Determining staffing needs for improving primary health care service delivery in Kaduna State, Nigeria [version 2; peer review: 2 approved, 1 approved with reservations]

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Abstract

Background: The equitable distribution of a skilled health workforce is critical to health service delivery. Kaduna state has taken significant steps to revamp the primary health care system to ensure access to health care for its populace. However, these investments are yet to yield the desired outcomes due to health workforce shortages and the inequitable distribution of those available.

Methods: A Workload Indicator for Staffing Need (WISN) study was conducted at Kaduna state’s primary health care level. The study focused on estimating staffing requirements; Nurses/Midwives and Community Health Worker practitioners, Community Health Officers, Community Health Extension Workers, and Junior Community Health Extension Workers in all government-prioritised primary health care facilities. A total of ten focal primary health care facilities in Kaduna North Local Government Area (LGA) were included in the study.

Results: Findings from the study revealed a shortage of Nurses/Midwives and Community Health Workers across the study facilities. For the Nurse/Midwife staffing category, nine of the ten PHCs have a WISN ratio < 1, indicating that the number of staff in the Nurse/Midwife category is insufficient to cope with the workload. In two of the ten primary health care facilities, there is an excess in the number of CHWs available; a WISN ratio > 1 was calculated.

Conclusion: The WISN study highlights staffing needs in Kaduna State's government-prioritised primary health care facilities. This evidence establishes the basis for applying an evidence-based...
approach to determining staffing needs across the primary health care sector in the State to guide workforce planning strategies and future investments in the health sector. The World Health Organisation (WHO) WISN tool is useful for estimating staffing needs required to cope with workload pressures, particularly in a resource-constrained environment like Kaduna State.

Keywords
Universal Health Coverage; Health Workforce; Human Resources for Health; Workload Indicators for Staffing Need; Nigeria; Service Delivery; Nurse; Midwife; Community Health Officer; Community Health Extension Worker; Junior Community Health Extension Worker.

This article is included in the Health Services gateway.
Introduction
The equitable distribution of resources, specifically Human Resources for Health (HRH), to meet the populace’s needs is critical for achieving Universal Health Coverage (UHC). However, this essential health system component is plagued with challenges in availability, distribution, skills, and retention. These challenges are prominent in developing countries like Nigeria, where shortages and inequitable health workforce distribution, poor HRH planning, inadequate recruitment exacerbated by a ban on workforce recruitment, and weak retention strategies are often encountered. These frequently result in disparities in health worker densities by locality, limit access to health care services and inadvertently undermine the quality of care provided, all of which are associated with poor health outcomes.

In the last decade, Nigeria has developed some health system reforms aimed at improving national health indices. One such reform is the Primary Health Care (PHC) Minimum Service Package (MSP). The MSP documents services to be provided by primary health facilities, articulates staffing norms and composition recommendations, and states what services each health worker cadre should provide. The MSP was fundamental because it was birthed in the wake of the UHC push in Nigeria, and it targets primary health care, which is the entry point into the health system, where promotive, preventive, and curative services for uncomplicated minor ailments are provided in Nigeria. However, these staffing standards have remained unmet. This may be due to the health workforce crisis that Nigeria is facing as well as the low government spending on health at national and sub-national levels. In response to sub-optimal staffing patterns at the primary health care level, the Government of Nigeria developed a Task Shifting and Task Sharing (TSTS) policy that allows lower-skilled clinical staff to perform high-skilled clinical tasks following training. However, this policy is fraught with implementation and monitoring challenges.

Kaduna is a State in Northern Nigeria, with a projected population of 8.98 million. Kaduna is one of the 36+1 States in Nigeria that has made considerable investments in healthcare. To attain UHC through community participation, as contained in the National Health Act, the State adopted and implemented the Ward Health System (WHS) for healthcare. The WHS utilises the electoral wards as the elementary operational unit for PHC service delivery. This formed the basis for the State government’s investment in one PHC facility per ward. There are 255 wards in Kaduna state, and the State government prioritised one PHC facility in each ward. Since 2015, 255 PHC facilities have benefitted from the government’s investments in establishing and sustaining a multi-level administrative governance structure, improved infrastructure and provision of basic equipment and essential medicines, amongst others. However, the State has been unable to meet the staffing needs for these facilities as stipulated by the MSP because of its limited fiscal space for health spending. As such, the availability of a sufficient, skilled, and equitably distributed health workforce to serve the population in Kaduna has remained a challenge.

