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# Healthcare Workforce Shortages and Population Demand: A Supply–Demand Analysis of Primary Healthcare Accessibility in Igabi Local Government Area

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## *Abstract*

Primary healthcare (PHC) remains the foundation of Nigeria's healthcare system; yet persistent workforce shortages and rising population demand continue to limit access, particularly in rural and peri-urban areas. This study examined the supply demand dynamics of PHC accessibility in Igabi Local Government Area, Kaduna State, focusing on residents' perceptions of how workforce shortages and population demand affect service delivery. A cross-sectional descriptive study design was used. Structured questionnaires were administered to 384 respondents selected through stratified random sampling proportional to the twelve wards; 382 valid responses (99.5% response rate) were analysed using descriptive statistics. PHC facility audits, key informant interviews, and reconnaissance observations were used to provide contextual information. Findings showed that 52.6% of respondents perceived inadequate medical and technical personnel as seriously affecting PHC access, with a further 25.7% reporting moderate effects. All respondents indicated population demand affects service delivery, with 61.0% describing the effect as strong. Workforce shortages and rising demand jointly reduce accessibility by lengthening waiting times, overburdening personnel, and lowering service quality. The study recommends recruitment and equitable deployment of health workers, expansion of facilities, improved health financing, and strengthened community-based health programmes.

**Keywords:** Primary Healthcare Accessibility; Healthcare Workforce Shortages; Population Demand; Primary Healthcare Service Delivery; Igabi Local Government Area

# Introduction

Primary health care (PHC) is the foundation of health systems worldwide and is critical to achieving Sustainable Development Goal 3 and Universal Health Coverage (World Health Organization [WHO], 2021). Yet, the achievement of PHC is inherently contingent on

the presence of a sufficient and equitably distributed medical workforce. WHO estimates a global shortfall of 11 million health and care workers by 2030, an upward revision from the earlier 10-million projection, with low- and middle-income countries feeling this most acutely (WHO, 2026).

Africa bears a disproportionate burden, with 2.3 health workers per 1,000 people well below the 4.45 threshold (World Health Organization Regional Office for Africa [WHO AFRO], 2021). Shortages are exacerbated by urban–rural maldistribution, health worker emigration, and rapid population growth increasing healthcare demand faster than workforce capacity expands (WHO AFRO, 2024; Nwankwo et al., 2022).

Nigeria is a case in point. Nigeria, with an estimated population of over 216 million as of the last national population projections (National Population Commission [NPC], 2022), has just 1.95 health workers per 1,000 population, with severe deficits in the northern region (Saka, 2026; Ajala, 2025). Between 2021 and 2024, over 42,000 nurses emigrated, further straining the current workforce (Ajala, 2025). Despite the NPHCDA's Priority PHC Initiative (National Primary Health Care Development Agency [NPHCDA], 2025), which by early 2026 had upgraded about 3,000 PHCs and retrained over 78,000 frontline health workers nationwide (Premium Times, 2026), Nigeria is still faced with a deficit of 122,696 PHC workers (AllAfrica, 2026).

The continued population growth (around 2.4% annually) leads to increased demand for healthcare, resulting in supply-demand mismatches where workforce expansion cannot keep pace with demographic pressure (NPC, 2022; WHO AFRO, 2024). Geospatial analyses show that a facility's presence is not a guarantee of access without sufficient staffing (Oluwayinka, 2023; Abdullahi et al., 2024).

Recent GIS mapping in Igabi LGA of Kaduna State shows a variable distribution of PHC facilities within wards, but the relationship between workforce supply and population demand has not been explored (Abdullahi et al., 2024; Mohammed & Stella, 2026). This study fills that gap by looking at whether the supply of the healthcare workforce meets the population demand in Igabi LGA, incorporating workforce data, population projections, and geographical accessibility at the ward level. The findings will guide PHC planning and workforce deployment and contribute to progress toward UHC in northern Nigeria.

**Aim**

The aim of this study is to examine the implications of healthcare workforce shortages and population demand for primary healthcare accessibility and service delivery in Igabi Local Government Area, Kaduna State, Nigeria, with the objectives to:

1. Assess the implication of lack of medical and technical personnel to service accessibility.
2. Assess the influence of demand (needs) on PHC facilities service delivery.

