materials in air, soil, water: ^{12,13} - biological, chemical, radiological		
							Food contamination ⁷		

Since its independence in 2011, it has suffered persistent conflicts, disease outbreaks, food insecurity, and flooding. After more than 11 years of humanitarian support, the situation is deteriorating, with 9.1 million (excluding refugees) still needing assistance (8–10). It is ranked 3rd in 2023 on the fragile state index, with 2.3 million displaced internally and 2.29 million refugees (8,11).



Figure 1. Map of South Sudan showing Lankien, a town in Nyirol county (12)

South Sudan’s health system suffers persistent degradation and fragmentation due to weakened government, insecurity, violence, and loss of resources. Its ability to cope is limited due to the overwhelming aid and response needed; hence, it depends on donors’ contributions. Many non-governmental organizations (NGO) offer support in providing and sustaining essential health services (12–15). As a result, people who are affected require more medical intervention, and therefore, the health sector is primarily responsible for preventing and minimizing the consequences of different emergencies (4). The acute health problems are mainly injuries and the spread of infectious diseases, while the long-term health problems are mental health and medical complications of chronic diseases (16). Regarding health indicators, South Sudan continues to rank among the lowest in the world. In 2017, only 28% of the population could access healthcare

services. Life expectancy at birth is 58 years. Immunization coverage is below 50%. Furthermore, the maternal mortality ratio is 789 deaths per 100,000 live births, and under-five mortality rate is 92.6 deaths per 1000 live births (17).

As the country transition, the government reorients its focus from emergency and immediate humanitarian needs to long-term health sector development (18). The current health expenditure of South Sudan is 5% of the gross domestic product; this is similar to other LIC. At the same time, the fiscal space for health as a share of total fiscal space is only 2%, far from the 15% target (19). The health system has two funding mechanisms: the Health Pooled Fund, through a consortium led by Crown Agents-UK, and the Essential Health Services Project, funded by World Bank through a consortium led by United Nations Children's Fund (20).

The delivery of health services in South Sudan follows a three-tiered system. The first tier is primary care, which includes community structures such as the Boma Health Teams, Primary Health Care Units, and Primary Health Care Centre. The second tier is secondary care, consisting of county and state hospitals. Lastly, the third tier is a tertiary care, encompassing national teaching hospitals, specialist hospitals, and referral hospitals. The healthcare structures are organized in accordance with the administrative units of the country (20).

CHAPTER 2: PROBLEM STATEMENT, JUSTIFICATION, AND OBJECTIVES

2.1. Problem Statement

Humanitarian needs worldwide are perpetually increasing, causing immense strain on humanitarian budgets and system capacity(21). United States Agency for International Development reported 30,704 deaths, 185 million people affected, and 224 billion dollars in economic damage worldwide due to disasters alone in 2022 (22). In extremely fragile contexts, such as South Sudan, humanitarian aid has significantly increased and outweighed developmental financing in recent years, as shown in Figure 2 (21). Furthermore, International Organization for Migration estimated that 76% of South Sudan’s population will need humanitarian assistance and protection in 2023 due to persistent conflict, disease outbreaks, and flooding (23).

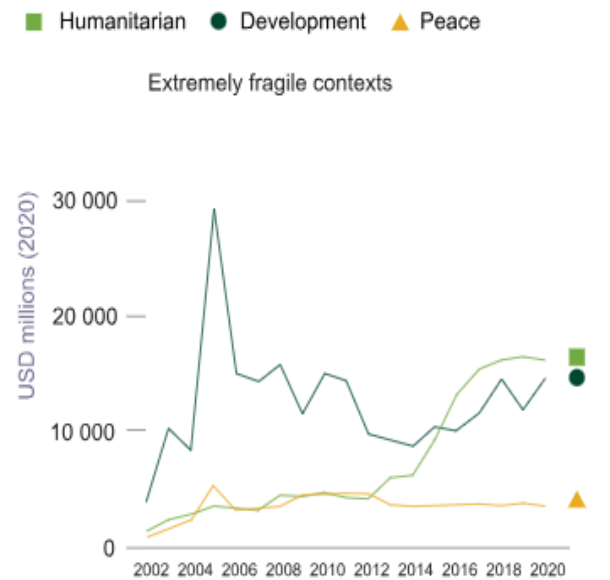


Figure 2. Aid activities in extremely fragile context (21)

One key indicator of the magnitude of the humanitarian situation and the effectiveness of the humanitarian responses is the mortality rate (24). South Sudan having the lowest indicators of health worldwide, reflects the crisis. The root cause for this is multifactorial. The health system is overwhelmed and has stretched the capacity of service provision. Moreover, material resources get depleted, a shortage of staffing occurs, and there may be a lack of anticipatory planning. There is a strong need to develop a basic understanding of the effectiveness, cost-effectiveness and delivery of interventions in these humanitarian crises (24).

The health system cannot function properly without the needed HR. It relies on the availability, accessibility, acceptability and quality of services of the healthcare workers (HCW) (25). They are the cornerstone of a resilient and sustainable health system to achieve universal health coverage (26,27). However, according to the world health statistics 2023 report, there is insufficient HR capacity, which stands as the second highest barrier in implementing national health strategies after lack of budget (28). Moreover, the shortage of HR is accentuated during a humanitarian crisis because there is migration and reduced productivity/performance among HCWs in these situations.

In South Sudan, the HR capacity is one of the most significant gaps in the world. The adult literacy rate is ranked 4th lowest of all the nations with only 35% of the population. One-third of their

schools are damaged or destroyed, while 63% of the teachers still need formal training (29,30). Only 12 health training institutes in the country produce mid-level healthcare professionals of midwives, nurses, medical officers, and laboratory technicians. The concentration of this workforce production is in the urban areas and hospitals, leaving the rural and primary healthcare facilities void of qualified HCWs (31). Payment of HCWs' salaries has emerged as a significant challenge due to the limited availability of government funds allocated to the public health sector. Consequently, HCWs have experienced low remuneration and delays in receiving their payments from the government. As a result, this frustrating situation has led many HCWs to seek alternative employment opportunities and engage in income-generating activities, contributing to a severe shortage of healthcare professionals in the country (32).

The provision of health services is often a task of the government. In a non-humanitarian setting, the distribution, management and mobilisation of HR is a challenge. Likewise, during a humanitarian crisis, this challenge escalates; hence the government usually contracts third parties (e.g., NGOs, religious organisations). During the conflict and the security can still be volatile, the NGOs are deployed in the rural areas while the government focuses on the less volatile and the urban regions (33). Across different types of crises, the challenges impacting the health workforce are increased demand for health services and reduced HR. Patient surge, unmet health needs, and insufficient facilities during this time. The reported strategies to adapt to these situations are increasing HCW within the needy area, increasing working hours, and using volunteers (34). With this approach, an appropriate calculation tool for HR is needed

Several methods are available to calculate HR requirements. The most common of these methods are:

- The acuity-quality method.
- Occupied bed method.
- Time-task/activity approach.
- Regression-based system.
- Professional judgement approach.

All methods have advantages and disadvantages, but many planning tools don't consider factors such as wide local variables in the demand for services and the workload of the cadre (35,36). A humanitarian NGO running several health facilities in South Sudan uses a combination of approaches called staffing ratio. This approach is based on the occupied bed method, acuity method, personal approach, and regression model. The guideline is simple, but implementation can be challenging due to task and patient acuity differences across health facilities (37).

WISN, a tool developed by WHO, considers the activities HCWs perform together with their available time. A vital advantage of this approach is generating insights responsive to changing

service utilisation at the health facility by drawing on routine health facility data (38). It makes the planning for the healthcare workforce efficient and effective (39). WISN is an HR management tool used to calculate staff requirements in a health facility. It's a realistic and practical way to assess the workload pressure of the healthcare staff. Its method considers the different services and complexities of each health facility. The technique identifies priority cadres, the available working time (AWT), workload components with the time it takes to perform well, and the allowance standards for support and additional activities. Determination of staff requirements and analysis of the results using difference and ratio are the last step of the method. With this, there will be improved decision-making in allocating staff, addressing current challenges equitably, and staff future health services (40).

2.2. Justification

There is a high patient number and acuity during crises, increasing the risk to HCW. Mitigating the risk requires healthcare managers and decision-makers to identify strategies(34). One of the factors that need to be prioritised is the rampant issue of insufficient workforce to cover the vast needs of the population and with appropriate skills that can deliver quality healthcare services (26). A systematic review by Jordan et al. revealed that poor quality of care is due to HR shortages, low workforce motivation, and inadequate training provision (12). Moreover, a desk review by Dovlo revealed that the productivity of HCWs is affected by stress, heavy workload, and burnout (41). Insufficiency to address these problems will impact the health system and, ultimately, the population. Therefore, supporting, building, managing and optimising HR through evidenced-based research is necessary. But HR policies and strategic planning need to be improved, particularly in developing countries, where most humanitarian crises arise, due to the failure of evidence-based planning to meet the population's needs (42). In humanitarian settings, the WISN method has never been explored. It is a valuable tool that caters to the different needs of staff in different environments and is adaptable to varying contexts. It makes this research study unique and explores the applicability of this tool in such settings. It is anticipated to provide proven-based planning and help quantify the various HR cadres needed to support the humanitarian settings.

South Sudan has a protracted and growing humanitarian need. It provides a setting where the health system becomes strained, therefore, needing effective workforce planning. With the budget constraints for humanitarian response and the shortage of qualified HR in the country, ensuring an efficient and equitable workforce is imperative. Insight to an adequate well-distributed healthcare workforce is what the WISN method could offer.

2.3. Research Objectives

2.3.1. Research Question

What is the workload for doctors, nurses, and midwives in humanitarian settings?

2.3.2. General Objective

To analyse the workload for doctors, nurses, and midwives in humanitarian settings to provide insights and recommendations to policymakers and health planners.

2.3.3. Specific Objectives

1. To conduct workload analysis of doctors, nurses, and midwives using the WISN method in a humanitarian hospital in Lankien, South Sudan.
2. To assess and compare the results of WISN calculations with the current HR calculator tool utilized by a humanitarian NGO managing the Lankien, South Sudan hospital.
3. To share the results with policymakers and organizations to guide the estimation of the health workforce in a humanitarian setting.

2.4. Hypothesis

The workload analysis for doctors, nurses, and midwives in humanitarian settings will demonstrate that the current workforce and staffing allocation are insufficient to meet healthcare demands.

CHAPTER 3: METHODOLOGY

This chapter will describe the methodology and the conceptual framework for approaching the objectives of the study. The section will narrate how to answer the research question and test the hypothesis.

3.1. Study Design

The study employed a two-step quantitative analysis to calculate healthcare staffing needs using the WISN method, a combination of consolidation of literature review and existing data utilization. The literature review was carried out to consolidate workload components and integrate HSAS to calculate the WISN method for each cadre. On the other hand, secondary data from a humanitarian NGO's vertical project in Lankien, South Sudan was used to supplement the remaining needed statistics of the WISN method.

3.1.1. Literature Review

This part of the study was conducted to search for literature that illustrated workload components and activity standards using the WISN method. The search strategy was through online databases using search engines: Vrije University Library, Pubmed, Proquest, Google Scholar, and Human Resources for Health. Two grey literatures were directly acquired from independent sources. Keywords and Boolean operators utilized during the search are found in Appendix 1. The snowballing technique of titles and abstracts on the literature found on the different keyword combinations was performed to filter the cadres. Only studies on nurses, doctors, and midwives were included. It was followed by scanning the articles if workload and activity standard databases were present. All articles with the workload and activity standards were saved in one folder. Individual papers were then read thoroughly and filtered based on World Bank Country Classification by Income Level. Separate folders for each cadre and income level grouping were created. All articles from LIC and LMIC were included, while all other income level classifications were excluded. Furthermore, literature written only in English was taken into consideration. The exclusion of literature written in other languages was done: one in Arabic and two in Bahasa. The search period starts from the WISN creation in 1998 to the present.

3.1.2. Secondary Data Source

The existing data was collected from the NGOs' databases from June 2022 to May 2023. A health information management system called DHIS2 was used for each health service activity's annual workload data. It is the tool used by the organization since 2015 to collect, save, and manage health data. The daily data collected from different health facilities of the organization are entered into this web-based application through each facility's data team. Additionally, data for HR, such as

leaves, training, meetings, and working hours, are retrieved from Homere software and individual departments' record keeping. Homere software enables the HR department to manage their staff and their payroll. All the HR data are entered and harmonized into the system, which makes it easy to view the different cadres, each staff worked hours, average leaves, etc. While department record keeping is a set of tasks outside patient care that the supervisors track for the team under them.

3.2. Study Area

The study was conducted in a hospital in Lankien, South Sudan. It is a vertical project of an international humanitarian NGO in Jonglei, the country's largest state seen in Figure 1. Lankien is a marshland part of Nyirol County (43,44). In the last census in 2008, Nyirol had a population of 108,674 (5,138 from Lankien) and a projected population of 132,312 in 2020 (45). The population comprises mainly agro-pastoralist groups, and due to ongoing conflicts within the country, many internally displaced people have moved in and out of the area. The common challenges faced in the area are inter-communal/tribal and armed attacks, drought, cattle raiding, severe food insecurity, and flooding (43). Moreover, this humanitarian hospital is the only functioning secondary hospital in the county, and many neighbouring counties also use its healthcare services (46,47). There is also a need for more qualified HCWs in South Sudan; hence the country relies heavily on unskilled workers to fill the gap, mainly in rural areas such as Lankien (48).

The health facility caters to primary and secondary care with 85 beds. The outpatient department (OPD) has four sub-departments: general OPD, kala-azar clinic, maternity OPD, and sexual and gender-based violence clinic. The inpatient department (IPD) has ten sub-departments: emergency room (ER), intensive care unit (ICU), malnutrition ward, tuberculosis (TB)-human immunodeficiency virus (HIV) ward, pediatric ward, trauma ward, adult ward, isolation ward, maternity ward, and neonatal ward.

3.3. Study Population

The study will involve three cadres: doctors, nurses, and midwives. These three cadres are essential to providing primary and secondary health services. They are critical service delivery components that impact the quality and accessibility of healthcare in the population. The midwives specialise in women's health, the most commonly neglected group during a crisis. Nurses play a significant role in patient care, from the community to the healthcare facilities. Lastly, doctors are essential in diagnosing and treatment.