Considering Kaduna State’s HRH gaps and its inability to attain the MSP staffing norms, there is a need to employ an evidence-based staffing approach that could support the determination of adequate staffing norms in line with the existing challenges. One such method is the WISN method developed by WHO. This study aims to estimate the staffing requirements for healthcare delivery at focal primary health facilities by the health worker cadre in Kaduna North Local Government Area in Kaduna State, Nigeria, employing the WISN methodology.

Methods

Ethics approval and consent to participate
Written informed consent was obtained before data collection during the field visit through the Health Research Ethics Committee (HREC) of the Kaduna State Ministry of Health and had an approved registration number NHREC/17/03/2018.

The study employed the WISN methodology to determine staffing needs. WISN is designed by the WHO and supports the evidential determination of the number of health workers by cadre required to cope with the workload in a particular health facility. The WISN methodology considers several relevant components by health worker cadre that includes: (i) services delivered, (ii) the time it takes to deliver both clinical and non-clinical services, (iii) the total annual work time
available to each Health Care Workers (HCW) cadre as well as (iv) retrospective annual service delivery statistics in the health facility. Computation of the statistics from these components produces a determined number of HCWs by cadre required in each health facility.

Scope of the study
The WISN study was completed in Kaduna North Local Government Area and included ten (10) primary health facilities. The study population were clinical health workers available and tasked with providing healthcare services to patients at these primary health facilities. These prioritised cadres are Nurses/Midwives and Community Health Workers (CHWs), comprising Community Health Officers (CHOs), Community Health Extension Workers (CHEWs), and Junior Community Health Extension Workers (JCHEWs). Health services such as Reproductive Maternal and Newborn Child Health (RMNCH), predominantly provided at the primary care level and make up most of the health facility visits in the LGA, were prioritised for the study.

Establishing state governance structures
Three Technical Working Groups (TWGs): Steering Committee, Technical Task Force, and an Expert Group were inaugurated to conduct the study. These study groups were a subset of the State’s larger HRH TWG. Their objectives include providing HRH-related advisory and technical support to the State government to enable workforce development. The three group members were drawn from relevant Ministries, Departments and Agencies (MDA), health training institutions, Civil Society Organisations (CSO), health facilities and development partners. These groups were engaged to build local capacity and create utility for study results.

Health facility inclusion criteria
Kaduna North Local Government Areas (LGA) was selected for convenience for this study. Consequently, all government-prioritised PHC facilities that had been in operation for at least one year before the time of the study were included. Kaduna North LGA is an urban area and one of the most densely populated areas in the State. The decision to include only government-prioritised PHC facilities is hinged on the significant investments made by the State government and donors in these facilities and a resultant increase in service utilisation rates.

Data collection
After a review of relevant documents that include the Nigeria Task Shifting and Task Sharing (TSTS) policy, the MSP, Ward Minimum Healthcare Package (WMHCP) and the public service handbook, data collection tools were developed. Data on health service statistics, facility HRH composition, staff Available Work Time (AWT) and time spent by healthcare workers on clinical and non-clinical activities were collected and compared from both primary and secondary sources.

Primary data sources included health facility service delivery registers, staff registers, and expert judgments through an Expert Group discussion. Primary data collection lasted three weeks between June and July 2021. Secondary data sources included the Nigeria District Health Information System (DHIS2) and Kaduna State Primary Healthcare Board (KSPHCB) Human Resources for Health Information System (HRH-IS). The DHIS2 is the electronic instance of the National Health Management Information System (NHMIS), a paper-based mechanism aggregating all healthcare services delivered in a health facility.

For health service statistics, data for family planning, antenatal care, postnatal care, immunization, diarrhoea, pneumonia and malaria in children and adults from January to December 2019 were obtained from health facility registers and compared with those retrieved from the DHIS2. Further, during field visits, facility workforce data focusing on clinical cadres were obtained from health facility staff registers.

A multi-step approach was taken to obtain information on staff AWT (the total amount of time available to a HCW by cadre to perform daily tasks in a year, considering authorised and unauthorised absences).

Firstly, a desk review of relevant public service statutory policy, rules, and guidelines was conducted to obtain the total number of HCW’s work hours per day, work days per week, and authorised and unauthorised absences allowed within the State’s service. Finally, the Staff AWT was subsequently reviewed and approved by the study’s governance structure.

An Expert Group comprising 17 clinical experts were convened to obtain time spent on clinical and non-clinical activities by HCWs in the study’s cadres of interest. These experts were purposefully selected and included individuals who are members of the study’s cadre of interest, currently employed in the public service, and have at least 15 years of experience providing health care services at the primary care level. All experts in the group responded on time that it takes the
prioritised health worker cadre to perform the selected activities to acceptable standards, and the mean value of their responses was utilised.