**Statement of the Problem**

Nigeria continues to experience a critical shortage of healthcare personnel, undermining the accessibility and effectiveness of primary healthcare services. The country's doctor-to-patient ratio is approximately 2.9 per 10,000 population, far below the WHO-recommended minimum of 17 per 10,000 (Nigeria Health Watch, 2025). The Medical and Dental Council of Nigeria reported only 74,543 registered doctors serving an estimated 218 million people in 2022 — roughly one doctor per 3,500 persons (Umar, Salihu & Azuine, 2025). This shortage is aggravated by persistent migration of health professionals: over 13,609 Nigerian healthcare workers relocated to the United Kingdom in 2021 alone (Lawal et al., 2022).

Facility functionality is similarly limited: only about 20% of Nigeria's 34,076 primary healthcare centres are fully functional (Adeniran et al., 2023), while out-of-pocket expenditure accounts for nearly 75% of total health spending, creating financial barriers to utilisation (Onwujekwe et al., 2023).

At the local level, these supply-side constraints are compounded by demand-side barriers. In Igabi LGA, cultural beliefs, poverty, low literacy, and poor road infrastructure discourage timely utilisation of PHC services (Yildam & Madaki, 2023; Obilor, 2024). Existing studies have largely examined workforce shortages or demand-side pressures independently, leaving limited empirical evidence on their simultaneous effects on PHC accessibility in Igabi LGA. This study addresses that gap by examining both personnel deficits and population demand together.

**Theoretical Framework**

Andersen's Behavioral Model of Health Services Utilization (Andersen, 1968, 1995) is one of the most widely applied frameworks for examining health-seeking behaviour. It proposes that utilisation is shaped by predisposing factors (demographics, education, beliefs), enabling factors (income, insurance, geographic access), and need factors (perceived and evaluated health conditions) (Babitsch et al., 2012). This study adapts the model to jointly analyse supply-side constraints and demand-side determinants in Igabi LGA, treating workforce shortages as enabling barriers and socio-demographic characteristics and perceived illness as predisposing and need factors.

The WHO's Global Strategy on Human Resources for Health: Workforce 2030 offers a complementary supply-side lens, emphasising availability, accessibility, acceptability, and quality (AAAQ) (WHO, 2016). Applied to Igabi LGA, this framework supports evaluation of staffing levels, skill mix, workforce distribution, and service readiness, and highlights gaps between normative staffing requirements and actual deployment.

**Conceptual and Empirical Review**

Sub-Saharan Africa carries nearly 25% of the global disease burden but holds less than 3% of the world's health workforce (WHO African Region, 2022). Nigeria accounts for roughly 26% of Africa's 3.6 million health workers, yet this remains insufficient relative to population size (Ahmat et al., 2022), and skilled professionals remain concentrated in urban centres such as Lagos and Abuja while northern and rural regions stay underserved (Nigeria Health Watch, 2025).

Workforce attrition through migration compounds the shortage: a significant share of Nigerian medical graduates emigrate within years of qualifying (Okoroafor et al., 2023), and a 15-year cohort study found nearly half of graduates from a major medical school had emigrated within that period (Wariri et al., 2024). The COVID-19 pandemic accelerated this trend, driven by inadequate remuneration, poor infrastructure, insecurity, and heavy workload (Lawal et al., 2022; Aluttis et al., 2014).

Nigeria's over 34,000 PHC facilities are frequently non-functional due to inadequate staffing, equipment, and infrastructure (Adeniran et al., 2023), and funding in northern Nigeria falls below minimum service package requirements (Ogundeji et al., 2023). The 2022 National Health Insurance Authority Act aims to widen financial access, but coverage remains limited (Onwujekwe et al., 2023), and similar gaps in PHC availability and utilisation are documented in Ogun and Oyo States (Alonge, 2025).

Health-seeking behaviour in Nigerian communities is shaped by socioeconomic, cultural, geographic, and institutional factors; proximity and affordability strongly influence rural utilisation (Yildam & Madaki, 2023), and male respondents are less likely to use formal services due to sociocultural norms (Obilor, 2024). In Igabi LGA specifically, utilisation remains low despite physical proximity to facilities, owing to poor roads and inadequate staffing — evidence that geographic access alone does not guarantee effective care.