It is good to note that the health facility in this study, like most of South Sudan, needs more qualified HCWs. The most difficult to recruit are doctors because of the need for more production in the country; hence this position is being compensated by clinical officers. These non-physician clinicians perform similar roles to doctors but have a shorter training program. They were initially

introduced to cover the gap of doctors in underserved areas during the early 19th century (49,50). In this study, the calculation for the cadre doctor will represent doctors and clinical officers.

3.4. Variables

The study calculated the WISN method using existing data and literature on health activity standards. There are 11 variables in the study: AWT, workload activities (health service activities, support activities, and additional activities), activity standards (HSAS, category allowance standard (IAS), individual allowance standard (IAS)), category allowance factor (CAF), individual allowance factor (IAF), annual workload, and standard workload. The dependent variables are CAF, IAF, and standard workload, while the rest are independent variables. These variables will be individually described and discussed in the analytical framework in section 3.9

3.5. Data Collection and Analysis

The study started with a literature review consolidating workload activities and standards per cadre using an Excel spreadsheet. From the collected data, workload activities per cadre were categorised by department and similar activities were combined, creating three checklist forms (appendix 2-4). The integrated health activities were then tabulated in Excel with the time standards of the different literature that matched the inclusion criteria. The time standards were subsequently statistically analysed using mean, median, variance, and standard deviation.

The secondary data was collected through a health facility data form seen in Appendix 5. This form and the three checklists were emailed to the hospital medical team leader (MTL) to fill up. The hospital MTL is contacted through emails, calls, and WhatsApp whenever there is incomplete data.

An Excel WISN calculator tool was created by the researcher for the data calculation and analysis. All information gathered from the literature sources and secondary data was entered into the tool. For the HSAS, the median was used to calculate each workload standard.

The study outcome of interest was each cadre's shortage and workload pressure. The required number of staff per cadre based on the WISN method was compared to the actual team and the NGO's HR calculator guidelines and tool to measure these two outcomes. This NGO's HR tool constitutes three components: Staffing ratio guidelines, excel calculator tool, and Ritmo (Excel rostering tool). This study utilised the guidelines and calculator tool to calculate the needed HR for the involved cadres.

3.6. Ethical Consideration

Obtaining ethical approval or exemption from KIT Royal Tropical Institute Research Ethics Committee was unnecessary for the literature review and use of aggregated anonymised secondary data. The study was submitted to the international NGO ethics review board and South Sudan Ethics Review Board, and both granted exemption for full review.

All the data were stored and kept in a password-protected flash drive and will be deleted after five years following completion of the research.

3.7. Quality assurance

The study will have a quality control check on data entry to identify and rectify errors. The Excel formulation will be pre-tested before entering the actual data by the principal investigator. Verification of missing data and outliers will be checked. Once the data has been entered, the principal investigator and the thesis advisor will double-check. Furthermore, a specified meeting on updates with the thesis advisor will be done to monitor the study's progress. After study completion, results will be shared with the NGO project head and the South Sudan Ministry of Health.

3.8. Analytical Framework

The framework used in the study was an adoption from Ahmat et al. WISN study that integrated the health activity standards of 12 African countries by Ahmat et al. It represents the different steps of the WISN method to be performed.

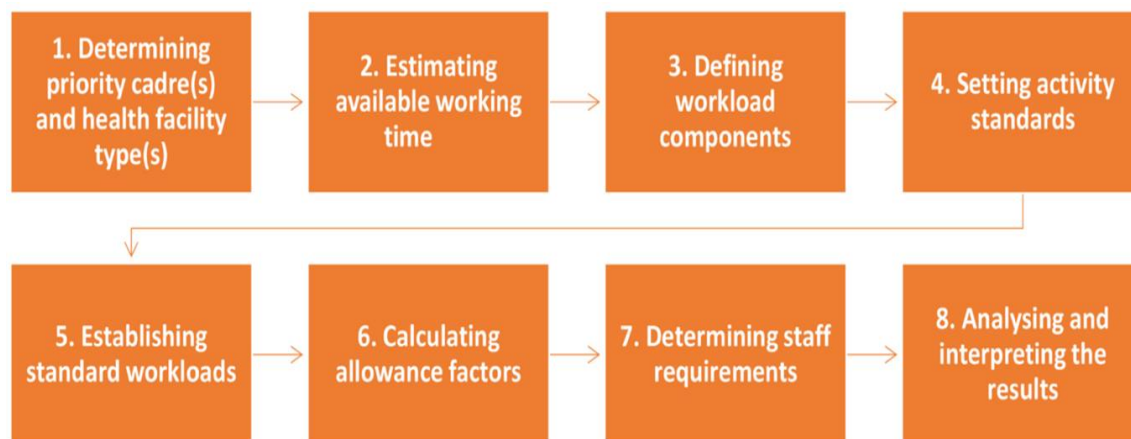


Figure 3. Steps of the WISN method (40)

Step

1: Determining priority cadres and health facility

All the cadres in a health facility are essential, but with limited resources for the study, three critical cadres were included: doctors, nurses, and midwives. They play vital roles in delivering healthcare services at a humanitarian hospital. The health facility was one of the proposal sites from the NGO, which could benefit from the WISN method, and the methodology is feasible.

Step 2: Estimating available working time (AWT)

The AWT is when an HCW is available in a year to do the work, including absences. In this study, it was expressed in hours. The time for each cadre was calculated separately using the following formula:

$$AWT = [A \times B] - [(C + D + E + F) \times 8]$$

A = the number of weeks per year

B = the number of working hours per week

C = the number of public holidays in a year

D = the number of annual leave per year

E = the number of sick leave per year

F = the number of other leaves per year (circumstantial, maternal, etc.)

The information on each component of AWT was obtained from the available statistics of the health facility.

Step 3: Defining workload components

In this step, three workload components that take up the most in the HCW's time will be defined:

- a. *Health service activities* – these are the activities performed by all HCW in the specific cadre; this will be obtained and identified through the literature review and was aligned to the existing health facility services.
- b. *Support activities* – these are the activities performed by all HCWs in the specific cadre; this will be obtained and identified through the literature review and was aligned to the existing health facility services.
- c. *Additional activities* – these are the activities performed by certain HCW in the specific cadre; this will be obtained and identified through the literature review and was aligned to the existing health facility services.

Each of the activities should be a representation of the most crucial task and activities of each cadre in their daily work. Each component has a distinct time requirement. The list of these activities was identified through consolidation of literature sources. This served as a checklist for the health service, support activities, and additional activities.

Step 4: Setting activity standards

This step will provide time for each workload component in step 3. Activity standards are the time needed for a skilled and motivated HCW to perform a specific professional activity. The time will be determined through a consolidation of the literature review of activity standards.

There are three components:

- A. Health service activity standard (HSAS) is the time a proficient HCW needs to perform each health service activity and is expressed as a unit of time. Since this component was collected through literature review consolidation, the median for the set of values obtained was used to represent each HSAS.
- B. Category Allowance standard (CAS) is the time a HCW needs to perform the support activities and is expressed as percentage. The working time was converted into percentages. Table 2 shows an example of how to set the CAS.

Table 2. Example of category allowance standard calculation

Average available working hours in a day = 8			
Available working days in a week = 5			
Available working hours in a week = 40			
Available working days in a year = 207			
Available working hours in a year = 1656			
Support activities for nurses	Workload components	CAS	CAS %
	Handover	23 mins per day	$[(23/60) / 8] \times 100 = 4.8\%$
	Department meeting	90 mins per month	$[\frac{(90/60) \times 12}{1656}] \times 100 = 1.09\%$
	Order from pharmacy	2 hours per week	$[3/40] \times 100 = 7.5\%$
Total CAS %			13.39%

- C. Individual allowance standard (IAS) is the time a HCW needs to perform the additional activities and is expressed as a unit of time. The list of activities was listed with the number of staff performing them and the time required for each activity. Table 3 shows an example of how to set IAS.

Table 3. Example of individual allowance standard calculation

	Workload components	Number of staff performing the task	Working time per person	All staff working time per year
Additional activities for nurses	Supervision of new recruits	5	8 hours, 5 times a year	200 hours per year
	Continuous professional development (trainings)	5	40 hours per year	200 hours per year
Total IAS in a year				400 hours

Step 5: Establishing standard workloads

This step calculated the amount of work one HCW can do in a year within each HSAS. It is expressed as the number of clients per year.

$$\text{Standard workload} = \text{AWT} \times (60/\text{HSAS})$$

Table 4. Example of standard workload calculation

AWT for midwife: 1416 hours		
1 hour = 60 min		
Health Service Activities	HSAS	Standard Workload
Antenatal care	23.5 min per patient	1416 x (60/23.5) = 3,615.32
Newborn care	80 min per patient	1416 x (60/80) = 1062
Family planning: short term	16	1416 x (60/16) = 5310

Step 6: Calculating allowance factors

In this step, the multiplier used for calculating the total requirement for each cadre was determined. There are two allowance factors, the CAF and the IAF.

$$\text{CAF} = 1/[1-(\text{total CAS}/100)]$$

$$\text{IAF} = \text{IAS}/\text{AWT}$$

Step 7: Determining staff requirements

Calculating the staff requirement per cadre used several variables: annual workload, standard workload, CAF, and IAF. The formula used to calculate this was:

$$\text{Total required number of staff for each cadre} = [G \times \text{CAS}] + \text{IAS}$$

- $G = \Sigma$ required number of staff per health activities
- *Required staff per health service activities* is the number of HCW needed for each health service activities. It was calculated by dividing the annual workload to the standard workload of step 5.
- *Annual workload* is the annual service statistics by each health service activity (e.g., Antenatal care consultation per year was 6356 based from the DHIS of the hospital).

Step 8: Analyzing and interpreting results

The determined staff requirements for each cadre in step 7 will be compared to actual staff using ratio and difference. The difference can identify understaffing and overstaffing. While the ratio will determine the work pressure of the healthcare staff. It will also be further compared to the HR calculator tool used by the NGO.

CHAPTER 4: STUDY RESULTS/FINDINGS

4.1. Literature Review Results

The workload components and activity standards values vary from one study to another, depending on several factors, such as context, practices, type of facility, and health service package, to name a few. A total of 19 literature sources were included, and each presented with a set activity standard of a particular cadre: 12 for midwives, 15 for nurses, and 6 for doctors. Table 5 summarises the literature and methods for setting the activity standards (see Appendix 6 for expanded descriptions). Two were grey literature, and the rest were peer-reviewed. The study designs comprised 12 quantitative, 5 mixed-method, and 2 literature reviews. At the same time, the type of health facility includes 11 hospitals, 7 primary healthcare centres, and 1 different-level facilities catering to maternal and newborn care.

Table 5. Activity standard literatures

<i>Cadres</i>	<i>Type of Study</i>		<i>Data Collection Method for Setting Activity Standards</i>		
	<i>Peer-Reviewed</i>	<i>Grey Literature</i>	<i>Time-motion</i>	<i>Expert Working Group</i>	<i>Secondary Data</i>
<i>Midwife</i>	11	1	3	6	2
<i>Nurse</i>	13	2	5	8	1
<i>Doctor</i>	4	2	3	3	0

Activity standards comprise three variables: HSAS, CAS, and IAS. Table 6 presents a convergence of the health service activities from the set literature for each cadre. There were 33 health service activities for nursing, 25 for medical doctors, and 28 for midwives. Integrating the time to perform individual health service activities showed variabilities, as shown in Figures 4, 5, and 6. These activities are performed by all staff in each cadre based on their training and competencies. The data revealed the greatest variability was among the midwives' HSAS, followed by those of the nurses. The midwife cadre had 4 HSAS with a range and IQR (Inter-Quartile Range) of more than 60 minutes: labour management, safe abortion, newborn care, and long-term family planning. There are 4 HSAS with more than 30 minutes: short-term family planning, ANC, PNC, and inpatient care. In comparison, the nursing health activity standards had 4 activities with a range of more than 30 minutes: monitoring ICU level patients, referral, and ATFC (ambulatory therapeutic feeding centre) consultation. The doctor HSAS showed the least variability among the three cadre, with only emergency management having a range of more than 20 minutes.

Table 6. Integrated health service activities

	Nurses	Doctors	Midwife
Outpatient	Patient assessment (triaging, vital signs and history taking)	Outpatient consultations/curative consultations	Antenatal care
	ATFC consultation	ATFC consultation	Post-natal care
	Information-Education-Communication-Counselling (IECC)	IECC	Family planning: short term
	Immunization	Immunization	Family planning: long term
	Enroll in ART* Care and Treatment	Enroll in ART* Care and Treatment	Outpatient consultations/curative consultations
	Provide ART* care and treatment	Provide ART* care and treatment	IECC
	Controlling vital symptoms (e.g, Fever, blood pressure)	Referral to higher facility or for admission	Immunization of women of reproductive age
	Dispensing medications		Safe Abortion
			Post abortion care
	Referral to higher facility or for admission		Referrals
Inpatient	Admission processes per patient	Admission processes per patient	Provide prevention of mother-to-child transmission (PMTCT)
	Providing nursing care to inpatients (e.g., VS, NGT feeding, etc.)	Conduct daily ward round	Cervical cancer screening and treatment
	Administering medications	Discharging patient	
	Participation in medical visits	Ward review	Admission processes per patient
	Blood or specimen sample collection for Lab test	Referral to other or higher facility	Labor monitoring and management
	Oxygen therapy	Patient education and counselling	Normal delivery
			Assisted delivery
	Monitoring patient with ICU levels	Confirm death and write death certificate	Inpatient management of complications of pregnancy
			Newborn care
			Inpatient care per patient day (routine care for mother and baby)

Discharging patient
 Transfusion of blood
 Referral to other or higher facility
 Patient education and counselling
 Dispensing medications
 Prepare dead body

Participation in the medical visit
 Emergency care of the newborn
 Immunization at birth
 Safe Abortion
 Post abortion care
 Completing admin/patient records
 Discharging patient
 Dead body care
 Dispensing medications

Emergency Room

Admission processes per patient
 Assisting OPD procedure / minor operation (e.g., Wound suturing)
 Blood or specimen sample collection for Lab test
 Wound dressing
 Transfusion of blood
 Administering medications
 Routine patient care (VS, IVF replacement, etc.)
 Referral to other or higher facility
 Discharging patient
 Prepare dead body
 Dispensing medications

Admission processes per patient
 OPD procedure / minor operation (e.g., Wound suturing)
 Emergency management - road traffic accident
 Emergency management – Obstetrics
 Interventions for minor (simple) medical emergencies
 Interventions for moderate-to-severe medical emergencies
 Interventions for critically ill medical emergencies
 Referral to other or higher facility
 Discharging patient
 Confirm death and write death certificate
 Dispensing medications

