Chapter 10: Productivity of health workers in primary healthcare facilities in Nigeria: *Why is the average caseload estimated to be low?*

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This chapter adds to the growing literature around primary healthcare productivity, by first quantifying the current caseloads of consulting health workers in Nigeria, then quantifying the associations between contextual factors and caseloads in Nigerian facilities, and lastly concluding with recommendations for optimizing worker productivity within the country. We explore resource productivity, including a) how productive is primary health care (PHC), measured by caseload, b) what health workers are observed to do with their productive time, c) how patient demand influences caseload, and d) what are the modifiable factors that are correlated with caseload.

Key messages:

1. We first estimated caseloads, ranging from a facility average of 1.35 to a worker average of 4.39, according to diverse policy perspectives. Workers seem productively busy during spot-checks, with medical officers spending the majority of their time on consultation and other consulting staff less so.
2. Low caseload in PHC facilities is mainly associated with low demand for PHC. Very short waiting-times and the pattern of task shifting with higher caseloads imply that there is excess capacity for patients to be seen at many facilities.
3. It is likely that building new primary health care facilities would siphon off patients from existing facilities and reduce caseload.
4. An investment that improves quality of PHC services or reduces the cost of PHC services has the potential to increase the demand for PHC. The most easily and helpfully modifiable factors for increasing the supply-demand equilibrium average caseload are to make sure that facilities have both electricity and water, reduce registration and consultation fees fully to zero where feasible, and increase diagnostic accuracy. When demand is generated and more patients arrive at a facility, tasks other than consulting can be proportionally sped up or reprioritized to allow for more consulting time.

A. Problem statements

Provider caseload is an important and complex resource productivity indicator. However, we have had limited understanding about typical caseloads and their related policy implications in Nigeria. High caseload might be caused by a shortage of health worker supply or high absenteeism, which potentially compromise service quality and lead to on-duty provider burnout. Low caseloads may be caused by low demand for primary health care services, and further impact provider absenteeism and the practice of skills, reinforcing lower demand in a dangerous cycle.

In this chapter, we first analyze caseload from diverse policy perspectives. Implicit concerns of stakeholders when reading a lower-than-expected caseload estimate are: "What are workers doing with their time?" "Whether demand or supply is the driving factor of low caseloads?" and "What are the modifiable factors that are correlated with caseload?" We used data from Nigeria's 2013 Service Delivery Indicator Survey to address these questions.

B. Global Context

High workloads are a common complaint amongst community health workers in low- and middle-income countries (LMIC).[1,2] The WHO estimated in 2006 that 57 countries around the globe, including Nigeria, had critical shortages of health workers, and that these shortages were concentrated in South-East Asia and Sub-Saharan Africa.[3,4] It has been theorized, under reasonable assumptions, that with a general shortage of health workers, there will be a negative correlation between caseload and effort per patient[3,5], though it may take a certain threshold number of patients for this negative relationship to begin to manifest.[3]

Effort per patient is a known and serious concern in LMICs. A recent 2018 review by Kruk and colleagues paints a stark picture; they state that mothers and children receive less than half of recommended clinical actions in a typical preventative or curative visit, that diagnoses are frequently incorrect for serious conditions such as pneumonia, myocardial infarction, and newborn asphyxia, and that one in three people in LMICs cited negative experiences with their health system.[2] A 2017 review by Irving and colleagues found that in 18 countries representing about 50% of the global population, patients spend 5 minutes or less with their primary care physicians.[6]

However, it is difficult to know where and to what extent this quality shortfall is due to an overstretched health workforce. For example, a 2011 study in Ghana in which the current tasks of health workers was observed by researchers, direct patient care accounted for less than 25% of all observations, and for all observed cadres of workers, personal time was the most common activity classification.[7] It has been alleged that in Tanzania, "many doctors see five patients in a day – and then spend 3 minutes on each."[8] Caseloads seem to vary greatly at national levels; a recently published study found estimates of daily caseloads per provider to range from 17.4 in Mozambique to 9.8 in Niger to 5.2 in Togo.[9] There further exists the possibility of a reversed relationship between quality and caseload, as higher quality of health care may stimulate demand for health services and thus increase caseloads.[3]

What prompts health workers to be productive and provide quality care in LMICs is an active area of research. Design factors that can be easily be adjusted such as supervision, incentives, and training have been the subject of significant inquiry, but research has focused much less on the health system and community context that affects health worker productivity.[10]

C. Results

c.1 How productive is primary health care in Nigeria?