Empirically, Okoroafor et al. (2021) used the Workload Indicators of Staffing Need methodology to document significant PHC understaffing, while Adeniran et al. (2023) found imbalances in facility distribution and personnel deployment in Lagos State. Spatial analysis within Igabi LGA itself has revealed ward-level disparities in PHC access (FUDMA, 2024), and a national scoping review identified poverty, distance, and workforce shortages as dominant barriers to equitable healthcare access (Adomi

et al., 2024). Out-of-pocket expenditure remains a further barrier: high direct payments expose households to catastrophic health costs and discourage care-seeking (Onwujekwe et al., 2023), and although health insurance enrolment has improved modestly, dissatisfaction persists in rural areas because of limited service availability and facility exclusions (Eze & Chukwuma, 2024).

**Gap in the Literature**

Subnational studies on healthcare workforce shortages remain limited in Kaduna State's LGAs, and existing research typically examines supply-side or demand-side factors in isolation. Few studies integrate both within a single analytical framework. This study addresses that gap through a cross-sectional descriptive assessment of workforce deficits and population demand in Igabi Local Government Area.

**Research Design**

This study adopted a cross-sectional descriptive study design. Structured questionnaires served as the principal data collection instrument, while PHC facility audits, key informant interviews, and reconnaissance observations were used to provide contextual information on workforce availability, facility capacity, and service delivery. The design enabled the collection of data on both supply-side factors (workforce and facility capacity) and demand-side determinants (perceived health needs and utilisation pressure) within Igabi Local Government Area at a single point in time.

**Study Area**

Igabi Local Government Area (LGA) is located in Kaduna State, north-western Nigeria, and has its administrative headquarters at Turunku. The LGA is geographically situated at approximately **10°47′00″ N latitude and 7°46′00″ E longitude** (10.783333° N, 7.766667° E), at an elevation of approximately 650 m above sea level. Igabi LGA is one of the 23 LGAs in Kaduna State and forms part of the wider Kaduna metropolitan area. It shares boundaries with **Giwa and Zaria LGAs to the north; Soba and Kauru LGAs to the east; Kajuru, Kaduna North, Kaduna South and Chikun LGAs to the south; and Chikun and Birnin Gwari LGAs to the west.** The LGA comprises both urban and rural settlements, including Afaka, Birnin-Yero, Kwarau, Rigachikun, Rigasa, Fanshanu, Gwaraji, Igabi, Kerawa, Sabo-Birnin, Turunku and Zangon-Aya. Its geographical location, extensive spatial coverage and mixture of urban and rural settlements make Igabi LGA appropriate for examining spatial variations in access to primary healthcare services (Ministry of Housing and Urban Development, Kaduna State, 2025).It comprises rural and peri-urban settlements, with Rigasa as the largest and most densely populated ward. The study covers all twelve formally designated public PHC wards.

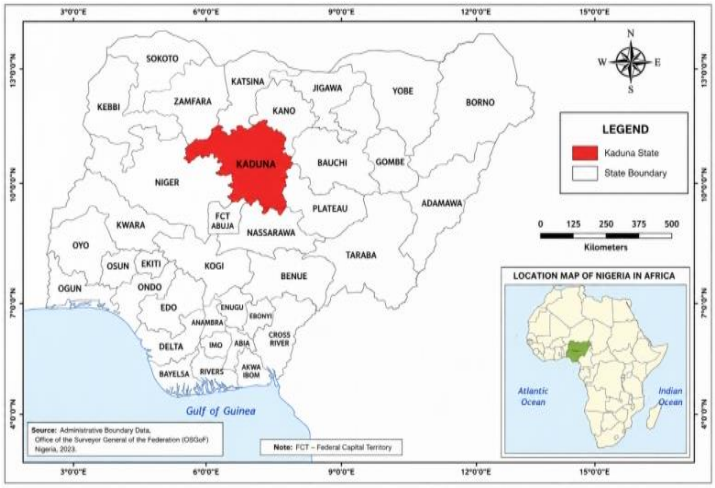



*Figure 1: The Map of Nigeria Showing Kaduna State Source: Adapted from* the Office of the Surveyor General of the Federation (2025), Nigeria, and Natural Earth Data.