*ART: antiretroviral treatment

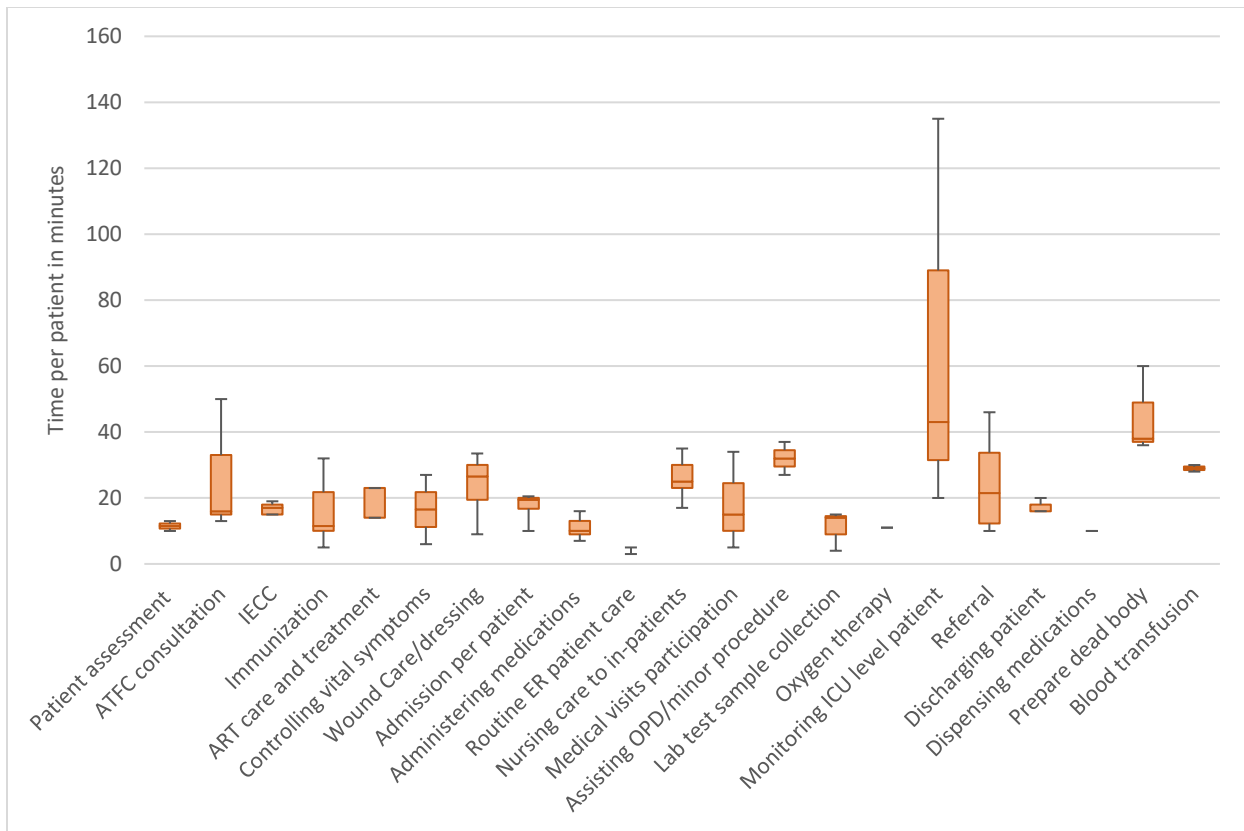


Figure 4. Variation in service standards of nursing health service activities

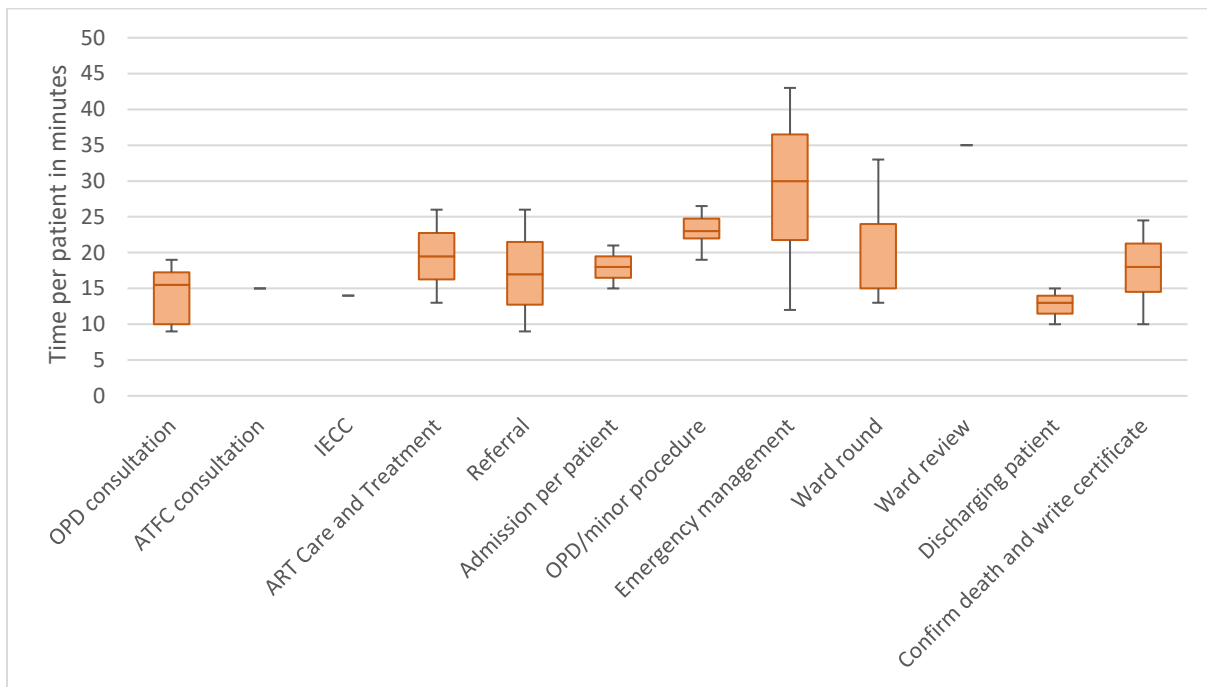


Figure 5. Variations in service standards for doctor's health service activities

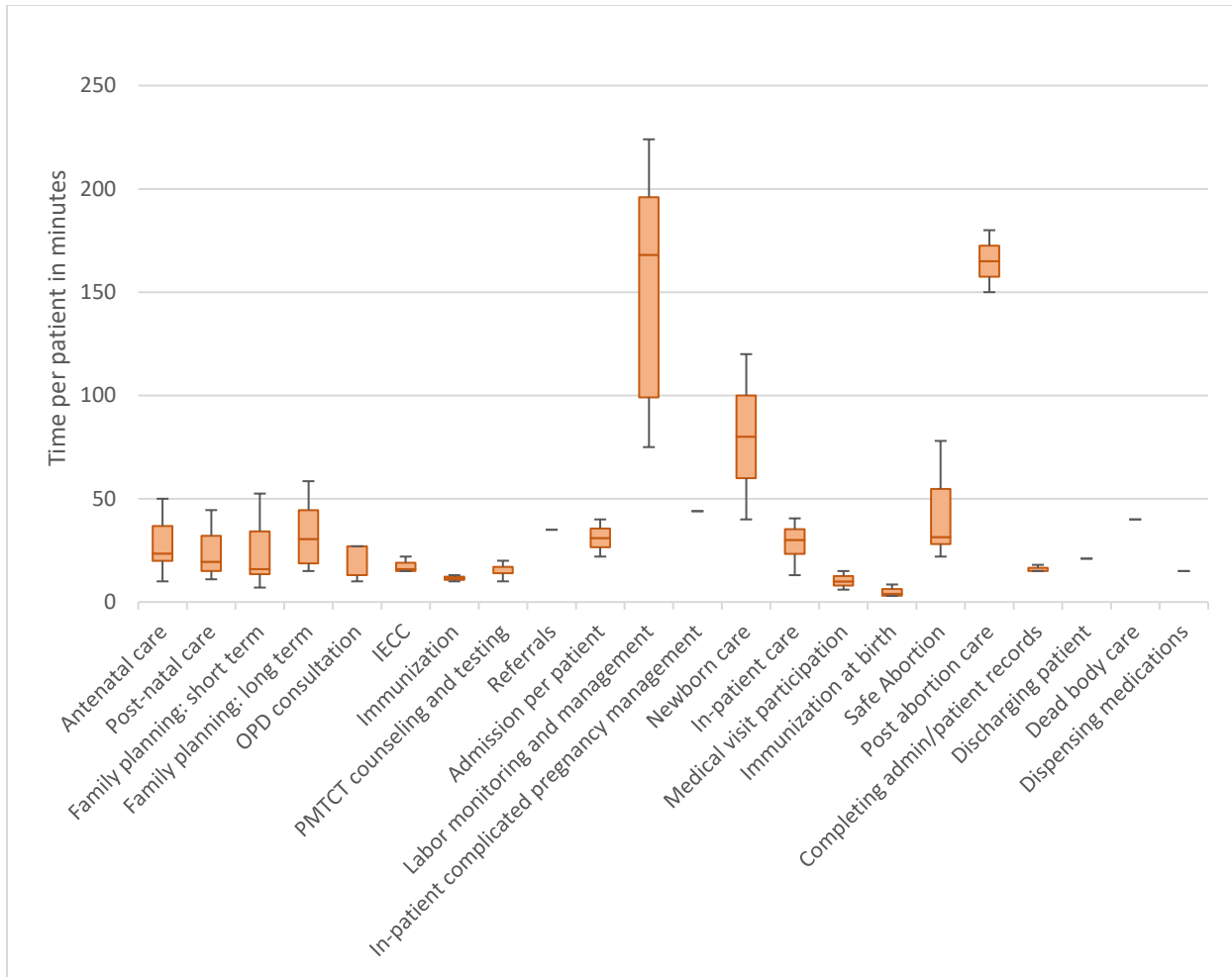


Figure 6. Variations in service standards for midwife health service activities

Table 7 presents a synthesis of the HSAS using median, mean, variance, and standard deviation to assess similarities and differences across different literature. Notably, 16% (9 out of 56) of the HSAS had only one value which indicates only one available literature source. Additionally, the midwife's health service activity "referral" had only two literature sources but the same value. 42% of health service activities presented significant variability in the performance time. Particularly noteworthy, substantial variances with SD ranging from 46 to 98 minutes are labour management, post-abortion care, and monitoring patients with ICU levels.

Table 7. Summary statistics for health service activity standards

Cadre	Health Activities	Median*	Mean*	Variance	SD**
Nurse	Patient assessment (triaging, vital signs and history taking)	11.5	11.5	4.5	2.121
	ATFC consultation	16	24.4	196.8	14.029
	Information-Education-Communication-Counselling (IECC)	17	18.2	20.7	4.55
	Immunization	11.5	15.3	69.643	8.345
	Antiretroviral treatment (ART)	23	23.8	160.7	12.677
	Controlling vital symptoms (e.g., Fever, blood pressure)	16.5	16.5	220.5	14.849
	Wound Care/dressing	26.5	23	98	9.899
	Admission processes per patient	19.5	17.3	23.583	4.856
	Administering medications	10	12	23.5	4.848
	Routine ER patient care (VS, IVF replacement, etc.)	5	4.8	1.2	1.095
	Providing nursing care to inpatients (e.g., VS, NGT feeding, etc.)	25	26.9	55.143	7.426
	Participation in medical visits	15	18	217	14.731
	Assisting OPD procedure / minor operation in the ER (e.g., Wound suturing)	32	32	50	7.071
	Blood or specimen sample collection for Lab test	14	11	37	6.083
	Oxygen therapy	11	11	0	0
	Monitoring patient with ICU levels	43	66	3703	60.852
	Referral to higher facility or for admission	21.5	27	401.6	20.04
	Discharging patient	16	17.3	5.333	2.309
	Dispensing medications	10	10	0	0
	Prepare dead body	38	44.7	177.333	13.317
Transfusion of blood	29	29	2	1.414	
Doctor	Outpatient consultations/curative consultations	15.5	15.25	31.929	5.651
	ATFC consultation	15	15	0	0
	IECC	14	14	0	0
	Enroll in ART	19.5	19.5	84.5	9.192
	Referral to higher facility or for admission	17	17.25	54.25	7.365
	Admission processes per patient	18	18	9	3
	OPD procedure / minor operation (e.g., Wound suturing)	23	23.75	20.917	4.573
	Emergency management	30	28.25	160.917	12.685

	Conduct daily ward round	15	18.6	35.3	5.941
	Ward review	35	35	0	0
	Discharging patient	13	12.667	6.333	2.517
	Confirm death and write death certificate	18	17.75	63.563	7.973
	Antenatal care	23.5	27.933	156.064	12.493
	Post-natal care	19.5	26.125	259.183	16.099
	Family planning: short term	16	25.567	404.531	20.113
	Family planning: long term	30.5	33.333	329.067	18.14
	OPD consultation	27	22.4	110.8	10.526
	IECC	16	17.6	11.8	3.435
	Immunization of women of reproductive age	11.5	11.5	4.5	2.121
	PMTCT counseling and testing	14	19	144	12
	Referrals	35	35	0	0
	Admission processes per patient	31	31	162	12.728
Midwife	Labor management	168	171	9578.125	97.868
	Inpatient management of complications of pregnancy	44	44	0	0
	Newborn care	80	80	3200	56.569
	Inpatient care	30	31.833	259.767	16.117
	Medical visit participation	10	10.333	20.333	4.509
	Immunization at birth	4	5.25	10.917	3.304
	Safe Abortion	31.5	51.25	2122.25	46.068
	Post abortion care	165	165	450	21.213
	Completing admin/patient records	15	16	3	1.732
	Discharging patient	21	21	0	0
	Dead body care	40	40	0	0
	Dispensing medications	15	15	0	0

**Minute as unit of measurement; **Standard Deviation*

4.2. WISN Method Results

This part of the results is divided into six sub-sections: Cadres, AWT, workload components, activity standards, staffing requirements, and analysis of the results. Data received from the health facility was entered in an Excel calculator tool and further analyzed.

4.2.1. Cadres

Table 8 presents the number of staff per cadre and department. There are 18 nurses, 15 midwives, and 13 doctors/clinical officers. It is good to note that the nurses and midwives are assigned to specific departments while doctors and clinical officers cover rotation across all departments.