Caseload was defined as the average number of outpatient visits seen by a consulting provider per day in the primary health care performance initiative (PHCPI) framework.[11] One construction of caseload was to divide the number of outpatient visits each facility had in a three month span by the number of days it was open (for outpatients per day), and then by the number of consulting health workers on staff to yield outpatients per day per consulting staff. The resulting estimate of caseload in our analysis was 1.35. Policy makers would likely cringe at the thought that their health workers were being paid to see a mere one and a half patients per day. However, this construction of caseload probably does not tell policy makers and implementers

what they assume it does, and other constructions may be preferred. Stakeholders at the Gates Foundation investigated other constructions based on preferred assumptions.

One probable unwanted assumption implicit in the abovementioned construction is that it treats *all* consulting staff on payroll as applicable to the calculation, essentially treating every one of them as on duty every single open day to consult with patients. It probably fits better with provider experience and with policy makers' interest to calculate the daily caseload for the staff actually *on duty* each day to reflect on productivity. Accounting for this increases the average daily caseload to 2.42.

Additionally, to consider only outpatient visits ignores inpatients as a legitimate portion of a worker's caseload. Since inpatients by definition require multiple on-going check-ups, a facility average was estimated counting each inpatient to need 3 consultations (according to the costing study results).[12] When inpatients are added to the caseload, and only workers present on a given day to consult with patients are considered, the resulting caseload estimate is 3.08.

Even correcting for inpatient caseload and how many staff are actually on duty each day still leaves obscured three important facts about realistic caseload. First, this construction assumes each patient is seen exactly and only *one time by one consulting worker*. In reality, a patient may first be seen by a community health worker and then by a nurse, and/or afterwards by a doctor, or possibly simultaneously by more than one health worker, or other sequences and combinations. The estimate of 3.08 is a mathematical minimum, which would be exceeded if we could know how many consulting workers realistically see each patient on average. However, such information was not available in the dataset utilized for this study.

Secondly, a facility average may not truly be the average of interest. This construction treats all facilities as equal, no matter how many or few consulting workers they employ, so that the experience of a facility with two consulting workers is given the same weight as one with 20 or 50. A worker average may be of more interest to some stakeholders, and averaging caseload by worker rather than by facility changes the estimate to 4.39 patients per average consulting worker per day. This difference in averages is due to larger facilities being busier facilities, even after accounting for increased staff size.

This leads to the third potential warning about interpreting this caseload number. It only considers patients seen *at the facility*, either as outpatients or inpatients. But, community health workers leave the facility to see patients in the community and their caseloads are underestimated because such visits are not recorded as outpatient visits. This might be part of the reason why larger clinics seem more than proportionally busier; it would fit the data if patients preferred to make the trip to larger facilities for visits, but workers from smaller clinics more often leave the facility to see patients in the community.

A summary of different estimates of caseload from diverse policy perspectives is presented in Table 1.

Table 1: Caseload Estimates with Differing Definitions of Caseload

Observations	Average	Caseload Definition
1,639 Facilities	1.35	Outpatients per day per consulting staff on payroll, facility average

1,635 Facilities	2.42	Outpatients per day per consulting staff on duty, facility average
1,633 Facilities	3.08	Accounts for absence and inpatients as 3 consultations, facility average
10,832 Workers	4.39	Accounts for absence and inpatients as 3 consultations, worker average

Finally, rather than treat all consulting health workers as the same, readers may be interested in how caseload varies by job type. While we cannot differentiate from the data who sees what patients, we can make a cursory glance at possible differences in caseload by looking at worker-average caseloads by profession, the results of which are shown in Table 2.

Table 2: Caseload by Job Type

Worker Type	**Average Caseload**
Medical Officer (n=131)	6.27
CHW (n=630)	3.80
CHEW (n=4,603)	3.87
Nurse Officer (n=1,068)	5.35
Other Consulters (n=4,400)	4.67
All Workers Combined (n=10,832)	**4.39**

Table 2 shows that Medical Officers work at facilities that conduct more consultations in the facility per worker than the national average. Comparatively, Community Health Workers (CHWs) and Community Health Extension Workers (CHEWs) make up the staffs at less busy facilities or they spend more time in community outreach. For instance, it is expected that 40% of junior CHEWs time will be spent in the health facility and 60% in the community, according to the Ward Minimum Health Care Package,[13] and for more senior CHEWs the split is 4:1.[13]

c.2 What are health workers observed to do with their productive time?