Data analysis and interpretation
The data collected were analysed using MS Excel, consistent with the WISN methodology. Activity standards, clinical and non-clinical workload components, annual service delivery statistics and AWT for the prioritised cadre for each facility were included. To complete the computation, the data collected was defined and analysed as follows:

- **Available Working Time:** The time a health worker is available in one year to do their work, considering authorised and unauthorised absences. AWT in Days is the difference between Possible Working days in a year (PWD) and Non-working days in a year (authorised and unauthorised absences).\(^\text{13–15}\)

\[
AWT = A - (B + C + D + E) \quad (1.0)
\]

Where in the formula:

- **AWT** is the total staff available working time
- **A** is the number of possible working days in a year
- **B** is the number of days off for public holidays in a year
- **C** is the number of days off for official leave in a year
- **D** is the number of days off due to sick leave in a year
- **E** is the number of days off due to casual leave, study or training leave and maternity leave in a year.

- **Activity Standard:** The time it takes an HCW of a particular cadre to deliver clinical and non-clinical services; core, individual and support activities.\(^\text{13}\)

- **Standard Workload:** The amount of work one HCW can perform in a year within a health service category.\(^\text{13}\) It is calculated in unit time or rate of work by dividing AWT by the time taken to conduct the work or multiplying the AWT by the rate of working, respectively.

- **Core health activities:** The WISN methodology describes these as health service activities. They refer to activities performed by all cadre staff, and regular statistics are collected.\(^\text{13}\) They are clinical and identified as clinical health services in this study.

- **Support activities:** According to the WISN methodology, these activities are performed by all members of the cadre, but routine statistics are not collected on them.\(^\text{13}\) Although these activities contribute to service delivery, they are not clinically related and are identified as non-clinical in this study.

- **Additional activities:** These activities do not involve all staff of the same cadre, and routine statistics are also not collected on them.\(^\text{13}\) For this study, they are categorised as non-clinical.

- **Staff requirement for core health activities:** This was calculated by taking the aggregate ratio of all annual core health services and standard workload for the identified clinical health services:

\[
\sum_{i=1}^{n} \left( \frac{AW_i}{SW_i} \right) \quad (2.0)
\]

Core health activities \(i = 1, 2, 3 \ldots n\)

- **AW** = Annual statistics for each core clinical health service
- **SW** = Standard Workload for each core clinical health service
Staff requirement for support activities: A Category Allowance Standard (CAS), which is the percentage of the working time required to cope with all support activities, was estimated, and Category Allowance Factor (CAF) was calculated using:

$$CAF = \frac{100}{100 - \text{Total CAS}}$$  \hspace{1cm} (3.0)

Staff requirement for individual activities: Individual Allowance Standard (IAS), which is the total number of hours per year needed to perform all additional activities undertaken by some HCWs, was also calculated. An Individual Allowance Factor (IAF) identifying the staffing requirement to undertake these workloads was estimated using the:

$$IAF = \frac{\text{Total IAS} \div \text{AWT}}{\text{Total WISN Staff Requirement}}$$  \hspace{1cm} (4.0)

Total staffing requirement was calculated using the following:

$$\text{Total WISN Staff Requirement} = CAF \times \sum \left(\frac{AW_i}{SW_i}\right) + IAF$$  \hspace{1cm} (5.0)

WISN staffing results with fractions were handled as recommended by the WISN guide. WISN differences and ratios were also calculated for each health facility. The WISN difference, which is calculated as the variance between the current staffing norm available by cadre and the computed staffing requirements and identifies staffing gaps or excesses by cadre. The WISN ratio represents the work pressure experienced by the HCW. A WISN ratio of > 1 indicates the availability of more HCWs than required to meet the facility workload.

**Results**

**Clinical and non-clinical workload components and standards**

Two categories of healthcare services were included in the study. The clinical health service forms the core health activities, while the non-clinical services comprise both support and additional services. The clinical core health services refer to activities directly related to service delivery performed by all prioritized cadres. Support activities are part of the non-clinical category, and activities performed by the prioritized cadre are not directly related to patient care and usually involve all staff of the same cadre. Additional activities are activities performed by these prioritized cadres that are not directly related to patient care and are undertaken by just a staff.

The workload and activity standards developed and validated by the expert group are presented in Table 1.