Table 8. Hospital workforce by cadre and department

Department	Nurses	Midwife	Doctors	Clinical Officers
Pediatric Ward	6	0	4	9
Adult Ward		0		
Trauma Ward		0		
Isolation/Outbreak Ward		0		
Emergency	4	0		
ICU		0		
HIV/TB Ward	1			
Malnutrition Ward	1	0		
OPD	7	2		
SGVB*	0	2		
Maternity-Neonatal Ward	0	9		
TOTAL	18	13		

*SGVB: Sexual and gender-based violence

4.2.2. Available Working Time

Health facilities and cadres may present different working availability. The humanitarian hospital in the study demonstrated a similar AWT of 1656 hours for the doctor/clinical officers and nurses, as presented in Table 9. On the other hand, midwives have fewer working hours due to higher circumstantial leave because 4 staff went on maternity leave during the study period. The circumstantial leave includes unpaid, maternity, paternity, marriage, and compassionate leaves.

Table 9. Available working time for each cadre

Cadre	Working days in one week	Working hours per day	Number of Public Holidays in a year	Number of annual leaves per year	Average number of sick leave per year	Average number of circumstantial leave per year	Possible working days in a year	Possible working hours in a year
Doctor/Clinical Officer	5	8	11	25	9	8	207	1656
Nurse	5	8	11	25	9	8	207	1656
Midwife	5	8	11	25	9	38	177	1416

4.2.3. Workload Components

The initial workload components included in the study were obtained from the literature review integration. The health facility was provided with the integrated health service activities, additional activities, and support activities list shown in Appendix 2-4. The hospital management team and cadre supervisors selected the workload components included in the services of the health facility. The modified health service activities of the different cadres are shown in Appendix 7-9. ATFC consultation and cervical cancer screening were removed from the list because they were not offered in the hospital health services. The IECC and ART were excluded from all cadres as the hospital has different cadres performing these tasks. Furthermore, immunization and referrals in the OPD are only performed by nurses, and blood transfusion is conducted solely in the ICU department. An OPD health service activity of wound care/dressing for the nurses was added.

Support activities and additional activities were modified based on the reported data from the health facility found in Appendix 10.

4.2.4. Activity Standards

Modified workloads discussed in the previous section were used to identify the activities needed for the activity standards. The median of the set of values of each HSAS was used in the study due to spread out or dispersed time between literature sources. Furthermore, two new health service activities were developed to combine specific health service activities from the literature to have a more generalized activity. The first activity is “emergency medical management” for the doctors. The health service activities combined were

emergency management for road traffic accidents and minor, moderate-to-severe, and critically ill medical management interventions. The second is the “labour management” for the midwife, wherein labour monitoring and management plus normal delivery and assisted deliveries were combined. The reason for combining these health service activities is the lack of specific health facility data for precise activities.

CAS for the cadres ranges from 11% to 30%. The nurses exhibited the highest percentage of 30%, followed by the midwives’ 25% and 11% for the doctors/clinical officers. The nurses had 12 activities, while doctors/clinical officers and midwives had 9 and 8, respectively. Consistently, the nurses had the highest IAS of 640 hours, compared to 480 hours for doctors/clinical officers and 200 hours for midwives. The reason is that more newly recruited nurses needed supervision during the study period. On the other hand, the doctors/clinical officers had more staff that received training. Both CAS and IAS are illustrated in detail in Appendix 10.

4.2.5. Staffing Requirements

The three activity standards should be factored together to calculate the actual staffing requirement for each cadre. The staff requirement to perform the health service activities were calculated for each cadre using the annual workload data from the health facility and the estimated standard workload (see Appendix 7-9). The CAF and IAF were then accounted for in the calculation shown in Table 10. The total workforce required for the hospital is 58 nurses, 29 doctors/clinical officers, and 14 midwives. The numbers are rounded off after getting the total for each cadre.

Table 10. Staffing need based on WISN method

Cadre	Department	Staffing need for health service activities	Required number
Nurses	Pediatric-Adult-Trauma-Isolation Wards	3.2	5.0
	ER-ICU	9.9	14.6
	HIV/TB Ward	0.1	0.5
	Malnutrition Ward	0.7	1.4
	OPD	24.5	35.7
	Maternity-Neonate Ward	0.2	0.7
	CAF		1.437
	IAS		0.386
		Total required number	58

	All departments	25.089	29
Doctors- Clinical Officers	CAF		1.123
	IAS		0.290
	Total required number		29
Midwife	OPD (ANC, PNC, FP, curative)	3.6	5.060
	SGVB	0.4	0.682
	Maternity-Neonate Ward	6.1	8.415
	CAF		1.364
	IAS		0.141
	Total required number		14

The nurses and midwives were allocated to specific departments to perform their tasks, looking back at Table 8. Figure 7 and 8 illustrates the actual and required nurses and midwives per department. OPD have the highest need for both cadres.

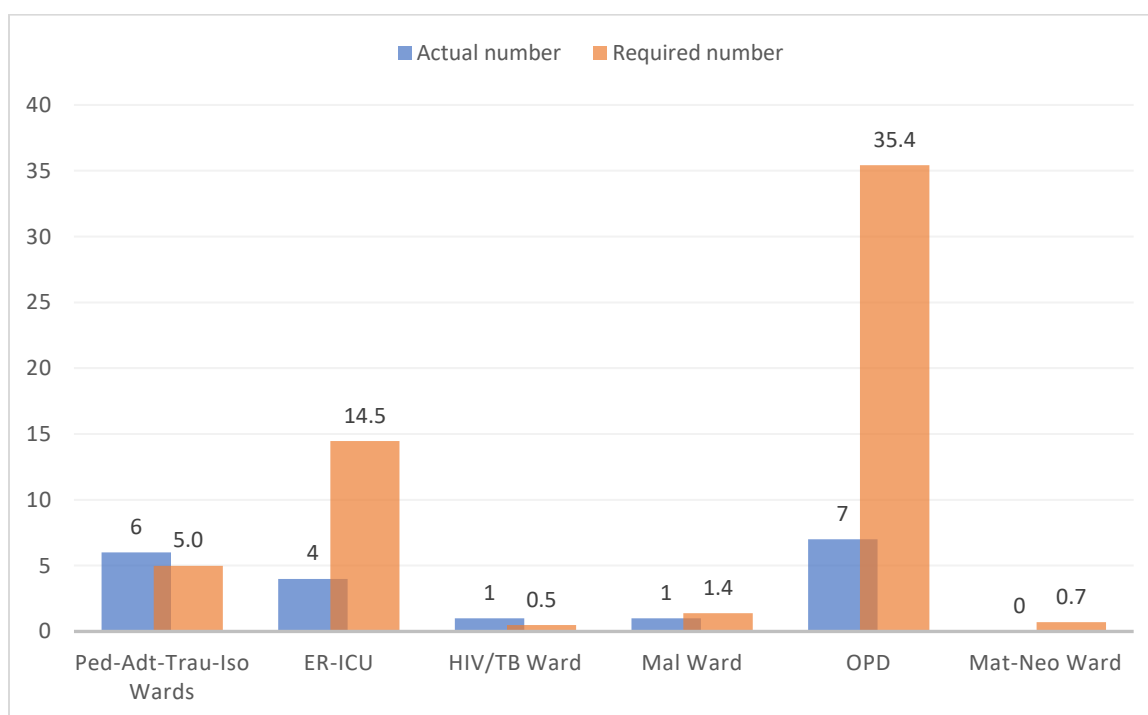


Figure 7. Comparison of actual vs required nurses

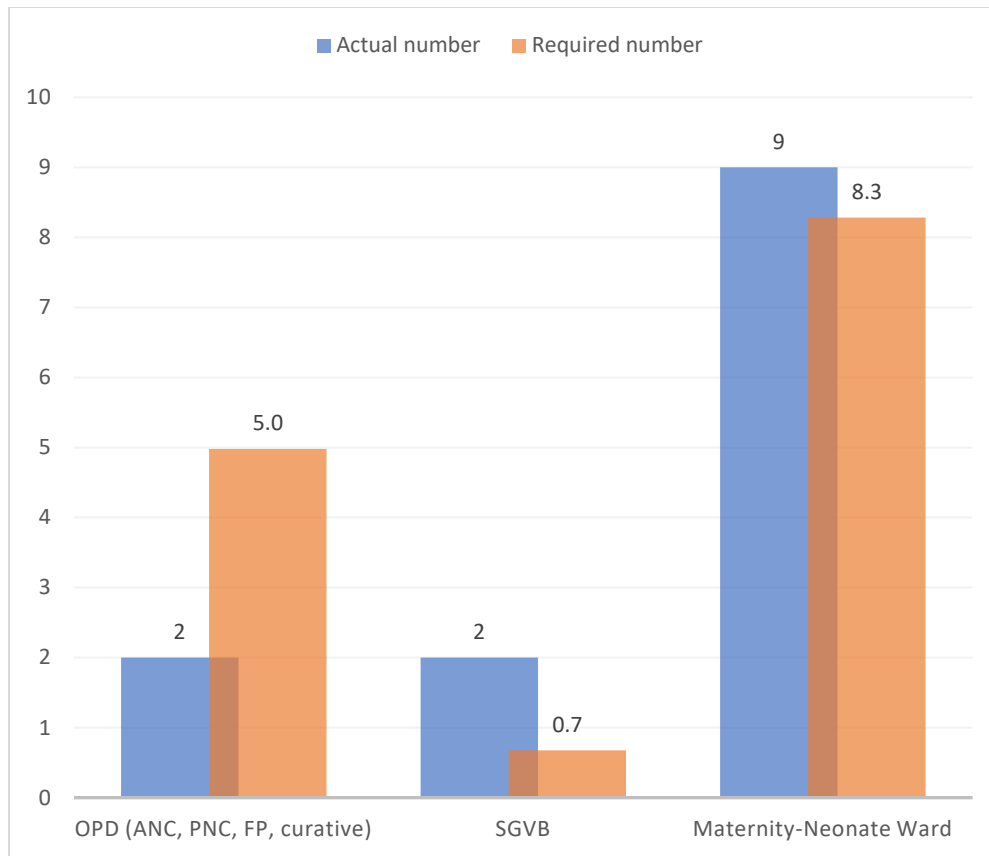


Figure 8. Comparison of actual vs required midwives

4.2.6 Staffing Analysis

Following the calculation of staff using the WISN method, there is an overall staff shortage among all cadres. The cadres' deficit included 39 nurses, 16 doctors/clinical officers, and 1 midwife. Since nurses and midwives are assigned to specific departments, a breakdown WISN calculation of the departments' staff was carried out. Table 11 revealed a surplus of 1 and 0.5 nurses in the Pediatric-Adult-Trauma-Isolation and HIV/TB wards, respectively. The SGVB and maternity-neonate wards also depicted more surplus than other cadres, with 1.3 and 0.7 midwives. Overall, OPD and ER-ICU nurses have the highest workload pressure. Based on the calculation, the neonatal ward didn't have any actual nurses, exhibiting a very high workload pressure.

Table 11. Analyzing WISN results

Cadre	Department	Actual number	Required number	Shortage/ Surplus	WISN Ratio	Workforce Problem	Workload Pressure
Nurses	Pediatric-Adult-Trauma-Isolation Wards	6	5.0	1.0	1.2	Surplus	None
	ER-ICU	4	14.5	-10.5	0.3	Shortage	Very High
	HIV/TB Ward	1	0.5	0.5	2.0	Surplus	None
	Malnutrition Ward	1	1.4	-0.4	0.7	Shortage	High
	OPD	7	35.4	-28.4	0.2	Shortage	Very High
	Maternity-Neonate Ward	0	0.7	-0.7	0.0	Shortage	Very High
Doctors-Clinical Officers	All departments	13	28.3	-15.3	0.5	Shortage	High
Midwife	OPD (ANC, PNC, FP, curative)	2	5.0	-3.0	0.4	Shortage	High
	SGVB	2	0.7	1.3	3.0	Surplus	None
	Maternity-Neonate Ward	9	8.3	0.7	1.1	Surplus	None

Calculations using the NGO calculator tool and guidelines showed a need for 42 nurses, 16 doctors/clinical officers, and 13 midwives (see Appendix 11). Comparing the results to WISN and analysing the workload using ratio and difference seen in Table 12 showed some differences. The results revealed a shortage of doctors and nurses with high and very high workload pressure, respectively. On the other hand, the midwives have the same number of actual staff as the NGO HR tool, unlike in WISN with 1 shortage.

Table 12. Comparison of WISN with the NGO HR tool

Cadre	Actual Number	NGO HR Tool			WISN method		
		Required	Workforce Problem	Workload Pressure	Required	Workforce Problem	Workload Pressure
Nurse	19	42	Shortage: 42	Ver High	58	Shortage: 39	Very High
Doctor	13	16	Shortage: 3	High	29	Shortage: 16	Very High
Midwife	13	13	None	None	14	Shortage: 1	High

CHAPTER 5: DISCUSSION

This section will provide a detailed analysis and interpretation of the study findings based on the research objectives.

5.1. Introduction and Summary of Findings

Humanitarian settings often occur in fragile contexts where HCWs have higher demand due to patient surge, accessibility and availability are compromised by insecurity, and loss of productivity due to insufficient support. South Sudan, a country undergoing prolonged humanitarian aid, needs efficient and effective strategies to prevent wastage of the limited HR and financial resources. This study is the first to analyse the workload of doctors, nurses, and midwives in a humanitarian setting. It employed a quantitative analysis that combined a literature review and secondary data to calculate staffing using the WISN method in an NGO-operated hospital in Lankien, South Sudan.

The study's findings revealed that integrating HSAS from different countries is possible. Using the HSAS from literature in calculating the WISN method in a humanitarian setting provides practicality. These settings make the fieldwork challenging because it is often insecure, and the workforce is strained to participate in the study. Results showed the hospital's shortage of doctors, nurses, and midwives with the highest workload pressure at the OPD and ER-ICU departments.

5.2. Consolidation and integration of health service activity standards

Health service activities and the time it is performed by a motivated and trained HCW, also called HSAS, are vital in calculating the staffing need using the WISN method. In the study, consolidation and integration of literature sources were conducted to produce this HSAS. Two literature sources offer contrasting findings on the consolidation of health activity standards. A study by Kunjumen et al. concluded that it is “inappropriate to develop activity standards to be adopted or adapted from one country to another despite the seeming similarity in the defined workload components and their related sub-components for reproductive maternal and child health at the PHC level”. On the other hand, Ahmat et al. presented a 12 African country harmonization of HSAS. Some low and high variations were acknowledged, but it was concluded that the findings are “helpful to countries in defining and setting health activity standards”. This study attempted to integrate the different health activity service standards from LIC to LMIC, covering primary health care to tertiary level, to further challenge the currently available literature. All the available resources the author could find were included based on the set inclusion criteria. A total of 19 literature sources from 20 countries were included, 7 from LIC and 13 from LMIC (refer to Appendix 1). This study was able to produce an integrated HSAS due to the inclusion of a multitude of countries with similar economic levels and grouping it into two categories of OPD and IPD, making it more feasible. The integration showed the least variations for the HSAS among doctors; this is similar to the findings by Ahmat et al. 1 on the harmonization of HSAS in 12 African countries.