An implicit concern of stakeholders when reading a lower-than-expected caseload estimate is: "What are workers doing with their time?"

It is very noteworthy that workers in facilities with differing caseloads use their time differently, as seen in Table 3. Table 3 uses our preferred facility-level measure of caseload (3.08, which accounts for workers being on-duty/present and accounts for inpatients) and maps caseload against how workers were using their time in spot-checks of their current activities. Consulting health workers at facilities with higher caseloads spend more time actually consulting; and proportionally less time on paperwork, gathering information, and "other" tasks. The time spent doing diagnostics and spent observably idle remains relatively in small proportion and stable. Health workers are productive in more than 98% of their time. This may suggest that when more patients arrive at a facility, tasks other than consulting are proportionally sped up or reprioritized to allow for more consulting time.

Table 3: Time Usage by Facility Average Caseload

	Average Daily Caseload At Facility					
	0 - 0.5 n=315	**0.5 - 1 n=303**	**1 - 2 n=286**	**2 - 4 n=226**	**4 - 10 n=172**	**10 - 100 n=61**

Percent Observed Performing Activity	**% Consulting**	35.2%	35.2%	38.4%	48.8%	55.5%	71.1%
	% Paperwork	20.1%	17.9%	18.5%	15.6%	15.0%	6.8%
	% Doing Diagnostics	2.5%	3.6%	1.5%	2.9%	2.5%	2.3%
	% Info Gathering	9.6%	10.2%	7.3%	7.2%	5.1%	4.7%
	% Other	32.0%	33.1%	33.4%	25.5%	21.9%	13.5%
	% Idle	0.6%	0.0%	0.9%	0.0%	0.0%	1.6%
	Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

This could imply that even though time gets almost fully spent on non-idle productive tasks at all facilities, the facilities with low caseloads may be able to fit in more patients simply by speeding up other tasks or time reallocation towards consulting patients. Table 4 reflects the potential to improve caseload, especially among community health workers, community health extension workers, nurse officers, and "others."

Table 4: Observed Activities of Consulting Health Workers during Spot Checks

	Medical Officer N=43	**CHW N=217**	**CHEW N=1,656**	**Nurse Officer N=322**	**Other Health Worker N=337**	**Total N=2,575**
% Consulting	74.4	42.4	39.7	45.3	33.8	40.4
% Paperwork	2.3	17.5	19.0	13.4	17.8	17.7
% Doing Diagnostics	7.0	1.4	2.6	4.7	3.9	3.0
% Info Gathering	2.3	10.1	9.2	9.6	10.7	9.4
% Other	14.0	28.1	29.2	26.7	33.5	29.1
% Idle	0.0	0.5	0.4	0.3	0.3	0.4
Total %	100.0	100.0	100.0	100.0	100.0	100.0

We see from Tables 3 and 4 that consultation takes up less than half of worker time for the vast majority of workers at the vast majority of facilities. It is, however, the largest share across all subgroups, even those with very low caseloads. One possible explanation is that workers at clinics with low caseloads feel free to spend much more time per patient and do so. Also, it should be remembered that both Tables 3 and 4 may suffer from the Hawthorne Effect, in which subjects modify their behavior while being observed. Idleness may be greater than measured if workers who would have been idle took up tasks to seem busy while an observer was at their facility. In particular, it is possible that they spent longer consulting with patients.

c.3 How does patient demand influence caseload?

We also want to understand whether demand or supply is the driving factor of low caseload. To investigate, we utilized the following reasoning process. Excess demand can be inferred from long facility waiting times; met demand or even excess capacity can be inferred from short facility waiting times. Therefore, the association between caseload and facility waiting times was investigated. If low patient demand is a strong driver of lower-than-expected caseload, waiting times would be generally shorter and waiting times and caseload would be positively associated,

with wait times being lengthened by more arriving patients. If low productivity of consulting health workers is the more influential factor, wait times would be generally long and the two would be negatively associated, with low caseloads correlating to low productivity that lengthens waiting times. The former scenario is the one seen in the data. Table 5 shows a clear positive association with between facility caseload and average waiting times.