A total of 26 health and non-health related services were identified in the state Primary Health Care level; of which 12 are clinical/core health services conducted by both Nurse/Midwife and CHW Practitioners. 14 non-clinical services;

**Table 1. Clinical and non-clinical workload components and service standards for primary level of care.**

| Service activity standards                      | Nurse/midwife | CHW | Unit         |
|------------------------------------------------|---------------|-----|--------------|
| **A) Clinical health service – core health service activity standards** |
| Antenatal care                                 | 10            | 10  | Minutes/Client |
| Delivery                                       | 60            | 60  | Minutes/Client |
| Postnatal care                                 | 14            | 19  | Minutes/Client |
| Family planning (counselling)                  | 18            | 17  | Minutes/Client |
| Family planning (insertion of IUCD)            | 20            | 17  | Minutes/Client |
| Family planning (insertion of an implant)      | 17            | 13  | Minutes/Client |
| Family planning (injection)                    | 7             | 8   | Minutes/Client |
| Family planning (oral pills)                   | 7             | 9   | Minutes/Client |
| Immunization                                   | 9             | 11  | Minutes/Client |
| Diarrhoea in U5 years old                      | 14            | 13  | Minutes/Client |
| Pneumonia in U5 years old                      | 15            | 14  | Minutes/Client |
| Confirmed uncomplicated malaria                | 18            | 21  | Minutes/Client |
7 support services and 7 individual services were also identified, and the corresponding category and individual allowance standards were also identified.

**WISN results - staffing requirement**

The results emanating from the study are based on documented annual workload from the ten (10) primary healthcare facilities in Kaduna North Local Government Area. The WISN results are presented in Table 2.

Kaduna North Local Government Area has only 17% of the Nurse/Midwife workforce it requires to provide primary health care services. Overall, the LGA requires about 54 Nurses/Midwives but currently has only 9 leaving a deficit of 45. All but one of the 10 PHCs have WISN ratios of less than one (WISN < 1), indicating that the current number of Nurse/Midwife staff available is insufficient to cope with the workload. While there is no Nurse/Midwife available in Primary Health Centre Unguwar Shanu, Primary Health Care Centre Hayin Banki has the lowest WISN ratio of 0.09.

WISN results for CHWs: CHO, CHEW and JCHEW also indicate a staffing shortage. Results provide an estimated requirement of 121 and an availability of 51 leaving a deficit of 70. CHWs are available in all assessed primary health care centres, with staffing surplus in two PHCs whose WISN ratios are above one (WISN >1); Doka (Zakari Isah) Primary Health Care Centre and Primary Health Care Badarawa. One PHC has the required number of CHWs, while the other seven PHCs have CHW staffing strength that is insufficient to cope with the work pressures.

**Discussion**

Kaduna state has employed several workforce planning strategies that include traditional workforce estimation practices: health service target or disease-focused staffing estimation, health workforce to population ratio and population to facility staff ratio. Although these workforce planning strategies are useful, they are costly to implement and do not incorporate the complexities of the health system that affects health service-seeking behaviours and service delivery.14,16–21

This study applied the WISN methodology, and the literature suggests that this staffing estimating approach is most suitable for guiding the deployment of skilled frontline workers from places with fewer work pressures, to locations with higher work pressures, particularly in a resource-constrained environment.14,22–32 Findings from this study revealed a gap in the number of Nurses/Midwives and CHWs available to provide primary health care services. Our study highlight variability in the availability of skilled HRH in these focal primary health care facilities. Nurses/Midwives are unavailable in all but one primary health facility with WISN ratios of less than one, indicating that the current number of staff available is insufficient to cope with the workload. Conversely, CHWs are available in all assessed facilities, with a cumulative

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**Table 1. Continued**

| Service activity standards                  | Nurse/midwife | CHW  | Unit     |
|--------------------------------------------|---------------|------|----------|
| **B) Non-clinical - support services activity standards** |               |      |          |
| Community mobilisation and education       | 0             | 2    | Hours/Week |
| Ward development committee meetings        | 51            | 50   | Minutes/Month |
| Outreaches/community-based services        | 0             | 2    | Hours/Week |
| Hand over/report writing                   | 36            | 25   | Minutes/Week |
| Staff meetings                             | 38            | 33   | Minutes/Week |
| Documentation on patients                  | 30            | 30   | Minutes/Day |
| Group health education                     | 40            | 31   | Minutes/Week |
| **C) Non-clinical - individual service activity standards** |               |      |          |
| Supervision of students                    | 60            | 60   | Minutes/Day |
| General administration                     | 50            | 66   | Minutes/Day |
| Monthly report writing                     | 50            | 69   | Minutes/Month |
| Review meetings                            | 2             | 3    | Hours/Month |
| Mentoring of subordinates                  | 44            | 36   | Minutes/Day |
| Facility management meeting                | 51            | 39   | Minutes/Month |
| Sterilisation of equipment                 | 5             | 4    | Minutes/Day |

CHW – Community Health Worker Practitioners comprising of CHO – Community Health Officers; CHEW – Community Health Extension Workers; JCHEW – Junior Community Health Extension Workers.
Table 2. WISN results for Kaduna North LGA.