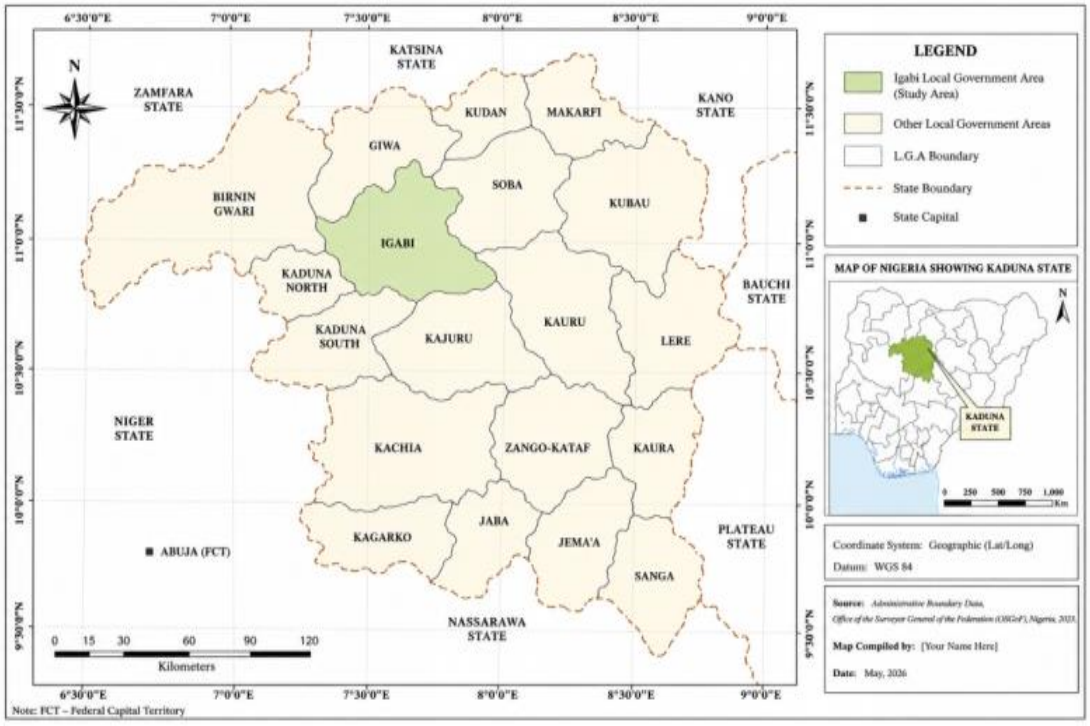



*Figure 2: The Study Area*
*Source: Adapted from the* **Office of the Surveyor General of the Federation.** (2025). *Administrative boundary data of Nigeria*. Federal Ministry of Housing and Urban Development, Abuja, Nigeria.

**Population of the Study**

The 2006 National Population and Housing Census recorded a population of 430,753 for Igabi Local Government Area (National Population Commission [NPC], 2006). In the absence of a more recent national census, the population was projected by the authors to 2025 using an exponential growth model with an annual growth rate of 3.0%, based on population growth information reported by the Kaduna State Bureau of Statistics (2025). The projected population of 754,720 was adopted as the study population and served as the basis for ward-level sample allocation and the population-to-facility ratio analysis.

**Table 1: Population Projection Sensitivity**

| Growth Rate | Projected 2025 Population |
|---|---|
| **2.5% (lower check)** | 686,215 |
| **3.0% (adopted)** | 754,720 |
| **3.2% (upper check)** | 781,833 |

Source: Author's Projection

**Sample Size and Sampling Technique**

A sample of 384 respondents was derived using the Cochran (1977) formula (Z = 1.96, p = q = 0.5, e = 0.05) at 95% confidence. Respondents were selected via stratified random sampling, with the twelve wards as strata and questionnaires allocated proportionally to ward population (Table 2). Of 384 questionnaires administered, 382 were validly completed (99.5% response rate) and form the basis of the descriptive analysis in Table 2.

**Table 2: Ward-Level Population and Sample Allocation**

| Ward | Population | Sample Size |
|---|---|---|
| **Afaka** | 39,919 | 20 |
| **Birnin Yero** | 34,385 | 17 |
| **Fanshanu** | 43,889 | 22 |
| **Gwaraji** | 50,928 | 26 |
| **Igabi** | 31,205 | 16 |
| **Kerawa** | 27,370 | 14 |
| **Kwarau** | 50,938 | 26 |
| **Rigachikun** | 76,623 | 39 |
| **Rigasa** | 115,956 | 59 |
| **Sabon Birni** | 87,474 | 45 |
| **Turunku** | 94,497 | 48 |
| **Zangon Aya** | 101,536 | 52 |
| **Total** | **754,720** | **384** |

Source: Kaduna State Government Survey, 2025.

