

Performance assessment of six public health programs in Katsina State, Nigeria

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ABSTRACT

This research aimed to evaluate the performance of six ongoing public health programs through core performance indicators in Katsina State, Nigeria. The healthcare delivery in Africa is mostly program-based. This requires that such programs need to be evaluated which may in turn help to identify any existing gaps towards the improvement of patients' access and coverage to their given service. We identified all active health facilities where our programs on malaria, Routine Immunization (RI), Family Planning (FP), Tuberculosis and Leprosy (TBL), HIV/AIDS, and Free Medicare (FMC) were being carried out. After that, a representative sample was derived to obtain data regarding five key performance indicators by using a Logistics Indicators Assessment Tool. Of 1,718 facilities, a total of 983 (57.22%) were visited. In other words, by assuming a normal distribution; each facility expectedly covers only 3,371 individuals. All programs provided different and diverse results on each indicator; however, the most obvious challenge was in the stock-out and demand vs. receipt of required medications. These are particularly for malaria, FMC, FP, and HIV. For instance, the stock-out lasted 222 days for malaria and 135 days for FP. Despite this, none of the programs had a lower than gold-standard near-term availability of required products. Program-based healthcare delivery is inadequate and ineffective unless the local system gets simultaneously developed. If required medications are not becoming available, optimal access, coverage, and benefits cannot be expected to be obtained. Clearly, Nigeria experiences a push system of meeting term supplies. Nigeria needs to strengthen its pharmaceutical system.

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1. INTRODUCTION

Like elsewhere, Africa's public health is multi-dimensional, multi-actor driven, fragmented, and fragile, where everything is likely to be affected by everything else [1]. For instance, in Africa, a single sudden change in policy has the capacity to hamper patient's access to treatment immediately and in turn devoid them of possible benefits in terms of favorable patient-level outcome and overall reduction of disease burden in the country [2]. Here, in Africa, the majority of healthcare delivery is "vertical" and program-based. Thus, outcomes are dependent on both in-countries as well as external factors [3]. Thus, there is a need to systematically examine such public health programs that may help identify opportunities, gaps, and challenges that might hamper patient's access and coverage to any given treatment. However, little has been formally done before on this. Assessment of programs is also crucial because

elsewhere it is shown that despite enormous program-based fund investment in Africa, little improvement in the strengthening of the local healthcare system has been achieved [3]. Thus, continuing with our vision of establishing a reliable public health profile and positive international presence of scientifically silent locations, and with an objective to systematically assess several ongoing public health programs, we performed this work in Katsina (Nigeria). This, if validated, would provide evidence-based conclusions on how the programs are functioning in an African cultural context before we may propose improvements, for the local and global level. Table 1 gives details of the six (6) supply chain systems being investigated [4-10].

Table 1. Supply chain systems in Katsina State, Nigeria

S/N	Supply Chain System	Number of Health Facilities Where Services Are Provided	Number of Local Governments Covered
1	Malaria	1.178 of 1.718 (100%)	34 of 34 (100%)
2	Family Planning	393 of 1.718 (23%)	34 of 34 (100%)
3	Routine Immunization	1.623 of 1.718 (94%)	34 of 34 (100%)
4	Tuberculosis and Leprosy Control	173 of 1.718 (10%)	34 of 34 (100%)
5	*HIV/AIDS	19 of 1.718 (1.1%)	16 of 34 (47%)
6	Free Medicare	25 of 1.718 (1.5%)	16 of 34 (47%)

*HIV/AIDS: Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome; S/N: Serial Number

2. RESEARCH METHOD

2.1. The significance of disease conditions addressed

The public health programs that we included were malaria, HIV/AIDS, maternal and child health, family planning, routine immunization, tuberculosis, and leprosy. These cover disease conditions of preventative, social, and communicable interest; all of which are of particular importance in our country's context [3]. Moreover, these conditions have a cross-therapeutic implication as well. For instance, those with cerebral malaria are five times more likely to develop epilepsy and dementia, just like tuberculosis, leprosy, and childhood infections for various neurological and mental health conditions. Mainly speaking, maternal and child health risk factors may account for 40.0% of epilepsy cases [11-13].

2.2. The significance of addressing nigeria

Nigeria is a large, diverse, and most populous country of Africa. It has about 182 million individuals who belong to at least 250 ethnic groups and speaks 350 languages. The population is predominantly youth probably because the current life expectancy is merely 55 years. Here, malaria causes 25.0% under-5 year deaths, and its caseload may change drastically over a short period time [3]. The HIV burden is second highest from among all countries. The incidence of TB is 311/100,000, one of the highest in the World. The system-related gaps are also visibly present, for instance, the general workforce for healthcare delivery is grossly inadequate. The current public and private expenditure on health (as a percentage of GDP) are meager, i.e., 0.8% and 2.6% respectively [3]. There are numerous such examples.

2.3. Project location

Katsina is the 5th most populous and 17th largest province of Nigeria and is located at about 500 KM from Abuja, the national capital. It has a population of 5,792,578 (51.0% males, <15 years: 49.0%, >65 years: 3.0%, life expectancy: 55.2 years according to 2016 census) [14-17]. Most of them belong to Hausa, the largest ethnic group of Africa, with contemporary Islam as their predominant religion. Katsina currently has a total of 34 Local Government Areas (LGAs), the 2nd most of all in Nigeria.