Furthermore, the most extensive variation of activities in the study was by midwives. Two midwife activities were similar to Ahmat et al. study findings of having wide variations: labour management and family planning. Also, a similar result was observed for nurses' referral activity, revealing one

of the most prominent variations. Conversely, the study by Kunjumen et al. was doubtful of the integration of HSAS; the reason for this is the limited number of countries included and differences in their economic levels, heterogeneity in scope and service coverage, and resource availability.

A large variety of health service activities and substantial variances among several HSAS can be possibly attributed to factors such as motivation, skills, available resources, data collection method, and practices of each context. This study recognised the need to standardise service packages and data collection methods for low-resource settings. Several WISN studies have recommended having this standardisation (36,40,51). Making standardised HSAS will help new health facilities or those with limited resources to conduct their WISN method efficiently and optimise their HR. It will also aid in planning during acute crises and for humanitarian response to simplify WISN method calculation and efficiently allocate their resources.

5.3. WISN methodology using existing data and literature review

A one-year retrospective data and HSAS integration from the literature were used to analyse the staffing need of a health facility providing humanitarian aid. The existing health service data were not built for WISN methodology, and there is no standardised HSAS. Still, the study has revealed that calculating staff using workload analysis is adaptable and feasible in this context.

5.3.1. Cadres and the Available Working Time

Three groups of HCWs were included in the study. They are all critical HR needs in a hospital. These three cadres are always the top priority on all literature sources from the LIC and LMIC (36,40,51,52). Performance of tasks per cadre varies. Their roles revolve around curative activities in the NGO health facility's primary and secondary services.

Nurses were rostered and grouped to perform their tasks departmentally or by a combination of several departments; ER and ICU together, the paediatrics, adults, trauma, and isolation were combined, and the rest were independent departments. Grouping the workforce in different departments makes the HR increase efficiency and caseloads manageable while maintaining the quality of care. It will allow practicality in the supervision and monitoring of the staff (53,54).

The midwives all function within the maternity department, which comprises outpatient, inpatient, and SGBV. Additionally, the neonatal ward is incorporated within the maternity since this group of patients comes with their post-partum mothers. It will facilitate integrated care for both the newborn and the mother. Also, midwives are known champions of breastfeeding and kangaroo care which can impact the recovery of the sick neonate. On the other hand, the midwives in South Sudan are not trained in nursing care, which can impede them in providing critical medical intervention to neonates without supplementary training (55–57).

The doctors were low in number in the hospital; hence they cannot be departmentalized. They work on a rostered schedule that covers all departments. Furthermore, this cadre functions similarly to another cadre, the clinical officers. In the calculation of WISN in the study, these two cadres were combined because the health service activities are the same and performed cohesively. The main advantage of using clinical officers are reduced training requirements, retention in rural

areas, and lower employment costs; it helps several countries in Sub-Saharan Region to alleviate the shortage of doctors (49,50,58). Furthermore, several works of literature have documented minimal differences in patient outcomes (58).

AWT for the cadres are similar except for the midwives. The reason for this is the midwives have a female workforce, unlike the other two cadres. 31% of the midwives were away for an average of 98 days each. A temporary replacement is usually hired, either a daily worker or a temporary contract worker; this can affect the quality of care. A potential risk to patient safety can emerge due to unfamiliarity with the clinical guidelines, limited familiarity with various work elements, and less time for orientation and opportunities for training as a regular employee would have (59).

All the study cadres need to cover the different departments rendering 24-hours services: ER and IPD. The calculation of the AWT took into account that the maximum working hours in a week is 40 hours, 8 hours for 5 days. The staff may be rostered on a night shift between 12-16 hours but ensuring to be at most 40 hours per week or 176 hours per month.

Comparing the AWT from other countries belonging to LIC and LMIC, this health facility has 1656 hours for nurses and doctors/clinical officers, while 1416 hours for midwives are reasonable. Multiple WISN studies in Appendix 1 reported AWT ranging from 1030 to 2021 hours. The Ethiopian WISN study for midwives had the lowest AWT, while a Vietnamese study on nurses had the highest (60,61). The variation was due to the difference in mandatory training days for all staff and daily working hours. This study included training days on support and additional activities as it is assessed on a need basis rather than mandatory.

5.3.2. Staffing Needs and Workload Pressure

It was hypothesized that the workload is higher in humanitarian settings. South Sudan's more than four decades-long conflicts and instability suffers a long-term public impact caused by the deterioration of infrastructures, supply chain, and healthcare workforce (62,63). Only 43% of the country's health facilities are working, and with sporadic targeting of humanitarian workers, the health service delivery is at risk of non-expansion and withdrawal of services (62,64). HCWs in humanitarian settings suffer high workload pressure from their job and risk losing their jobs and, even worse, their lives. This study has validated that the workload pressure is very high for two cadres: nurse and doctor/clinical officer. The deficit is 203% for nurses and 118% for doctors/clinical officers. All literatures included in the study analysing workload of doctors, nurses, and midwives showed shortages and moderate to very high workload pressure, except for one study in Burkina Faso showing adequate and overstaffing of midwives (37–49)

Moreover, the department showing the highest staff shortage was the OPD for both cadres, but ER-ICU concurrently showed a considerable lack of nurses. It can be associated with an increased need for primary healthcare services within the geographical location of the health facility. And it is further substantiated by the doctors/clinical officers' highest workload of OPD consultations.

An uncommon finding is that the midwives have no workload pressure and have a surplus of staff in the IPD and SGBV clinics. Comparing the workload in their OPD, where there is high pressure and shortage, this might be a cause of concern because those attending their ANC must return to

deliver safely in the health facility. Further investigation is needed as South Sudan has one of the highest maternal and neonatal mortality in the world.

The results from the NGO HR tool were also analysed by comparing the ratio and difference with the actual staff numbers to validate the result obtained from this WISN study. Overall, the results showed similarities in the shortage of doctors and nurses while the midwives were adequately staffed. Notably, the NGO HR tool exhibits more need for IPD nurses. One factor to consider in the results difference could be the lack of existing guidelines on calculating nurses in the OPD, except for vaccination.

Moreover, the OPD calculation for midwives was based on ANC and PNC consultation without specifying other services such as family planning and SGVB. There can be an underestimation because of the limited statistics. The NGO guidelines based on staffing ratio are almost a decade old, and it is recommended to assess and update the applicability based on the evolving humanitarian response.

5.4 WISN Method in Humanitarian Settings

Calculation of the healthcare workforce can be challenging. Several factors should be considered to produce an effective and efficient HR pool that can respond to the population's health needs. The NGO HR calculator tools are based on the staffing ratio approach. Unlike WISN, workload components are taken into account, and it calculates the workload pressure of each healthcare workforce cadre. It will provide an effective way of assessing the workforce need, avoiding wastage of resources in the tightened humanitarian aid funding. It will also give the "human" aspect of calculating HR since it will consider each cadre's different workload statistics (annual and standard).

On the other hand, humanitarian settings are such a complex environment. Staff may suffer stress outside work, burnout, and demotivation. It is good to consider that most of the workforce are victims of the fragility of the context itself, and they may be functioning for survival. And WISN is calculated using the performance time of a motivated and trained staff which is unlikely in this context. Hence there may be an underestimation of the actual need.

5.5. Implications of finding for policy, practice, and future research

This study highlighted workforce shortages and high workload pressures with inequity in the distribution of staff within the hospital. Understaffing HCW cadres results in exhaustion that will eventually lead to decrease productivity, low motivation, and quality of care, and patient safety may be affected. On the other hand, overstaffing leads to wastage of precious resources. This evidenced-based WISN study will provide important information to the organisation's policymakers as they seek to improve their HR policies, guidelines, and tools. The South Sudan Ministry of Health (MoH) will also benefit from having the first WISN method study in the country to have a baseline assessment of staffing needs in the health facilities in the country's rural area. A

workload analysis tool for calculating HCW in a humanitarian context like South Sudan will help in resource planning, development, and allocation. It can generate interest in the national and organisational application of the WISN method after more extensive field-based research of the HSAS and adjustment of collected data based on WISN.

5.6. Study strengths, weaknesses, limitations

Integrating the health service activities and standards was feasible using LIC and LMIC literature sources that have provided a wide variety of settings that improve generalisability and external validity. Clustering health services into joint hospital departments such as OPD, IPD, ICU, and ER enhances organization. Furthermore, recategorizing specific activities that target similar health services into a broader term will make it more suitable and comprehensive for setting activity standards. Using existing data and literature also provided sustainable research wherein time efficiency and cost-effectiveness were demonstrated.

On the other hand, setting activity standards requires accuracy to represent the workload better. If there is an overestimation or underestimation, it will greatly impact the staffing requirements. Since the HSAS has dispersed data sets, the median was used to mitigate the spread, but the accuracy is not guaranteed. Health service data statistics gaps and mismatched with the integrated HSAS (e.g., referrals are only recorded in the ER, and blood transfusion is only facilitated in ICU) present another area for the study's improvement. Again, It poses a challenge in underestimating or overestimating the actual staffing need. Lastly, the WISN study has never been conducted in South Sudan or any humanitarian hospital. South Sudan is included among LIC, but there is minimal literature on WISN in these settings, particularly for doctors.

The researcher had restricted access to health facilities in humanitarian settings and had time limitations in conducting this research. Approval from an NGO and South Sudan MoH was needed, and depending on the type of study design, it can take 1-6 months. Due to this, the study used a literature review for setting service standards for the different workload components. This data consolidation from the varying study designs may present huge variance and limited triangulation. Furthermore, this study acknowledges the differences in activities in each health facility and the capacities of individual HCWs.

There will never be a perfect activity standard that can be used in all settings. Expert opinions differ from actual time-motion studies. Furthermore, even time-motion study differs from one another. Individual HCW motivation and capacity, environment, and skills are all significant factors in the variability of the activity standards. It is good to know that what you need in the WISN method is a realistic estimation.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1. Conclusion

The WISN method can be effectively calculated in a humanitarian setting using integrated health activity standards from reports and research, together with the secondary service data of a hospital. Analysing the workload of Lankien, South Sudan Hospital, it revealed a shortage of doctors and nurses. Additionally, very high workload pressure for doctors and nurses was unveiled. On the other hand, examining the midwives HR situation gave minor differences in the results, it showed adequate numbers in the NGO HR tool while a shortage of 1 in the WISN method.

Calculating workload is a better tool for HR because it takes account of various factors, such as the specific tasks of each cadre, the number of patients, and other related activities outside of patient care. It also allows precise determination of staff and the unique demands of each department. It will ensure overall efficiency and cost-effectiveness in allocating staff based on patient needs.

Factoring all the circumstances, WISN method might have a more accurate results as the NGO HR tool that may have underestimated the task requirement for the cadres particularly in the OPD. The WISN method in this study have also highlighted two gaps beyond HR; the need for more primary healthcare services within Lankien, South Sudan and the need to further assess safe delivery within the County.

Therefore, results have validated the hypothesis that there is a higher workload pressure in the humanitarian settings. If this shortage is addressed, it will improve working conditions for health professionals and provision of better-quality patient care.

6.2. Recommendations

Knowing the preliminary WISN study in South Sudan, it is imperative to address several issues. It is recommended to:

1. Use workload analysis for HR calculation, such as the WISN method, to have a more suitable working condition amongst HCWs in humanitarian settings to prevent staff burnout, reduce errors, improve patient safety, and better patient satisfaction. It will also give a more efficient and effective way to manage human resource.
2. Addressing the shortages can be done innovatively, such as skill-mix changes with proper planning and training. It will create a cost-effective approach without sacrificing quality of care.
3. There is a necessity for a comprehensive assessment to determine the need for primary healthcare and further evaluation of safe delivery of women within Nyirol County.
4. Further research is needed to validate and adopt the HSAS in a humanitarian setting using time-motion and expert panel integration study methods.

In improving the quality of clinical care in humanitarian settings, there is a need to address the HR gap.