**Data Sources and Analysis**

Primary data were collected through structured questionnaires covering personnel availability, facility accessibility, utilization frequency, and perceived demand pressure, supplemented by key informant interviews with facility in-charges and by facility observation and audit. Secondary data on staffing, facility distribution, and population came from the Igabi LGA Primary Healthcare Department, Kaduna State Ministry of Health, and the Kaduna State Bureau of Statistics. Descriptive statistics (frequencies and percentages) addressed Objective One; the same techniques, together with a population-to-facility ratio derived from the facility audit, addressed Objective Two.

**Validity, Reliability, and Ethics**

The questionnaire underwent expert review for content validity and was piloted in a neighbouring LGA to assess reliability, with feedback used to revise ambiguous items. Ethical approval was obtained; participation was voluntary and confidential, with no personal identifiers recorded, and data were used strictly for academic purposes.

**Demographic Characteristics**

**Table 3: Demographic Characteristics of Respondents (n = 382)**

| Variable | Frequency | % |
|---|---|---|
| **Male** | 274 | 71.7 |
| **Female** | 108 | 28.3 |
| **Age 21–40** | 245 | 64.1 |
| **Age 41–60** | 117 | 30.6 |
| **Age above 60** | 20 | 5.2 |
| **Single** | 153 | 40.0 |
| **Married** | 229 | 60.0 |
| **Primary education** | 45 | 11.9 |
| **Secondary education** | 125 | 32.7 |
| **Tertiary education** | 140 | 36.6 |
| **Quranic education** | 72 | 18.8 |

Source; Field Survey, 2025

The sample skews notably male (71.7% versus 28.3% female), despite stratified sampling across wards. This pattern is common in northern Nigerian household surveys, where household heads or the adult member present typically respond, and sociocultural norms can limit women's availability to engage with outside interviewers (Obilor, 2024). Because gender shapes health-seeking patterns in similar settings, this imbalance limits how confidently the findings generalise across sexes; future data collection should set ward-level sex quotas to correct it.

**Implications of Personnel Shortages on PHC Accessibility**

**Table 4: Effect of Personnel Shortages on PHC Accessibility**

| Response | Frequency | % |
|---|---|---|
| **Seriously affected** | 201 | 52.6 |
| **Moderately affected** | 98 | 25.7 |
| **Affected** | 66 | 17.3 |
| **Not affected** | 17 | 4.5 |

Source; Field Survey, 2025

A clear majority (78.3% combined) rated personnel shortages as seriously or moderately affecting PHC accessibility. Read against the AAAQ framework, this point to an availability failure: residents experience longer waits, reduced service hours, and occasional closures rather than problems of acceptability or quality once care is received. High patient inflow combined with inadequate staffing overburdens available personnel, eroding quality even where facilities remain nominally open; poor financing, congestion, and unreliable water and electricity compound these constraints. This aligns with Omoleke and Taleat (2017), who identified workforce shortages and poor infrastructure as major constraints on PHC delivery in rural Nigeria.