| Name of health facility                                      | N/M available | N/M calculated | N/M gap/excess | N/M WISN ratio | CHW available | CHW calculated | CHW gap/excess | CHW WISN ratio |
|---------------------------------------------------------------|---------------|----------------|----------------|----------------|---------------|----------------|----------------|----------------|
| Doka (Zakari Isah) Primary Health Care Centre                 | 1             | 3              | -2             | 0.33           | 9             | 5              | +4             | 1.80           |
| Junction Road Primary Health Care Centre                      | 1             | 3              | -2             | 0.33           | 5             | 5              | 0              | 1.00           |
| PHC Clinic Jos Road                                           | 1             | 1              | 0              | 1.00           | 1             | 2              | -1             | 0.50           |
| Primary Health Care Badarawa                                  | 1             | 3              | -2             | 0.33           | 14            | 5              | +9             | 2.80           |
| Primary Health Care Centre Hayin Banki                        | 1             | 11             | -10            | 0.09           | 3             | 26             | -23            | 0.12           |
| Primary Health Care Centre Kabala                             | 1             | 5              | -4             | 0.20           | 5             | 13             | -8             | 0.38           |
| Primary Health Care Centre Unguwar Rimi                       | 1             | 8              | -7             | 0.13           | 5             | 20             | -15            | 0.25           |
| Primary Health Centre Unguwar Shau                           | 0             | 11             | -11            | 0.00           | 4             | 24             | -20            | 0.17           |
| Primary Health Centre Mohammed Bello Tukur Memorial           | 1             | 3              | -2             | 0.33           | 3             | 6              | -3             | 0.50           |
| Primary Health Care Centre Unguwar Sarki                      | 1             | 6              | -5             | 0.17           | 2             | 15             | -13            | 0.13           |
| **Total for Kaduna North LGA**                                | **9**         | **54**         | **-45**        | **51**         | **121**       | **-70**        |                |                |

N/M – Nurse/Midwife; CHW – Community Health Worker Practitioners comprising of CHO – Community Health Officers; CHEW – Community Health Extension Workers; JCHEW – Junior Community Health Extension Workers; LGA – Local Government Area.
13 staffing excesses in two PHCs; Doka (Zakari Isah) Primary Health Care Centre and Primary Health Care Badarawa, having WISN ratios greater than one; one PHC has the required number of CHWs, while the other seven PHCs have shortages of CHWs. Our findings are consistent with workload studies in Cross River and Rivers states, Nigeria, as well as in Burkina Faso, where there were shortages in the Nurse/Midwife cadre of the health workforce.

Our study presents several opportunities for the Kaduna state government. To the best of our knowledge, this study is the first attempt at applying WISN to estimate staffing requirements in the State. As such, this study provides lessons on how to apply the WISN methodology. More importantly, it outlines the steps taken in establishing the WISN governance structure to drive ownership, knowledge transfer, and follow-through on staffing decisions and prevents the loss of institutional memory. For example, the study’s steering committee and technical task force were sub-sets of the broader state HRH TWG. This study provides an evidence base to redistribute staff from underutilised health facilities to locations experiencing high work pressures. The 13 surpluses CHWs should be redistributed to understaffed health facilities to increase primary health care services coverage. For the Nurse/Midwife category, there is an acute shortage, with just nine available and a lack of 45. A WISN scale-up study across the state primary health care structure is recommended to effectively utilise scare HRH towards increasing coverage and improving PHC services.

The WISN methodology estimates the number of health workers needed to cope with work pressure in the facility. However, there are a few assumptions that the health worker is available and not absent from duties, well-behaved, and that the administered health service relies on established standards, amongst others. Regardless of having the right numbers in a facility, workforce productivity and performance-inhibiting factors could affect service delivery. A recommendation is for Kaduna state to routinely assess the PHC workforce productivity level to guide incorporating HRH management strategies with planning.

Our study had a few limitations, and steps were taken to address them. No national or regional activity standards are available across the different categories of services: clinical and non-clinical, for the primary health care level. For the study, the Expert Group was tasked with establishing the activity standards, and there were slight variations in the timings provided for the prioritised cadres. To address the marginal variation across the activity standards, an average was taken. Another limitation was with availability and quality of health service statistics at the facility level owing to paper storage challenges. To address this challenge, we compared the data with a secondary source; the DHIS2. In cases where paper registers were unavailable, we used data retrieved from the DHIS2.