REFERENCES

1. UNICEF. UNICEF. 2023 [cited 2023 Jun 26]. Glossary UNICEF Core Commitments for Children. Available from: <https://www.corecommitments.unicef.org/ccg-glossary>
2. World Health Organization. CBR Guidelines Community-Based Rehabilitation Supplementary booklet [Internet]. Geneva; 2010. Available from: www.iniscommunication.com
3. Law Insider. Law Insider. 2023 [cited 2023 Jun 27]. Humanitarian Organization Definition | Law Insider. Available from: <https://www.lawinsider.com/dictionary/humanitarian-organization>
4. World Health Organization. Health Emergency and Disaster Risk Management Framework. 2019.
5. Iserson K V. Tackling the global challenge: Humanitarian catastrophes. Vol. 15, *Western Journal of Emergency Medicine*. eScholarship; 2014. p. 231–40.
6. Embassy of South Sudan Embassy - Norway. South Sudan Embassy. [cited 2023 Jun 26]. Culture of South Sudan. Available from: <https://www.embrss-norway.org/culture/>
7. World Bank. The World Bank Group. 2023 [cited 2023 Jun 26]. World Bank Country Classification. Available from: <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>
8. United Nations Office for the Coordination of Humanitarian Affairs. South Sudan Humanitarian Snapshot April 2023. 2023.
9. World Health Organization. World Health Organization. 2023 [cited 2023 Jun 26]. South Sudan crisis. Available from: <https://www.who.int/emergencies/situations/south-sudan-crisis>
10. UNICEF. Humanitarian Action for Children South Sudan [Internet]. 2023. Available from: www.unicef.org/appeals/south-sudan
11. Fragile States Index. The Fund For Peace. [cited 2023 Jun 26]. Fragile States Index Country Dashboard. Available from: <https://fragilestatesindex.org/country-data/>
12. Jordan K, Lewis TP, Roberts B. Quality in crisis: a systematic review of the quality of health systems in humanitarian settings. Vol. 15, *Conflict and Health*. BioMed Central Ltd; 2021.
13. United Nations Office for the Coordination of Humanitarian Affairs. Reliefweb. 2023 [cited 2023 Jun 26]. Global Humanitarian Overview 2023. Available from: <https://reliefweb.int/report/world/global-humanitarian-overview-2023-enaesfr>
14. Widdig H, Tromp N, Lutwama GW, Jacobs E. The political economy of priority-setting for health in South Sudan: a case study of the Health Pooled Fund. *Int J Equity Health* [Internet]. 2021 [cited 2023 Jun 26];21:68. Available from: <https://doi.org/10.1186/s12939-022-01665-w>
15. United Nations Office for the Coordination of Humanitarian Affairs. United Nations Office for the Coordination of Humanitarian Affairs. [cited 2023 Jun 26]. About OCHA South Sudan. Available from: <https://www.unocha.org/south-sudan/about-ocha>
16. Kohrt BA, Mistry AS, Anand N, Beecroft B, Nuwayhid I. Health research in humanitarian crises: An urgent global imperative. *BMJ Glob Health*. 2019 Nov 1;4(6).
17. Anib VA, Achiek MM, Ndenzako F, Oluseun Olu O. South Sudan's Road To Universal Health Coverage: A Slow But Steady Journey. *Pan Afr Med J*. 2022 Jun 7;42(1):3.
18. World Health Organization. UHC-Partnership. 2021 [cited 2023 Jun 26]. South Sudan Universal Health Coverage Partnership. Available from: <https://extranet.who.int/uhcpartnership/country-profile/south-sudan>
19. World Health Organization. World Health Organization. 2014 [cited 2023 Jun 26]. Global Health Expenditure Database. Available from: <https://apps.who.int/nha/database/Select/Indicators/en>
20. Health Pooled Fund South Sudan. Access to Health Care in South Sudan: A Qualitative Analysis of Health Pooled Fund Supported Countries [Internet]. South Sudan; 2020 Dec [cited 2023 Jun

- 26]. Available from: <https://www.kit.nl/wp-content/uploads/2021/09/HPF3-Access-to-healthcare-study-A-qualitative-analysis-report.pdf>
21. OECD Development Co-operation Directorate. States of Fragility 2022 [Internet]. 5th ed. OECD publishing; 2022 [cited 2023 Jul 28]. (States of Fragility). Available from: https://www.oecd-ilibrary.org/development/states-of-fragility-2022_c7fedf5e-en
 22. Delforge D, Below R, Wathelet V, Speybroeck N. 2022 Disasters in Numbers. 2023.
 23. United Nations Office for the Coordination of Humanitarian Affairs. South Sudan Humanitarian Response Plan 2023. 2022 Dec.
 24. Ratnayake R, Degomme O, Roberts B, Spiegel P. Conflict and Health: Seven years of advancing science in humanitarian crises. Vol. 8, Conflict and Health. BioMed Central Ltd.; 2014. p. 1–6.
 25. Kunjumen T, Okech M, Diallo K, Mcquide P, Zapata T, Campbell J. Global experiences in health workforce policy, planning and management using the Workload Indicators of Staffing Need (WISN) method, and way forward. Vol. 19, Human Resources for Health. BioMed Central Ltd; 2022.
 26. Sousa A, Scheffler RM, Nyoni J, Boerma T. A comprehensive health labour market framework for universal health coverage. Vol. 91, Bulletin of the World Health Organization. World Health Organization; 2013. p. 892–4.
 27. World Health Organization. The world health report 2006 : working together for health. World Health Organization; 2006. 209 p.
 28. World Health Organization. World health statistics 2023: monitoring health for the SDGs, Sustainable Development Goals [Internet]. 2023. Available from: <https://www.who.int/publications/book-orders>.
 29. UNICEF. Education in South Sudan Briefing Note. 2021.
 30. The World Bank. World Bank Group. 2023 [cited 2023 Jul 12]. The World Bank Database: Literacy rate South Sudan. Available from: <https://data.worldbank.org/indicator/SE.ADT.LITR.ZS?locations=SS>
 31. Ministry of Health South Sudan. Ministry of Health - Republic of South Sudan. 2023 [cited 2023 Jul 13]. Medical Training and Professional Development. Available from: https://moh.gov.ss/medical_training_and_professional_development.php
 32. The United Nations Population Fund. Opening for Consultancy Job Title: Human Resources for Health Lead Consultant. UNFPA South Sudan Country Office. Juba, South Sudan: UNFPA South Sudan; 2022.
 33. Witter S, Falisse JB, Bertone MP, Alonso-Garbayo A, Martins JS, Salehi AS, et al. State-building and human resources for health in fragile and conflict-affected states: Exploring the linkages. Vol. 13, Human Resources for Health. BioMed Central Ltd.; 2015.
 34. Coates A, Fuad AO, Hodgson A, Bourgeault IL. Health workforce strategies in response to major health events: a rapid scoping review with lessons learned for the response to the COVID-19 pandemic. Hum Resour Health. 2021 Dec 1;19(1).
 35. Goetz O, Schmidt JO, Broch Alvarez V, Blackaby S, Seksenbaeva D. Using the Workload Indicator of Staffing Need (WISN) – Method to model the HR requirements and costs of Health Care Services in Kyrgyzstan. SHS Web of Conferences. 2022;131:02002.
 36. Asamani JA, Christmalls C Dela, Reitsma GM. Health Service Activity Standards and Standard Workloads for Primary Healthcare in Ghana: A Cross-Sectional Survey of Health Professionals. Healthcare [Internet]. 2021 [cited 2023 Jun 26];9(332). Available from: <https://doi.org/10.3390/healthcare9030332>
 37. Morice K, De Groote N. Staff ratio and work organization. Brussels: Medecins Sans Frontieres; 2014.

38. Okoroafor SC, Ahmat A, Osubor M, Nyoni J, Bassey J, Alemu W. Assessing the staffing needs for primary health care centers in Cross River State, Nigeria: a workload indicators of staffing needs study. *Hum Resour Health*. 2022 Jan 1;19.
39. World Health Organization. *WISN User's Manual*. 2nd Version. Geneva: World Health Organization; 2010.
40. Ahmat A, Millogo JJS, Illou MMA, Maritza T, Bamogo F, Okoroafor SC, et al. Workloads and activity standards for integrated health service delivery: insights from 12 countries in the WHO African region. *BMJ Glob Health*. 2021;7.
41. Dovlo D. Wastage in the health workforce: Some perspectives from African countries. Vol. 3, *Human Resources for Health*. 2005.
42. Al-Sawai A, Al-Shishtawy MM. Health Workforce Planning: An overview and suggested approach in Oman. *Sultan Qaboos Univ Med J*. 2015;15(1):27–33.
43. MSF Lankien Project. Jonglei Secondary Health Care Siterep June 2023. Lankien; 2023 Jun.
44. Joselow G. Voice of America. 2015 [cited 2023 Aug 3]. Population Under Pressure in South Sudan Opposition Territory. Available from: <https://www.voanews.com/a/population-under-pressure-in-south-sudan-opposition-territory/2687530.html>
45. National Bureau of Statistics South Sudan. POPULATION DISTRIBUTION BY SEX BY BOMA [Internet]. 2013 [cited 2023 Aug 3]. Available from: https://web.archive.org/web/20171114004041/http://www.ssnbss.org/sites/default/files/2016-08/boma_populations_southern_sudan.pdf
46. Medair. Assessment report Emergency Response Team-WASH & SNFI Lankien and Pultruk of Nyirol County, Jonglei State. Jonglei State; 2022.
47. United Nations Office for the Coordination of Humanitarian Affairs. Inter-Agency Rapid Needs Assessment IRNA Report: Lankien, Jonglei State [Internet]. 2020. Available from: <http://southsudan.humanitarianresponse.info/>
48. Okech O, Duclos D. Roles of local healthcare workers in the humanitarian response in South Sudan: a literature review. *South Sudan Medical Journal* [Internet]. 2022 Nov 25 [cited 2023 Aug 4];15(4):127–31. Available from: <https://www.ajol.info/index.php/ssmj/article/view/237011>
49. Wilson A, Lissauer D, Thangaratinam S, Khan KS, MacArthur C, Coomarasamy A. A comparison of clinical officers with medical doctors on outcomes of caesarean section in the developing world: Meta-analysis of controlled studies. *BMJ*. 2011 May 21;342(7807).
50. Mullan F, Frehywot S. Non-physician clinicians in 47 sub-Saharan African countries. *thelancet.com* [Internet]. 2007;370:2158–63. Available from: www.thelancet.com
51. Aytona MG, Politico MR, McManus L, Ronquillo K, Okech M. Determining staffing standards for primary care services using workload indicators of staffing needs in the Philippines. *Hum Resour Health*. 2022 Jan 1;19.
52. Mziray E, Gorgens M, McCauley Pamela. Draft Final Report of the Analysis of Human Resources for Health in Malawi through Implementation of a WISN Study in 75 Facilities. Washington DC; 2017 Jun.
53. Credentialing Resource Center. Credentialing Resource Center Digest. 2019 [cited 2023 Jul 30]. Should the medical staff be departmentalized? | Credentialing Resource Center. Available from: <https://credentialingresourcecenter.com/articles/should-medical-staff-be-departmentalized-0>
54. Govindarajan R. Moving on from CUSP to CUP: empowering multidisciplinary teams and integrating them in the management structure of hospital organization. *J Multidiscip Healthc* [Internet]. 2019 [cited 2023 Jul 30];12:257. Available from: [/pmc/articles/PMC6489672/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6489672/)
55. Bucyabahiga J. Nursing and Midwifery in Southern Sudan - Undersubscribed in a High Demand Environment [Internet]. Juba; 2010 Aug [cited 2023 Jul 30]. Available from:

- http://www.southsudanmedicaljournal.com/assets/files/Journals/vol_3_iss_3_aug_10/College%20of%20N&M.pdf
56. Hirata M, Omine F, Endo Y, Tamashiro Y, Kawamitsu K. Factors Affecting The Learning Implementation Of Midwife In-Service Training In South Sudan. *Int J Nurs Clin Pract* [Internet]. 2016 Feb 10 [cited 2023 Jul 30];2016(1). Available from: <https://www.graphyonline.com/archives/IJNCP/2016/IJNCP-167/index.php>
 57. World Health organization. World Helth Organization. 2023 [cited 2023 Jul 30]. Strengthening quality midwifery for all mothers and newborns. Available from: <https://www.who.int/activities/strengthening-quality-midwifery-for-all-mothers-and-newborns>
 58. Dovlo DY. Using mid-level cadres as substitutes for internationally mobile health professionals in Africa. A desk review. Vol. 2, *Human Resources for Health*. 2004.
 59. Page AEK. Chapter 27. Temporary, Agency, and Other Contingent Workers. United States; 2008.
 60. Asres GD. Workload Indicators of Staffing Need (WISN) Method for Midwives Planning and Estimation at Asrade Zewude Memorial Primary Hospital, North west Ethiopia. *Discover Health Systems*. 2023 Jan 10;2(1).
 61. Nguyen TTH, Phung HT, Bui ATM. Applying the workload indicators of staffing needs method in nursing health workforce planning: evidences from four hospitals in Vietnam. *Hum Resour Health*. 2022 Jan 1;19.
 62. Sami S, Amsalu R, Dimiti A, Jackson D, Kenyi S, Meyers J, et al. Understanding health systems to improve community and facility level newborn care among displaced populations in South Sudan: A mixed methods case study. *BMC Pregnancy Childbirth*. 2018 Aug 10;18(1).
 63. Jervase A. Forty years of primary health care programming and its future in South Sudan. *South Sudan Medical Journal*. 2019;12(2).
 64. Kenyi E. Stop killing healthcare workers in South Sudan. *South Sudan Medical Journal*. 2021;14(3):70.
 65. Millogo-Traore TFD, Ouedraogo-Drabo PRMJ, Yameogo P. Evaluation of the Adequacy between the Workload and the Number of State Midwives and Maieuticians Practicing in the Gynecology-Obstetrics Departments of the University Hospitals of Burkina Faso. *Open J Obstet Gynecol*. 2022;12(07):649–60.
 66. Ly A, Kouanda S, Ridde V. Nursing and midwife staffing needs in maternity wards in Burkina Faso referral hospitals. *Hum Resour Health*. 2014 May 12;12(1).
 67. Brenda Z. WORK LOAD INDICATORS OF STAFFING NEEDS FOR MIDWIVES AND NURSES OFFERING MATERNAL NEONATAL AND CHILD HEALTH SERVICES IN CHONGWE DISTRICT LUSAKA ZAMBIA. 2019.
 68. Kpebo D, Ly A, Yameogo WME, Bijou S, Bertrand Ivlabèhirè M, Tougri H, et al. Assessment of Staffing Needs for Frontline Health Workers in Selected Maternal and Child Health Services in 3 Countries of Sub-Saharan West Africa: Cote d’Ivoire, Burkina Faso, and Niger. *Health Serv Insights*. 2022 Jan 1;15.
 69. Kunjumen T, Okech M, Deki, Asamani JA, Mohamed N, Nuruzzaman M. Multi-country case studies on planning RMNCH services using WISN methodology: Bangladesh, Ghana, Kenya, Sultanate of Oman and Papua New Guinea. *Hum Resour Health*. 2022 Jan 1;19.
 70. Okoroafor SC, Oaiya AI. Using the workload indicators of staffing need method to determine the staffing requirements for primary healthcare service delivery in Nigeria. *J Glob Health Rep*. 2021 Oct 14;5.
 71. Shivam S, Roy R, Dasgupta S, Bhattacharyya D, Misra R, Roy S, et al. Nursing Personnel Planning for Rural Hospitals in Burdwan District, West Bengal, India, Using Workload Indicators of Staffing Needs. *J Health Popul Nutr*. 2014;32(4).