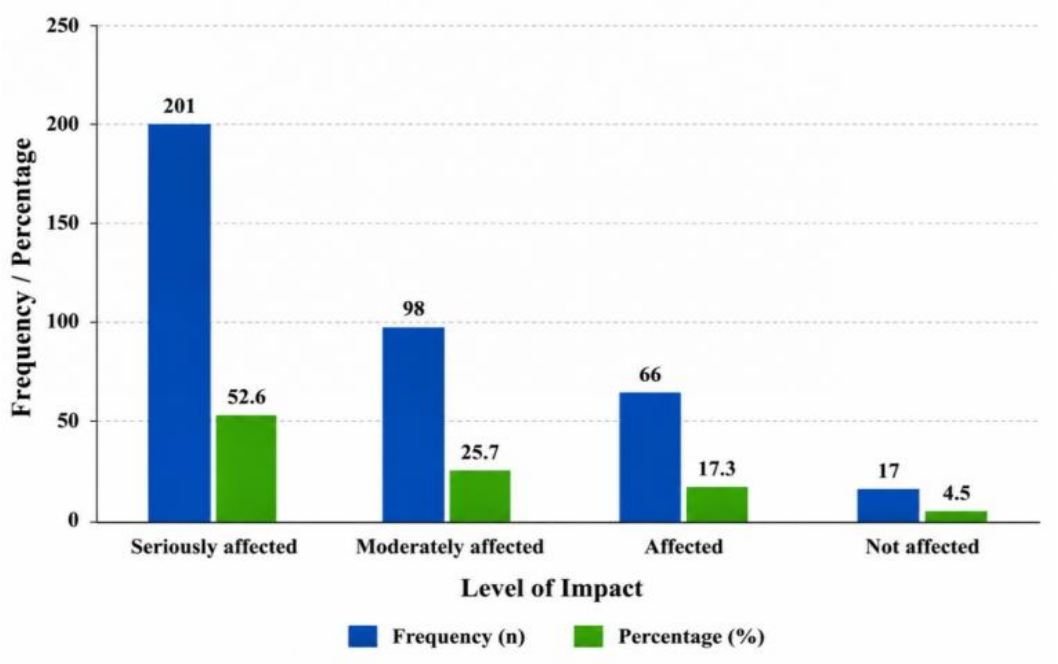



*Figure 3: Graphical Representation of the Implications of Lack of Medical and Technical Personnel on PHC Service Accessibility*
*Source: Field Survey (2025)*

**Influence of Population Demand on PHC Service Delivery**

**Table 5: Effect of Population Demand on PHC Service Delivery**

| Response | Frequency | % |
|---|---|---|
| **Strongly affected** | 233 | 61.0 |
| **Affected** | 149 | 39.0 |
| **Moderately affected** | 0 | 0.0 |
| **Not affected** | 0 | 0.0 |

Source; Field Survey, 2025

Every respondent reported that population demand affects PHC service delivery, with no responses in the "moderately affected" or "not affected" categories. Such uniformity is unusual for a self-reported perception item and warrants caution: plausible explanations include acquiescence bias, leading question wording, or a genuine ceiling effect where demand pressure is uniformly severe. Because a single item measured this construct, the design cannot distinguish between these explanations, and future iterations should use multi-item scales piloted for acquiescence effects.

Taken with Table 6, the pattern is nonetheless consistent with demand growth outpacing service capacity: overcrowding, longer waits, reduced consultation time, and heavier workload where staffing is already inadequate. Rising demand may push facilities toward informal triage, prioritising severe cases while less urgent ones experience delays that can affect early diagnosis, preventive care, and routine utilisation. Dimakou et al. (2015) documented a comparable dynamic in UK surgical care, where demand growth eroded delivery capacity despite a well-resourced system — a different context, but the same underlying pressure of demand outpacing capacity.

**Facility Distribution and Population-to-Facility Ratio**

The facility audit identified 68 PHC facilities across the twelve wards: 64 (94.1%) publicly owned and 4 (5.9%) privately owned, with all four private facilities located in Rigasa.

**Table 6: Distribution of PHC Facilities by Ward and Ownership**

| Ward | Total | Private | Public |
|---|---|---|---|
| **Afaka** | 4 | 0 | 4 |
| **Birnin Yero** | 4 | 0 | 4 |
| **Fanshanu** | 3 | 0 | 3 |
| **Gwaraji** | 5 | 0 | 5 |
| **Igabi** | 3 | 0 | 3 |
| **Kerawa** | 7 | 0 | 7 |
| **Kwarau** | 6 | 0 | 6 |
| **Rigachikun** | 6 | 0 | 6 |
| **Rigasa** | 14 | 4 | 10 |
| **Sabon Birni** | 3 | 0 | 3 |
| **Turunku** | 5 | 0 | 5 |
| **Zangon Aya** | 8 | 0 | 8 |
| **Total** | **68** | **4 (5.9%)** | **64 (94.1%)** |

Source; Field Survey, 2025

Facility counts vary considerably, from 3 in Fanshanu, Igabi, and Sabon Birni to 14 in Rigasa (20.6% of the LGA total), consistent with Rigasa's status as the largest, most densely populated ward. Private-sector provision is confined entirely to Rigasa, leaving the remaining eleven wards without a private-sector alternative when public facilities are understaffed mirroring the broader urban-centred pattern

of private and skilled-provider distribution reported elsewhere in Kaduna State and Nigeria (Nigeria Health Watch, 2025).