Conclusion
As countries strive toward achieving UHC, the need for equitable distribution of frontline health workers has become paramount. Historically, Kaduna State has relied on other ways of determining staffing requirements for health facilities; however, these have been unrealistic, costly, and difficult to implement. Our study applied the WISN methodology to estimate staffing requirements in Kaduna State government-prioritised PHC facilities. The study highlights an acute shortage of Nurses/Midwives and CHW practitioners in these prioritised health facilities and provides an evidence-based for determining staffing needs.

Data availability
Underlying data
Due to security restrictions, data cannot be made publicly available. The underlying data for this article are available on government-approved health information systems. Annual health service statistics are available on the National Health Management Information System (NHMIS) - http://dhis2ng.org, with access only available for users with login details. Also, health workforce data is also available in the State Human Resources for Health Information System (HRH-IS).

For readers without access to these platforms, data may be requested by contacting the corresponding author via email (bonkhi@gmail.com) or phone (+2348034118557), and access will be granted to the CSV format.

Authors’ contribution
AIO, OT and HB conceptualised and designed the study, as well as coordinated its implementation. AIO coordinated data collection. AIO and OT analysed the data. AIO and OT drafted the initial manuscript. All authors read, reviewed, and approved the final version of the manuscript.

Acknowledgements
The authors acknowledge the support of the Kaduna State Primary Health Care Board. Our profound appreciation also goes to the senior management and staff of the Kaduna State Ministry of Health.
Open Peer Review

Current Peer Review Status: ✔️ 未知 ✔️

Version 2

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Ibor Nelson

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The authors have addressed the comments raised in the previously review sufficiently and satisfactorily.

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Health Systems specifically health financing, human resource for health management

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Reviewer Report 30 November 2022

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Richard F Heller

University of Newcastle, Newcastle, NSW, Australia

While the authors have not directly responded to all of the concerns raised in my original report, the revisions that have been made allow me to conclude that the paper is acceptable for indexing. I did ask for a discussion on the generalisability of the results to other settings, and while this has
not been addressed directly, I think that others who wish to apply the results to their setting will find enough in the revised paper to allow them to do so.

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** Public health, health services, education

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

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**Reviewer Report 20 May 2022**

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**Iboro Nelson**

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**Strength:** The work is a useful contribution to knowledge in the field of human resource for health management. Well-written in simple and understandable English devoid of jargons, the paper frames the problem statement in a lucid manner and situates it contextually. Key concepts such as WISN (Workload Indicators for Staffing Need) and the key steps, DHIS (District Health Information System), Task Shifting and Task Sharing are adequately defined and broken down to the readers' understanding. The study limitations and mitigation strategies are also clearly discussed.

**Weakness:** However, in an attempt to present the evidence-base methodology of WISN approach for health workforce estimation as superior to the other approaches earlier adopted by the State such as disease-focused staffing estimation, and health workforce to population ratio and population to facility staff ratio, the study failed to make recommendations for a major of the study's findings: the unavailability of Nurses/Midwives in all but one facility in the LGA (Local Government Areas). Besides, some grammatical error gaps which is usually characteristics of such work as this are highlighted for the authors' consideration.

**General Conclusion:** The work has academic merit and is fit for indexing, howbeit a number of minor grammatical errors and changes to the article needs to be addressed and or amended.

**Is the work clearly and accurately presented and does it cite the current literature?**

Yes
Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?
Yes

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
Partly

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** Health Systems specifically health financing, human resource for health management

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

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Author Response 23 Oct 2022

**Agbons Oaiya**, PATH, Abuja, Nigeria

Many thanks for your comments. The concerns raised have been addressed in the revised submission.

**Competing Interests:** No competing interests were disclosed.

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Reviewer Report 19 May 2022

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**Pamela A. McQuide**
IntraHealth International, Chapel Hill, NC, USA

This is an important paper using the evidenced-based approach of the World Health Organization's (WHO) Workload Indicator of Staffing Need to determine facility level staffing in
primary health care (PHC) sites in Kaduna State in Nigeria. The authors have done well in applying this method and results for PHC.

There are a few considerations for the authors to improve the quality of the paper and a few small mistakes to correct.

Small mistakes to correct:
1. Page 7 in the table on document on patients 3 minutes but the unit is missing. Is it per patient, per day etc. It would seem that 3 minutes per day to document on patients would not be sufficient.

2. Page 7, last paragraph states “Nurse/Midwives are unavailable in all but one primary health facility”. I think it should read NM are available in all but one primary health facility.

3. Page 6 second to last paragraph states Hayin Bank WISN ratio is .10 and in the Table 2, it says .09. It also says Hayin Bank has the lowest WISN ratio, but, Unguwar Sahnu WISN ratio is .0 because they have no Nurse/Midwives. This would be consistent in the abstract which states that 9/10 sites have WISN ratio <1.0 which would include the site with a WISN ratio of 0.0

Recommendations:
1. The paper did not indicate how the 10 PHC sites were selected. Were they part of the wards discussed in the introduction, randomly selected across Kaduna State or did they represent the different characteristics of sites in Kaduna State or another methodology?