Table 5: Association between Facility Caseload and Facility Average Waiting Times

		Patient Average Wait Time					
		<=5 min	**5-10 Min**	**10-20 min**	**20-60 Min**	**1-5 Hours**	**Total**
Facility Caseload	**0 - 0.5 Patients/Day N=285**	70.5	15.1	7.4	5.0	1.9	100
	0.5 - 1 Patients/Day N=255	67.5	19.6	8.6	3.1	1.2	100
	1 - 2 Patients/Day N=247	61.9	23.5	10.1	4.5	0.0	100
	2 - 4 Patients/Day N=218	58.3	22.5	15.1	2.8	1.4	100
	4 - 10 Patients/Day N=173	54.3	22.5	11.6	11.0	0.6	100
	10 - 50 Patients/Day N=64	29.7	28.1	18.8	15.6	7.8	100
	All Facilities Combined N=1,215	61.5	20.8	10.8	5.5	1.4	100

The vast majority of facilities (82.3%) have a measured average patient waiting time of 10 minutes or less, implying that when patients arrive at facilities, they usually get seen almost right away.

c.4 What are the modifiable factors that correlated with caseload?

To investigate societal and facility level correlates of demand for caseload, a linear regression was run on the log of caseload. The definition of caseload used for this regression was the third in Table 1, which is a facility caseload average that accounts for health worker presence/absence and accounts for inpatients as three consultations per day. The results of how caseload varies with these societal and facility factors are presented below in Table 6.

Table 6: Correlates of Caseload from Regression Results on 1,467 facilities

Variable	Change in Variable	Implied Change in Caseload	P Value
Infrastructure			
Electricity & Water	Gaining both if none	1.004	0.002
Electricity Only	Gaining electricity if none	0.241	0.410
Water Only	Gaining water if none	0.253	0.446
No Electricity or Water (Omitted)			
Registration or Consultation Fees			
Charges ANY Fees	Charging any Naira more than 0	-0.558	0.007
Avg. Fees	Adding 50 Naira to current fee	-0.090	0.052
Open Hours			
24 / Open Day	Change from 0-7 hours	1.192	0.002

11 -16 / Open Day	Change from 0-7 hours	0.559	0.226
9-10 / Open Day	Change from 0-7 hours	0.520	0.239
8 / Open Day	Change from 0-7 hours	0.654	0.083
0-7 / Open Day (Omitted)			
Other Facility Variables			
Avg. Diagnostic Accuracy	Increase of 10%	0.205	0.000
Equipment Summary Indicator	Acquiring a piece of equipment	0.190	0.008
Rx Summary Indicator 1	1 unit increase	0.189	0.000
Facility Classification			
Health Post or Dispensary	Being a Health Post or Dispensary	-0.481	0.081
Health Clinic or Center (Omitted)			
State-Level Variables			
PHC Per 100K People	Add 1 PHC facility per 100,000 people	-0.459	0.000
Per Capita Federal Transfers	Increase of 1,000 Naira per capita	-0.129	0.049
Poverty Headcount %	Increase in poverty rate of 10%	-0.005	0.001
Improved Sanitation %	Improve sanitation to 10% of households	-0.005	0.000
Child Wasting %	Increasing child wasting by 10%	0.012	0.000

D. Applications/policy linkage

The take-away from these regression results is that from an efficiency perspective, it is better for Nigeria to invest in improving its facilities rather than building new ones. Regression results show that for every extra facility in a state per 100,000 people in that state, there is an associated caseload decline of about 0.46 consultations per present-worker per day. Actually, there are 18 PHC facilities per 100,000 people in Nigeria, which is higher than other countries (i.e., 14.8, 13.9, 12.8, and 8.4 PHC facilities per 100,000 people in Kenya, Tanzania, Uganda, and Senegal, respectively). The network of PHC facilities does not appear to be a critical factor affecting availability of care in Nigeria. It is likely that building new facilities would siphon off patients from existing facilities.

However, numerous facility quality indicators are clearly associated with an increased caseload, very likely through increased demand for facility services. First of note is infrastructure. On average, facilities with both electricity and water see one more patient per worker per day than facilities with neither, if the facilities are otherwise comparable. Having either water or electricity may be improvements of themselves by 0.25 or 0.24 caseload, respectively, but the combined effect of both is much more than the sum of the parts. Currently, amongst health clinics and health centers, about 20% have neither and a further roughly 40% only have one, with only 40% reported as having both.

Next, we see that better average diagnostic accuracy of health workers is associated with more patients seen per worker per day. The average across facilities of accuracy of diagnosis was measured to be only 35%. Our regression indicates a 10% improvement to 45% would be associated with 0.2 patients per day. Demand also seems responsive to missing equipment and the availability of prescription drugs.