72. Ghorbani A, Rajaei R, Jamaly Z, Najafi M, Najafi M. Estimating Required Number of Nurses in Emergency Department of Imam Ali Hospital Affiliated by Alborz Province Using WISN Method. Evidence Based Health Policy, Management and Economics. 2019 Dec 23;
73. Joarder T, Tune SNBK, Nuruzzaman M, Alam S, De Oliveira Cruz V, Zapata T. Assessment of staffing needs for physicians and nurses at Upazila health complexes in Bangladesh using WHO workload indicators of staffing need (WISN) method. BMJ Open. 2020 Feb 13;10(2).
74. Ministry of Health - Royal Government of Bhutan. Workload indicators of staffing need (WISN) in selected health facilities of Bhutan. Thimpu; 2021.
75. Wundavalli LT, Agrawal US, Satpathy S, Debnath BR, Agnes TA. How much is adequate staffing for infection control? A deterministic approach through the lens of Workload Indicators of Staffing Need. Am J Infect Control. 2020 Jun 1;48(6):609–14.
76. Das S, Manna N, Datta M, Sengupta D, Baur B, Mundle M. A study to calculate the nursing staff requirement for the Maternity Ward of Medical College Hospital, Kolkata Applying WISN method. IOSR Journal of Dental and Medical Sciences (IOSR-JDMS) e-ISSN [Internet]. 2013 Jul;8(3):1–07. Available from: www.iosrjournals.org

APPENDICES

Appendix 1. Search Table

	Topic/Problem/Issue	<i>AND</i>	Factors related to the topic	<i>AND</i>	Geographical scope
<i>OR</i>	WISN		Health		Low-income
	Workload Indicator of Staffing Need		Nurses		Low-middle-income
	Workload		Doctors		LIC
	Staffing		Healthcare worker		LMIC
	Human Resource		Health workforce		South Sudan
	Human resource for health		Physician		Afghanistan
	Human resource tool		Clinical officer		Burkina Faso
	Human resource calculation				Burundi
	Human resource calculator				Central African Republic
	HR tool				Chad
	HR calculation				Democratic republic of Congo
					Togo
					Eritrea
					Ethiopia
					Gambia
					Guinea
					Guinea-Bissau
					North Korea
					Uganda
					Liberia
					Madagascar
					Malawi
					Mali
					Mozambique
					Noger
					Rwanda
					Sierra Leone
					Somalia
					Sudan
					Syria
					Yemen
					Zambia

					Algeria
					Angola
					Bangladesh
					Benin
					Bhutan
					Bolivia
					Cabo Verde
					Cambodia
					Cameroon
					Comoros
					Congo
					Cote D' Ivoire
					Djibouti
					Egypt
					El Salvador
					Eswatini
					Ghana
					Haiti
					Honduras
					India
					Indonesia
					Iran
					Kenya
					Kiribati
					Kyrgystan
					Lao
					Lebanon
					Lesotho
					Mauritania
					Micronesia
					Mongolia
					Morocco
					Myanmar
					Nepal
					Pakistan
					Papua New Guinea
					Philippines
					Samoa
					SaoTome & Principe
					Senegal
					Solomon Islands
					Sri Lanka

				Tajikistan
				Tanzania
				Timor-leste
				Tunisia
				Ukraine
				Uzbekistan
				Vanuatu
				Vietnam
				West bank & Gaza
				Zimbabwe

Appendix 2. Workload components form for nurses

Health Activities		Please put "x" on the Yes or No category.	
OPD		Yes	No
1	Patient assessment (triaging, vital signs and history taking)		
2	ATFC consultation		
3	Information-Education-Communication-Counselling		
4	Immunization		
5	Enroll in ART Care and Treatment		
6	Provide ART care and treatment		
7	Controlling vital symptoms (e.g., Fever, blood pressure)		
8	Dispensing medications		
9	Referral to higher facility or for admission		
10	Others: <i>Please specify by writing</i>		
ER		Yes	No
1	Admission processes per patient		
2	Assisting OPD procedure / minor operation (e.g., Wound suturing)		
3	Blood or specimen sample collection for Lab test		
4	Wound dressing		
5	Transfusion of blood		
6	Administering medications		
7	Routine patient care (VS, IVF replacement, etc.)		
8	Referral to other or higher facility		
9	Discharging patient		
10	Prepare dead body		
11	Dispensing medications		
12	Others: <i>Please specify</i>		

Inpatient: ICU/Pediatric/ITFC/Neonate/Trauma/Adult/HIV-TB/Outbreak		Yes	No	Comments (if specific ward perform the task, please indicate)
1	Admission processes per patient			
2	Providing nursing care to inpatients (e.g., VS, NGT feeding, etc.)			
3	Administering medications			
4	Participation in medical visits			
5	Blood or specimen sample collection for Lab test			
6	Oxygen therapy			
7	Monitoring patient with ICU levels			
8	Discharging patient			
9	Transfusion of blood			
10	Referral to other or higher facility			
11	Patient education and counselling			
12	Dispensing medications			
13	Prepare dead body			
14	Others: <i>Please specify by writing</i>			
Support Activities (all staff perform these activities)		Yes	If YES, how many minutes or hours per activity (e.g., 1 hour per month, year, day)	No
1	Handover/Takeover			
2	Department meeting			
3	Clinical audits/Mortality review			
4	General assembly meeting			
5	Daily report writing/patient census			
6	Patient documentation			
7	Administrative/Management responsibilities (e.g., Trolley cleaning, checking equipment, etc.)			
8	Order drugs from pharmacy			
9	Disaster drills or emergency preparedness drills			

10	Development of individual workplan (performance evaluation)				
11	Continuous professional development (trainings)				
10	Others: <i>Please specify (include time)</i>				
Additional Activities (a specific number of staff perform these activities, excluding supervisors of the departments)		Yes, if the one of the staff perform the task (excluding the supervisor of the department)	If YES, how many minutes or hours per activity (e.g., 1 hour per month)	How many staff perform this activity	No
1	Administrative/Management responsibilities (e.g., Supply and drug inventory of the shift leader))				
2	Roster/Schedule creation				
3	Escorting patient for referrals				
4	Attending other meetings (e.g., IPC)				
5	Conducting performance evaluation/appraisal				
6	Supervision of trainees/students/new recruits				
7	Provide trainings for other staff (Trainer)				
8	Individual continuous professional development (trainings/courses)				
9	Others: <i>Please specify (include time and number of staff)</i>				

Appendix 3. Workload components form for doctors

Health Activities		Please put "x" on the Yes or No category.		
OPD		Yes	No	
1	Outpatient consultations/curative consultations			
2	ATFC consultation			
3	Information-Education-Communication-Counselling			
4	Immunization			
5	Enroll in ART Care and Treatment			
6	Provide ART care and treatment			
7	Referral to higher facility or for admission			
8	Others: <i>Please specify by writing</i>			
ER		Yes	No	
1	Admission processes per patient			
2	OPD procedure / minor operation (e.g., Wound suturing)			
3	Emergency management - road traffic accident			
4	Emergency management – Obstetrics			
5	Interventions for minor (simple) medical emergencies			
6	Interventions for moderate-to-severe medical emergencies			
7	Interventions for critically ill medical emergencies			
8	Referral to other or higher facility			
9	Discharging patient			
10	Confirm death and write death certificate			
11	Dispensing medications			
12	Others: <i>Please specify by writing</i>			
Inpatient: ICU/Pediatric/ITFC/Neonate/Trauma/Adult/HIV-TB/Outbreak		Yes	No	Comments
1	Admission processes per patient			
2	Conduct daily ward round			

3	Discharging patient				
4	Ward review				
5	Referral to other or higher facility				
6	Patient education and counselling				
7	Confirm death and write death certificate				
8	Others: <i>Please specify by writing</i>				
Support Activities (all staff perform these activities)		Yes	If YES, how many minutes or hours per activity (e.g., 1 hour per month, year, day)	No	
1	Handover/Takeover				
2	Department meeting				
3	Clinical audits/Mortality review				
4	General assembly meeting				
5	Telemedicine consultation				
6	Development of individual workplan (performance evaluation)				
7	Monthly medical report				
8	Disaster drills or emergency preparedness drills				
9	Continuous professional development (trainings)				
10	Others: <i>Please specify (include time)</i>				
Additional Activities (a specific number of staff perform these activities, excluding supervisors of the departments)		Yes, if the one of the staff perform the task (excluding the supervisor of the department)	If YES, how many minutes or hours per activity (e.g., 1 hour per month)	How many staff perform this activity	No
1	Participate in management/coordination meeting				
2	Roster/Schedule creation				
3	Monthly medical report				

4	Conducting performace evaluation/appraisal				
5	Supervision of trainees/students/new recruits				
6	Provide trainings for other staff (Trainer)				
7	Individual continuous professional development (trainings/courses)				
8	Others: <i>Please specify (include time and number of staff)</i>				

Appendix 4. Workload components form for midwives

Health Activities		Please put "x" on the Yes or No category.	
OPD-Maternity		Yes	No
1	Antenatal care		
2	Post-natal care		
3	Family planning: short term		
4	Family planning: long term		
5	Outpatient consultations/curative consultations		
6	Information-Education-Communication-Counselling		
7	Immunization of women of reproductive age		
8	Provide prevention of mother-to-child transmission (PMTCT) counseling and testing		
9	Safe Abortion		
10	Post abortion care		
11	Referrals		
12	Cervical cancer screening and treatment		
13	Others: <i>Please specify by writing</i>		
IPD Maternity		Yes	No
1	Admission processes per patient		
2	Labor monitoring and management		
3	Normal delivery		
4	Assisted delivery		
5	Inpatient management of complications of pregnancy		
6	Newborn care		
7	Inpatient care per patient day (routine care for mother and baby)		
8	Participation in the medical visit		
9	Emergency care of the newborn		
10	Immunization at birth		
11	Safe Abortion		
12	Post abortion care		

13	Completing admin/patient records				
14	Discharging patient				
15	Dead body care				
16	Dispensing medications				
17	Others: <i>Please specify by writing</i>				
Support Activities (all staff perform these activities)		Yes	If YES, how many minutes or hours per activity (e.g., 1 hour per month)	No	
1	Handover/Takeover				
2	Department meeting				
3	Clinical audits/review				
4	General assembly meeting				
5	Daily cleaning				
6	Health education				
7	Daily report writing/Tallying				
8	Development of individual workplan (performance evaluation)				
9	Continuous professional development (trainings)				
10	Others: <i>Please specify by writing</i>				
Additional Activities (a specific number of staff perform these activities)		Yes, if the one of the staff perform the task (excluding the supervisor of the department)	If YES, how many minutes or hours per activity (e.g., 1 hour per month)	How many staff perform this activity	No
1	Participate in management meeting				
2	Roster/Schedule creation				

3	Monthly departmental report				
4	Supervision of trainees/students/new recruits				
5	Individual continuous professional development (trainings/courses)				
6	Others: <i>Please specify (include time and number of staff)</i>				

Appendix 5. Health Service Delivery Form

Analysis of staffing needs using workload tools in a humanitarian setting													
Period: June 1, 2022 - May 31, 2023													
HUMAN RESOURCE DATA													
Working Time					Total Staff per Department								
	Nurses	Doctors	Clinical Officers	Mid wife		Department	Nurses	Doctors	Clinical Officers	Mid wife			
Number of weekly working hours						ER							
Number of maximum working hours per month						ICU							
Leaves						Pediatric							
	Nurses	Doctors	Clinical Officers	Mid wife		Trauma/Injuries							
Annual leave per staff						Adult Medical							
Number of days of Public Holidays per year						Malnutrition							
Average number of maternity leave per year						TB/HIV							
Average number of sick leaves per year						Maternity							
Average number of circumstantial leaves per year						Neonate							
Average number of other leaves per year (e.g., Unpaid)					Isolation								
Number of Staff per Department													
Wards	Nurses			Doctors			Clinical Officers			Midwife			
	Shift 1	Shift 2	Shift 3	Shift 1	Shift 2	Shift 3	Shift 1	Shift 2	Shift 3	Shift 1	Shift 2	Shift 3	
<i>Number of Hours per shift (leave blank if the shift is not applicable)</i>													
ER													
ICU													

Pediatric												
ITFC												
Trauma/Injuries												
Adult Medical												
TB/HIV												
Maternity												
Neonate												
Isolation												
OPD	Nurses			Doctors			Clinical Officers			Midwife		
	Shift 1	Shift 2	Shift 3	Shift 1	Shift 2	Shift 3	Shift 1	Shift 2	Shift 3	Shift 1	Shift 2	Shift 3
<i>Number of Hours per shift (leave blank if the shift is not applicable)</i>												
General												
TB/HIV												
ANC												
SGVB												

NUMBER of PATIENTS per DEPARTMENT and ACTIVITIES

Wards	Total admissions	Total Normal Deliveries	Total Assisted Deliveries (e.g., Vacuum)	Abortion	Post-Abortion Consultation	Total Mortality	Wound Dressing	Referrals to other facilities	Road Traffic accidents	Minor medical emergencies	Major medical emergencies	Blood transfusion	Wound suturing
ER													
ICU													
Pediatric													
ITFC													
Trauma/Injuries													
Adult Medical													
TB/HIV													

Maternity													
Neonate													
Outbreak													
OPD	Total admission s/Patients	Total Normal Deliveries	Total Assisted and complicated Deliveries (e.g., Vacuum, episiotomy)	Abortion	Post-Abortion Consultation	Total Mortality	Wound Dressing	Referrals to other facilities or for admission to the wards	Road Traffic accidents	Minor medical emergencies	Major medical emergencies	Blood transfusion	Wound suturing
General													
TB/HIV													
ANC													
PNC													
Family Planning: short term methods (oral, injectibles, condoms)													
Family Planning: long term methods (IUD, implants, tubal ligation, vasectomy)													
SGVB													
Immunization for reproductive women													
Immunization for <5 year old													

Appendix 6. WISN literature sources for nurses, doctors/clinical officers, and midwives