2. It would be easier for the reader if the definitions for the types of teams (Steering Committee, Technical Team and Expert Group) are pulled together in the methods section and uses the definitions from WHO. It is fine that they are part of the larger HRH TWG group in this Kaduna State. The definitions in the paper are inconsistent with the WHO definitions in the WISN User Manual (WHO 2010) p. 17. Health service activities are performed by all members of a staff category and regular statistics collected; support activities are performed by all members of a staff category but regular statistics are not collected on them; and additional activities are performed by only a certain members of a staff category and regular statistics are not collected. Some of the support and additional activities can be clinical in nature but no statistics are available for them.

3. Use of the term triangulated is not used as would be expected. It appears different data were used to fill in for missing data and not to validate the data used with different data sources (e.g. DHIS2 and primary data).

4. In the discussion it mentions that two other states in Nigeria had similar WISN results, i.e., Cross River and River State but it did not indicate if the health service activities and standards were comparable for PHC. You also indicated that there were no regional or national standards for PHC but it seems this could lead to adapting standards for the country.

5. It might be helpful to put in a small table showing the relationship with health service activities, support activities, and additional activities with the activity standard and the standards workload and allowance factor for the CAF and IAF. It is a little hard to follow in
the paper and at times the terms used in the paper are inconsistent. For example, health service activities are sometimes called core activities. If you put all the definitions under methods section, then you can just discuss the results and not have to put in definitions in other parts of the paper. These definitions are important for setting up the study and not in the results section. Use the same terms through-out the paper or it gets confusing.

6. Since the service statistics are not available, I cannot validate the results given in the paper.

7. In the background section you mention previously staffing norms used for budgeting positions. It might be interesting to compare the staffing norms to the actual WISN results to see if they are comparable or if the WISN results could be used to develop new evidenced-based norms that can be used.

8. In the Table 2, it gives staff available. Is the staff available consistent with budgeted positions for this facility? You might want to put in a comment in the paper about budgeted positions versus actual positions available.

Thank you for using the evidenced based approach using WISN to estimate staffing needs for PHC.

Is the work clearly and accurately presented and does it cite the current literature?
Yes

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Partly

If applicable, is the statistical analysis and its interpretation appropriate?
Yes

Are all the source data underlying the results available to ensure full reproducibility?
Partly

Are the conclusions drawn adequately supported by the results?
Yes

**Competing Interests:** No competing interests were disclosed.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 23 Oct 2022

Agbons Oaiya, PATH, Abuja, Nigeria
Many thanks for your comments. The typos, grammatical errors and other concerns raised have been addressed in the revised submission.

**Competing Interests:** No competing interests were disclosed.

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Reviewer Report 26 April 2022

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Richard F Heller

University of Newcastle, Newcastle, NSW, Australia

This paper is a thorough and well written report of a valuable project with important practical results. The findings indicate a gap between the required and provided staffing needs in primary health care in one part of one State in Nigeria.

I have three areas that I feel would improve the understanding of the paper.

First, in the Methods, we learn that the data come from DHIS2 (District Health Information System), an electronic database, triangulated by field visits to health facilities. This is an appropriate method, but the term 'triangulation' does not give us adequate information about what was done. Were field visits made to each of the facilities, how was the data obtained, how was the 'triangulation' actually performed and how were discrepancies resolved?

Second, the Methods give us five formulae, which each look fine to me, and relate to Table 2, which is really clear and presents the main results of the study. However, I can't see a description of how the formulae lead to the column headings (N/M and CHW available and calculated) in the Table. Clarifying this would make the paper more understandable.

Finally, I would have liked to see a discussion of the generalisability of the findings. The choice of Kaduna North LGA (Local Government Areas) is described as purposive, and that is fine, but how representative might this particular LGA be to other settings. Government prioritized health facilities within the LGA were chosen for the study, but how representative might these be to to generality of health facilities.

I think that it should be quite easy to resolve the issues I have highlighted, which are only matters of presentation rather than questions about the validity of the research.

**Is the work clearly and accurately presented and does it cite the current literature?**

Yes
Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Partly

If applicable, is the statistical analysis and its interpretation appropriate?
Yes

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
Yes

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** Public health, health services, education

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 23 Oct 2022

**Agbons Oaiya,** PATH, Abuja, Nigeria

Many thanks for your insightful comments. You concerns have been taken care of in the revised manuscript.