Using the projected 2025 population (754,720) and 68 facilities, the LGA-wide population-to-facility ratio is approximately 11,099 persons per facility markedly above the implied national average of roughly one facility per 6,750 persons (Adeniran et al., 2023; WHO, 2023), meaning each facility in Igabi LGA serves over 60% more people than the national norm implies.

**Table 7: Ward-Level Population-to-Facility Ratio**

| Ward | Population | Facilities | Persons per Facility |
|---|---|---|---|
| **Kerawa** | 27,370 | 7 | 3,910 |
| **Rigasa** | 115,956 | 14 | 8,283 |
| **Kwarau** | 50,938 | 6 | 8,490 |
| **Birnin Yero** | 34,385 | 4 | 8,596 |
| **Afaka** | 39,919 | 4 | 9,980 |
| **Gwaraji** | 50,928 | 5 | 10,186 |
| **Igabi** | 31,205 | 3 | 10,402 |
| **Zangon Aya** | 101,536 | 8 | 12,692 |
| **Rigachikun** | 76,623 | 6 | 12,770 |
| **Fanshanu** | 43,889 | 3 | 14,630 |
| **Turunku** | 94,497 | 5 | 18,899 |
| **Sabon Birni** | 87,474 | 3 | 29,158 |
| **LGA average** | **754,720** | **68** | **11,099** |

Source; Field Survey, 2025

Ward-level ratios reveal much greater unevenness than the LGA average suggests. Sabon Birni is the most underserved, at roughly 29,158 persons per facility more than 2.6 times the LGA average and over four times the national norm followed by Turunku (18,899) and Fashanu (14,630). Kerawa is comparatively well served (3,910), and Rigasa, despite its size, is also relatively well provided for (8,283) because its 14 facilities scale with its population. This disparity is consistent with spatial accessibility gaps already reported for Igabi LGA (FUDMA, 2024), and sharpens the case for prioritising new facilities in Sabon Birni, Turunku, and Fashanu rather than distributing them evenly.

**Conclusion**

This study examined the supply–demand dynamics of PHC accessibility in Igabi LGA, Kaduna State, with emphasis on the implications of inadequate medical and technical personnel and increasing population demand for service delivery. Workforce shortages constitute a major perceived constraint to healthcare accessibility: more than half of respondents indicated that lack of personnel seriously affects PHC access, while only a small proportion reported no effect; suggesting inadequate staffing contributes to longer waits, limited service availability, and occasional facility closures.

Population demand also significantly influences PHC service delivery. All respondents reported that demand affects service delivery, with a majority describing the effect as strong though, as discussed above, the absence of any "moderate" or "no effect" responses warrants some caution about the single-item measure used. Increasing pressure on limited facilities has resulted in overcrowding, excessive workload, reduced consultation time, and delays in care, further compromising service quality, particularly in wards with limited facility capacity and poor accessibility.

Overall, PHC accessibility in Igabi LGA is constrained by both workforce shortages and rising population demand, as perceived by residents surveyed. The interaction between these supply- and demand-side factors widens the gap between healthcare needs and service delivery capacity, and

addressing only one is likely to yield limited improvement. Sustainable improvement requires integrated interventions targeting workforce availability, facility capacity, and demand management across the study area.

**Recommendations**

1. Strengthen workforce deployment**:** Government and health authorities should recruit and deploy additional medical and technical personnel to understaffed PHC facilities, prioritizing wards with high demand and limited staffing, and introduce incentives such as rural posting allowances and career development opportunities to attract and retain workers.
2. Expand and upgrade PHC facilities**.** Existing facilities should be upgraded and additional ones established in underserved wards particularly Sabon Birni, Turunku, and Fanshanu with essential equipment, reliable electricity and water supply, and adequate consultation space to reduce overcrowding and improve service quality.
3. Improve accessibility and demand management**.** Government should improve road infrastructure and strengthen community-based outreach to reduce travel burden and distribute demand more evenly, alongside public health education to promote appropriate utilisation, including preventive care and early treatment.
4. Strengthen healthcare financing**.** Given that out-of-pocket spending accounts for a large share of total health expenditure nationally, expanding effective health insurance coverage and exploring targeted subsidies for PHC services in Igabi LGA would reduce financial barriers to care and complement the workforce and infrastructure measures above.

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