Charging fees for either registration, consultation, or both seems to discourage demand for services. Many facilities (43%) charge for neither. But, facilities that charge any amount at all

see 0.56 fewer patients per worker per day than facilities that do not. Caseload seems to then further fall at a rate of 0.09 patients per 50 Naira charged. For facilities that do charge registration or consultation fees, 62% charge a combined 100 Naira or less, and 97% charge 1,000 Naira or less. In Nigeria, majority of patients are not covered by any insurance. In such cases, patients are sensitive to fees, as they need to pay out-of-pocket.

Hours of operations has a clear association with caseload when facilities are open 24 hours, but this relationship is a bit difficult to interpret. It is not surprising that such facilities see more patients per day, but such facilities have at least one extra shift to account for, which muddles our measure of workers on duty. Being open at least 8 hours and up to 16 hours has not-quite significant association with an increase in caseload of about 0.52-0.65 over being open 7 or less hours per day. It is difficult to determine the extent to which such facilities draw more people by being open longer or deciding to stay open longer due to larger demand in their area. In Minimum Standards for PHC in Nigeria, recommended operating hours for health facilities are at least seven hours (from 9am to 4pm), with the expectation of eight hours for health posts[13] and 24 hours for PHC clinics and centers.[13]

From a modifiable factors standpoint, meeting the standard of minimum infrastructure seems to be the stand-out variable that is modifiable and has a strong positive association with caseload, as well as fully eliminating registration and consultation fees where feasible. Increased ability of consulting health workers to diagnose illnesses accurately also seems to be associated with a moderate increase in demand for their services, and irrespective of demand, would certainly be a worthy goal in itself.

We would like to think about a feasible aggregated impact by implementing multiple policies to improve primary health care. For a hypothetical health clinic or health center with typical 35% diagnostic accuracy and no water or electricity, to realistically improve diagnostic accuracy to 55%[14] and to install water and electricity, we would expect an associated increase in caseload 0.41 and 1.005, respectively, which yields 1.4 patients per on-duty worker per day in simulation. For comparability, measures of diagnostic accuracy in Uganda and Tanzania were 56% and 57%, and Kenyan providers achieved 72%. (See Table 7 in Kress, Su, Wang's paper, 2016).

Below are the key findings from our study.

1) Accounting for how many workers are present rather than simply on payroll, as well as accounting for inpatient bed days (rather than only outpatient consultations), raises the estimated *facility average* consulting worker caseload at public PHCs from 1.35 to 3.08 consultations per day. Averaging caseload by *worker* rather than by *facility* further changes the average caseload to 4.39 consultations per day at public PHCs.

2) Medical officers spend the majority of their time on direct patient consultation. Other consulting health workers, such as nurses and community health workers, have the potential to adjust time allocation for more consultation.

3) **Low patient demand** for consultation at many facilities has most likely left **excess capacity** to see patients at those facilities, as can be seen from very short patient waiting times and the likely potential for task-shifting amongst health-care workers.

4) It is better for Nigeria to invest in improving its current facilities rather than building new ones. It is likely that building new facilities would siphon off patients from existing facilities.

5) **Making sure all facilities have electricity and water** may be the easiest and effective first step at increasing patient demand for consultations at public PHC's. Reducing registration and consultation fees, which are already usually low, fully to zero where feasible also seems likely to elicit increased demand. Increasing diagnostic accuracy also appears associated with modest increases in caseload and is, regardless, an important and worthy goal for Nigeria's health system. Once demand is generated and more patients arrive at a facility, tasks other than consulting can be proportionally sped up or reprioritized to allow for more consulting time.

Appendix

(1) Data source and methods

Nigeria's 2013 Service Delivery Indicator Survey was the source of data for this analysis. This survey included 2,482 facilities that were surveyed on 5 extensive modules; four of which were used in this analysis: Module 1, a facility questionnaire that included information in infrastructure, equipment, and medical supplies; Module 2, a staff roster with information regarding the background, job description, and activities of staff; Module 3, which assessed staff diagnostic accuracy and adherence to clinical guidelines via vignettes of hypothetical patients; and Module 4, a facility financing module.

(2) Limitations

This report has several limitations. First, it is restricted to in-facility service, and we have no information about the caseloads of community outreach programs or how they affect the caseloads of in-facility services. Second, being observed by a survey worker likely altered, at least somewhat, the tasks being performed by workers, almost certainly in the direction of seeming busier on average than they otherwise would be. How much this changed the results are unknown. Third, this analysis is cross-sectional, and only association, not causation, can be inferred from the data.

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