**Competing Interests:** No competing interests were disclosed.

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**Comments on this article**

**Version 2**

Author Response 29 Nov 2022

**Agbons Oaiya,** PATH, Abuja, Nigeria

**Point-By-Point Summary of the Changes to Revised Submission**

**Abstract**
Changes made in this section included additions of a few words to strengthen a few sentence structures, defining and using abbreviations, replacing numbers with words, correcting a few
grammatical errors - pluralising some words, and spelling corrections for some US/UK words. For example, prioritize and prioritise

**Highlights:**

- **Background:** Two words “health” and “the” were inserted in the last sentence
- **Methods:** Added WISN and LGA abbreviation, “10” replaced with “Ten”
- **Results:** Replaced 9/10 with “nine of the ten PHCs”, restructured a sentence, used WISN abbreviation
- **Conclusion:** used WISN abbreviation, rephased a few words for easy understanding

**Main Article**

**Introduction:**
Changes made in this section were mostly around restructuring some sentences. A few words were introduced, some removed due to grammatical errors/typos errors, pluralising some words and spelling corrections for some US/UK words.

**Highlights:**
- Previously:
  One of such reform is the Primary Health....

- Now:
  One such reform is the Primary Health....

**Methods:**
Following the recommendation from the reviewers, major changes in this section were on the definition of “Core health activities”, “Support activities”, and “Additional activities”, to reflect data/statistics availability which is in line with the WHO definition. Other changes made were based on feedback received – moving some paragraphs around to improve the flow, grammatical/typo corrections, and spelling corrections for some US/UK words.

- Previously:
  - Core health activities: These are clinical health services. This refers to activities directly related to service delivery performed by all staff of a cadre.
  - Support activities: There are non-clinical activities performed by a health worker but not directly related to a patient and usually involve all staff of the same cadre.
  - Additional activities: These activities are also not clinically related and are performed by health workers but not directly related to a patient. They usually do not involve all staff of the same cadre.

- Now:
  - Core health activities: The WISN methodology describes these as health service activities. They refer to activities performed by all cadre staff, and regular statistics are collected. They
are clinical and identified as clinical health services in this study.

- Support activities: According to the WISN methodology, these activities are performed by all members of the cadre, but routine statistics are not collected on them. Although these activities contribute to service delivery, they are not clinically related and are identified as non-clinical in this study.
- Additional activities: These activities do not involve all staff of the same cadre, and routine statistics are also not collected on them. For this study, they are categorised as non-clinical.

Results:
Three main changes were made in this section and identified by a reviewer. One was a typo in Table 1 “B) Non-clinical - support services activity standards”, the other was a round-off/approximation error and the last was restructuring a sentence for easy understanding.

Table 1
Previously:
 Documentation on patients | 3 | 3 | Minutes

Now:
 Documentation on patients | 30 | 30 | Minutes/Day

Round-off/Approximation error
Previously:
WISN ratio of 0.1

Now:
WISN ratio of 0.09.

Sentence Restructuring
Previously:
Primary Health Care Centre Hayin Banki has the lowest WISN ratio of 0.1, while there is no Nurse/Midwife available in Primary Health Centre Unguwar Shanu.

Now:
While there is no Nurse/Midwife available in Primary Health Centre Unguwar Shanu, Primary Health Care Centre Hayin Banki has the lowest WISN ratio of 0.09.

Discussion:
Changes made in this section were in response to the reviewer's comments on the use of the term “triangulation”, no linkage of Nurse/Midwife results to study recommendation, removed excess details on HRH TWG as well as a few minor grammatical/typo corrections.

1. Introduced a preceding sentence to respond to a reviewer’s comment on recommendations for the Nurse/Midwife category...“For the Nurse/Midwife category, there is an acute shortage, with just nine available and a lack of 45”. A WISN scale-up study across the state primary health care structure is recommended to effectively utilise scare HRH towards increasing coverage and
improving PHC services.

2. Rephrased a few sentences to provide clarity on the use of triangulation.

Previously:
Another limitation was with availability and quality of health care data at the facility level. At this level, challenges arose with the storage of paper registers. To address this challenge, we chose to compare and triangulate data with other sources; the national DHIS2. In cases where paper files/registers were unavailable during field trips to the facility due to poor storage facilities, we opted for data with the national DHIS2 data source.

Now:
“Another limitation was with availability and quality of health service statistics at the facility level owing to paper storage challenges. To address this challenge, we compared the data with a secondary source; the DHIS2. In cases where paper registers were unavailable, we used data retrieved from the DHIS2.”

Conclusion:
Minor typo and grammatical correction.

Competing Interests: No competing interests were disclosed.