	Title of the Study	Country	Economy Classification of the Study Area	Midwife	Nurses	Doctors	Peer-Reviewed?	Study Design (methods for health activity standards)	Type of Health Facility
1	Workload indicators of staffing need (wism) method for midwives planning and estimation at Asrade Zewude memorial primary hospital, north west Ethiopia (60)	Ethiopia	LIC	•	X	X	•	Quantitative (Expert Working Group)	Primary Hospital
2	Evaluation of the adequacy between the workload and the number of state midwives and maieuticians practicing in the gynecology-obstetrics departments of the university (65)	Burkina Faso	LIC	•	X	X	•	Quantitative (Secondary data)	Maternity Department of a University Hospital
3	Nursing and midwife staffing needs in maternity wards in Burkina Faso referral hospitals (66)	Burkina Faso	LIC	•	•	X	•	Quantitative (Time-motion Study)	Referral Health Centers
4	Work load indicators of staffing needs for midwives and nurses offering maternal neonatal and child health services in Chongwe district Lusaka (67)	Zambia	LIC	•	X	X	•	Mixed-Methods (Time-motion survey)	Maternity and Newborn Services of all facilities in a particular District
5	Draft final report of the analysis for human resource for health in Malawi: implementation of wism study in 75 facilities (52)	Malawi	LIC	•	•	•	X	Quantitative (Time-motion and Expert Working Group)	Health Centers and Hospitals
6	Assessment of staffing needs for frontline health workers in selected maternal and child health services in 3 countries of sub-saharan west Africa: Cote d'Ivoire, Burkina Faso, and Niger (68)	Cote d'Ivoire, Burkina Faso, and Niger	LIC and LMIC	•	X	X	•	Mixed-Methods (Expert Working Group)	PHCs
7	Determining staffing standards for primary care services using workload indicators of staffing needs in the Philippines (51)	Philippines	LMIC	•	•	•	•	Quantitative (Expert Working Group)	PHCs
8	Multi-country case studies on planning RMNCH services using WISN methodology: Bangladesh, Ghana, Kenya, Sultanate of Oman and Papua New Guinea (69)	Bangladesh, Ghana, Kenya, Sultanate of Oman and Papua New Guinea	LMIC and MIC	•	•	X	•	Literature Review	PHCs
9	Health service activity standards and standard workloads for primary healthcare in Ghana: a cross-sectional survey of health professionals (36)	Ghana	LMIC	•	•	•	•	Quantitative (Expert Working Group)	Rural Hospitals
10	Assessing the staffing needs for primary health care centers in Cross River State, Nigeria: a workload indicators of staffing needs study (38)	Nigeria	LMIC	•	•	X	•	Quantitative (Secondary data)	PHCs

11	Using the workload indicators of staffing need method to determine the staffing requirements for primary healthcare service delivery in Nigeria (70)	Nigeria	LMIC	•	•	X	•	Quantitative (Expert Working Group)	PHCs
12	Nursing Personnel Planning for Rural Hospitals in Burdwan District, West Bengal, India, Using Workload Indicators of Staffing Needs (71)	India	LMIC	X	•	X	•	Quantitative (Expert Working Group)	Rural Hospitals
13	Estimating Required Number of Nurses in Emergency Department of Imam Ali Hospital Affiliated by Alborz Province Using WISN Method (72)	Iran	LMIC	X	•	X	•	Quantitative (Expert Working Group)	Emergency Department of a University Hospital
14	Applying the workload indicators of staffing needs method in nursing health workforce planning: evidences from four hospitals in Vietnam (61)	Vietnam	LMIC	X	•	X	•	Mixed-Methods (Expert Working Group)	Provincial Hospitals
15	Workloads and activity standards for integrated health service delivery: insights from 12 countries in the WHO African region (40)	Benin, Botswana, Burkina Faso, Chad, Cote d'Ivoire, Ghana, Liberia, Malawi, Namibia, Nigeria, South Africa and Zimbabwe	LIC, LMIC, MIC	•	•	•	•	Literature Review	PHCs, Secondary, and Tertiary Hospitals
16	Assessment of staffing needs for physicians and nurses at Upazila health complexes in Bangladesh using WHO workload indicators of staffing need (WISN) method (73)	Bangladesh	LMIC	X	•	•	•	Mixed-Methods (Time-motion survey)	PHC
17	Workload indicators of staffing need (WISN) in selected health facilities of Bhutan (74)	Bhutan	LMIC	X	•	•	X	Mixed-Methods (Time-motion survey)	PHCs, Secondary and Tertiary Hospitals
18	How much is adequate staffing for infection control? A deterministic approach through the lens of workload indicators of staffing need (75)	India	LMIC	X	•	X	•	Quantitative-Longitudinal (Time-motion survey)	Acute Care Cancer Hospital
19	A study to calculate the nursing staff requirement for the Maternity Ward of Medical College Hospital, Kolkata Applying WISN method (76)	India	LMIC	X	•	X	•	Quantitative (Expert Working Group)	Maternity Department of a University Hospital

Appendix 7. Nurses' staffing requirement for health service activities

Health Service Activities		Time needed to perform the activity per patient (minute)	Annual Workload	Standard Workload	Required Number of Staff
OPD	Patient assessment (triaging, vital signs and history taking)	11.5	95873	8640	11.096
	Wound Care	26.5	8352	3749	2.228
	Immunization	11.5	13473	8640	1.559
	Dispensing medications	10	95873	9936	9.649
	Referral to higher facility or for admission	21.5	4	4621	0.001
ICU	Admission processes per patient	19.5	454	5095	0.089
	Providing nursing care to inpatients (e.g., VS, NGT feeding, etc.)	25	454	3974	0.114
	Administering medications	10	454	9936	0.046
	Participation in medical visits	15	454	6624	0.069
	Blood or specimen sample collection for Lab test	14	454	7097	0.064
	Oxygen therapy	11	454	9033	0.050
	Monitoring patient with ICU levels	43	454	2311	0.196
	Discharging patient	16	409	6210	0.066
	Transfusion of blood	29	189	3426	0.055
	Referral to other wards	21.5	189	4621	0.041
Prepare dead body	38	45	2615	0.017	
Emergency	Admission processes per patient	19.5	10934	5095	2.146
	Assisting OPD procedure / minor operation (e.g., Wound suturing)	32	162	3105	0.052
	Blood or specimen sample collection for Lab test	14	10934	7097	1.541
	Wound dressing	26.5	2691	3749	0.718
	Transfusion of blood	29	189	3426	0.055
	Administering medications	10	10934	9936	1.100
	Routine patient care (VS, IVF replacement, etc.)	5	10934	19872	0.550
	Referral to other or higher facility	21.5	119	4621	0.026

	Discharging patient	16	10934	6210	1.761
	Prepare dead body	38	0	2615	0.000
	Dispensing medications	10	10934	9936	1.100
Malnutrition	Admission processes per patient	19.5	632	5095	0.124
	Providing nursing care to inpatients (e.g., VS, NGT feeding, etc.)	25	632	3974	0.159
	Administering medications	10	632	9936	0.064
	Participation in medical visits	15	632	6624	0.095
	Blood or specimen sample collection for Lab test	14	632	7097	0.089
	Discharging patient	16	626	6210	0.101
	Dispensing medications	10	626	9936	0.063
	Prepare dead body	38	6	2615	0.002
Neonate	Admission processes per patient	19.5	226	5095	0.044
	Providing nursing care to inpatients (e.g., VS, NGT feeding, etc.)	25	226	3974	0.057
	Administering medications	10	226	9936	0.023
	Participation in medical visits	15	226	6624	0.034
	Blood or specimen sample collection for Lab test	14	226	7097	0.032
	Discharging patient	16	217	6210	0.035
	Prepare dead body	38	9	2615	0.003
HIV/TB	Admission processes per patient	19.5	61	5095	0.012
	Providing nursing care to inpatients (e.g., VS, NGT feeding, etc.)	25	61	3974	0.015
	Administering medications	10	61	9936	0.006
	Participation in medical visits	15	61	6624	0.009
	Blood or specimen sample collection for Lab test	14	61	7097	0.009
	Discharging patient	16	61	6210	0.010
	Dispensing medications	10	61	9936	0.006
	Prepare dead body	38	26	2615	0.010
	Admission processes per patient	19.5	2882	5095	0.566
Pediatrics	Providing nursing care to inpatients (e.g., VS, NGT feeding, etc.)	25	2882	3974.4	0.725141
Adult	Administering medications	10	2882	9936	0.290056
Trauma	Participation in medical visits	15	2882	6624	0.435085
Isolation	Blood or specimen sample collection for Lab test	14	2882	7097.1429	0.406079

Wound Care	11	217	9032.7273	0.024024
Discharging patient	16	2882	6210	0.46409
Dispensing medications	10	2882	9936	0.290056
Prepare dead body	38	54	2614.7368	0.020652
Total Nurses needed				13.7624

Appendix 8. Doctors/clinical officers staffing requirement for health service activities

Health Service Activities	Time needed to perform the activity per patient (minute)	Annual Workload	Standard Workload	Required Number of Staff
Outpatient consultations/curative consultations	15.5	95147	6410	14.843
Admission processes per patient	18	4255	5520	0.771
Conduct daily ward round	15	4255	6624	0.642
Discharging patient	13	4111	7643	0.538
Ward review	35	4255	2839	1.499
Confirm death and write death certificate	18	144	5520	0.026
Admission processes per patient	18	10934	5520	1.981
OPD procedure / minor operation (e.g., Wound suturing)	23	162	4320	0.038
Emergency medical management	30	10934	3312	3.301
Referral to other or higher facility	17	119	5845	0.020
Discharging patient	13	10934	7643	1.431
Confirm death and write death certificate	18	0	5520	0.000
Total Doctors/Clinical Officers Needed				25.089

Appendix 9. Midwife staffing requirement for health service activities

	Health Service Activities	Time needed to perform the activity per patient (minute)	Annual Workload	Standard Workload	Required Number of Staff
OPD	Antenatal care	23.5	6356	3615	1.758
	Post-natal care	19.5	1367	4357	0.314
	Family planning: short term	16	498	5310	0.094
	Family planning: long term	30.5	141	2786	0.051
	Outpatient consultations/curative consultations	27	1078	3147	0.343
	Provide prevention of mother-to-child transmission (PMTCT) counseling and testing	14	6356	6069	1.047
	Referrals	35	0	2427	0.000
SGVB	Outpatient consultations SGBV	27	1248	3147	0.397
	Safe Abortion	120	0	708	0.000
	Post abortion care	165	0	515	0.000
IPD	Admission processes per patient	31	1764	2741	0.644
	Labor monitoring and management	168	1075	506	2.126
	Inpatient management of complications of pregnancy	44	257	1931	0.133
	Newborn care	80	1075	1062	1.012
	Inpatient care per patient day (routine care for mother and baby)	30	1764	2832	0.623
	Participation in the medical visit	10	1764	8496	0.208
	Immunization at birth	4	553	21240	0.026
	Safe Abortion	31.5	102	2697	0.038
	Post abortion care	165	102	515	0.198
	Completing admin/patient records	15	1764	5664	0.311
	Discharging patient	21	1760	4046	0.435
	Dead body care	40	4	2124	0.002
	Dispensing medications	15	1760	5664	0.311
Total Midwives Needed					10.069

Appendix 10. Allowance standards and factors

Support Activities		Category Allowance Standard	CAS %
Nurses	Handover/Takeover	23 mins per day	4.792
	Department meeting	90 mins per month	1.087
	Clinical audits/Mortality review	90 mins per month	1.087
	General assembly meeting	90 mins twice per year	0.008
	Daily report writing/patient census	8 mins per day	1.667
	Administrative/Management responsibilities (e.g., Trolley cleaning, checking equipment, etc.)	23 mins per day	4.792
	Order drugs from pharmacy	90 mins per day	1.087
	Disaster drills or emergency preparedness drills	90 mins twice per year	0.008
	Development of individual workplan (performance evaluation)	90 mins twice per year	0.008
	Continuous professional development (trainings)	90 mins per month	1.087
	Escorting patient for referrals	450 mins per month	5.435
	IPC monitoring and evaluation	45 mins per month	9.375
			Total CAS %
		CAF	1.437
Additional Activities		Allowance standard (mins)	Number of staff
Supervision of trainees/students/new recruits		8 hours per day 13 times a year	5
Continuous professional development (trainings)		40 hours	3
		IAS	640
		IAF	0.386
Support Activities		Category Allowance Standard	CAS %
Doctors/ Clinical Officers	Handover/Takeover	23 mins per day	4.792
	Department meeting	90 mins per month	1.087
	Clinical audits/Mortality review	3 hours per month	2.174
	General assembly meeting	90 mins twice per year	0.008
	Telemedicine consultation	1 hour per month	0.725

Development of individual workplan (performance evaluation)	1 hour/year	0.005
Monthly medical report	90 mins per month	1.087
Disaster drills or emergency preparedness drills	90 mins twice per year	0.015
Continuous professional development (trainings)	90 mins per month	1.087
	Total CAS %	10.979
	CAF	1.123
Additional Activities	Allowance standard (mins)	Number of staff
Supervision of trainees/students/new recruits	8 hours per day 5 times a year	5
Continuous professional development (trainings)	40 hours	7
	IAS	408
	IAF	0.290
Support Activities	Category Allowance Standard	CAS %
Handover/Takeover	60 mins per day	12.500
Department meeting	90 mins per month	1.271
Clinical audits/review	90 mins per month	1.271
General assembly meeting	90 mins twice per year	2.542
Health education	30 mins per day	6.250
Daily report writing/Tallying	7.5 minutes once a day in the morning	1.563
Midwife Development of individual workplan (performance evaluation)	1 hour/staff twice a year	0.012
e Continuous professional development (trainings)	90 mins per month	1.271
	Total CAS %	26.680
	CAF	1.364
Additional Activities	Allowance standard (mins)	Number of staff
Supervision of trainees/students/new recruits	8 hours per day 5 times a year	5
Continuous professional development (trainings)		0
	IAS	200
	IAF	0.141

Appendix 11. Calculation for doctors, clinical officers, nurses, midwives using the NGO's human resource tool and guidelines

Department	Bed Number (n=85)	NGO Calculator Tool								
		Staffing Ratio	Staff need based on Staffing Ratio				Staff Requirement after Excel HR Tool			
			Doctor	Clinical Officer	Nurse	Midwife	Doctor	Clinical Officer	Nurse	Midwife
Pediatric	10	1 doctor for 30 beds	1	1	4 day 2 night	n/a	4	4	16	n/a
Adult	15	1 clinical officer for 20 beds								
Trauma	7	1 nurse for 10 beds during day								
Isolation	5	1 nurse per 20 beds during night								
HIV/TB Ward	7									
ER	6*	1 doctor for 24 hours 1 Triage nurse per 50-100 patients 1 observation nurse per 10 beds 1 nurse for 6 yellow cases 1 nurse for 3 red cases	1	n/a	2	n/a	4	n/a	5	n/a
ICU	10	1 doctor for 12 beds; if less than 10 beds the doctor can be the same as IPD 1 nurse per 5 beds	1	n/a	2	n/a	4	n/a	10	n/a
Malnutrition Ward	12	1 doctor for 50 beds 1 nurse for 20 beds**	1	n/a	1	n/a		n/a	5	n/a
Neonate	6	1 doctor for 20-25 neonates 1 nurse for 5-10 neonates	1	n/a	1	n/a		n/a	5	n/a
Maternity	13	1 midwife for every 3.5 deliveries 1 midwife for 10 post-partum beds	n/a			2	n/a			12
OPD***	n/a	1 for 50 general consultations	5		n/a	1	1		n/a	1
		1 for 25 ANC or PNC consultations	n/a				n/a			
		1 for 100 vaccinations	n/a				n/a			
Total							12	4	42	13