2.4. Procedures

For this work, we prepared a comprehensive list of all active service-delivery facilities that are catering to an ongoing public health program (both national and provincial) on *malaria* (national), *family planning* (national), *routine immunization* (national), *HIV/AIDS* (national), *tuberculosis and leprosy* (national), and *Free Medicare-women and child* (provincial). A simple random sample of facilities was after that derived from this source population by assuming that 50.0% facilities would have a "gold-standard situation" on five chosen key performance indicators as shown in Table 2, 95% Confidence Interval (CI), 3.5% variance between groups, and 10.0% total width of CI [18].

Table 1. Sample size determination from number of service points of programs to be visited

S/N	Program Area	Number of Health Facilities Where Services Are Provided	Sample Size
1	*HIV/AIDS	19	19
2	Malaria	1,718	315
3	Tuberculosis & Leprosy Control	173 *DOTS centres	120
4	Routine Immunization (RI)	1,623	311
5	Family Planning	393	195
6	Free Medicare	25	24

*DOTS: Directly Observed Treatment Short Course; *HIV/AIDS: Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome; S/N: Serial Number

In order to collect required data, we used a validated questionnaire, named the Logistics Indicator Assessment Tool (LIAT) that covered various aspects related to indicators of our interest [19]. These included: (a) accuracy of inventory data, (b) demand *versus* receipt of required health products, (c) actual storage conditions in-place, (d) near-term availability of required medications, (e) frequency of stock-out of health products. All these indicators were examined in details. For instance, for the accuracy of inventory data, the physical balance of the products and most recent requisition reports were matched.

Similarly, demand versus receipt was examined by referring to the quantities ordered as per requisition reports and quantity received as per supplier's proof of delivery. The actual storage conditions were examined by using a set of 17 sub-indicators (e.g., the arrangement of products with labels visible, physical conditions of cartons and packs, a quarantine area for unusable stock, etc.). Near-term product availability was examined by taking stock at-hand *vis-à-vis* average monthly consumption of the facility to see if the stock would last till the next due supply. A stock-out was measured as a point estimate, i.e., on the day of the examination, and in the preceding six months, along with the duration of stock-out that may have happened. All facilities use an identical number and nature of health products for their part of activities. For this work, all eleven (11) field staff recruited received three rounds of training on orientation, practical filling of LIAT, and mock data collection. All data were systematically entered in MS-Excel and appropriately analyzed. Ethics permission was obtained from the Institutional Review Board of Pôle Universitaire Euclide. Informed consent was obtained from all participants before their participation. No direct patient-related or any other identification data was collected.

3. RESULTS AND DISCUSSION

A total of 1,718 facilities were found to be operational in our province. Of them, a total of 983 (57.22% of the total) facilities were surveyed across all LGAs in the province. These belonged to *HIV/AIDS* (n=15, 78.9%), *Free Medicare-women and children* (n=15, 60.0%), *tuberculosis and leprosy* (n=123, 71.1%), *family planning* (n=195, 49.6%), *malaria* (n=319, 18.6%), and *routine immunization* (n=311, 19.5%). For convenience, the remaining results are summarized in Tables 3 and Table 4.

Table 3. Collated data for logistics indicators assessment of six public health programs in Katsina State, Nigeria

Parameter	Malaria (n=319)	RI (n=316)	FP (n=125)	TBL (n=123)	HIV (n=15)	FMC (n=15)
Mean staff experience (in months)	181	182	90	77	47	47
Presence of road	253	215	159	108	15	15
Presence of electricity	82	74	65	64	15	15
Presence of water supply	69	74	63	73	15	15
No. of products used	12	17	9	18	23	165
Emergency orders placed	50	40	39	16	7	0
Determine quantities themselves	114	275	118	44	5	0
6-month stock-out	201	0	99	23	5	15
Point frequency of stock-out	184	0	75	34	5	15
No. of days stocked out	222	0	135	1	4	30
Keep records of expired products	66	37	6	11	1	0

Table 4. Rated performance (%) of the core logistics indicator

Core Logistics Indicator	Malaria	RI	FP	TB	HIV	FMS
Indicator 1: Accuracy of logistics data for inventory management	98%	99%	91%	96%	97%	100%
Indicator 2: Percentage difference between the quantity of products ordered and the quantity of products received *(the lesser, the better)	100%	1%	8%	2%	2%	100%
Indicator 3: Percentage of facilities that maintain acceptable storage conditions	85%	85%	93%	91%	96%	96%
Indicator 4: Percentage of facilities whose stock levels ensure near-term product availability	83%	100%	100%	83%	96%	92%
Indicator 5: Percentage of facilities that experienced a stock out at any point during a given period *(the lesser, the better)	63%	0%	51%	19%	33%	100%

Logistics systems in Nigeria are facing many challenges. The biggest is funding which is somewhat unilateral- mostly donors' fund used to support the entire system [20]. Counterpart funding has been wholly ineffective. Consequently, stock-outs loom for many products. Another significant challenge faced by logistics systems is the storage conditions of health commodities. Nearly all medical stores are not of pharmaceutical grade. Thirdly, data quality has challenges ranging from updating records, missing reports, errors in reporting, and quality of data often is inadequate [21]. Logistics technical know-how is also highly inadequate among service providers in health facilities.

The challenges of logistics systems in Nigeria are more pronounced in the Northern part of the country where literacy level and coverage are low [22]. The indices of health and logistics of health commodities in Katsina State are very poor particularly in the direction of maternal & child health and nutrition [23]. Of the five disease areas identified and supported by the Nigeria Supply Chain Integration Project (NSCIP), there is no information on the performance of at least the five core logistics indicators [24].

We performed a very comprehensive examination of six ongoing public health programs in Katsina State, for which we used five key performance indicators. This work was necessary for several reasons but, as far as we are aware, this is the first work from Africa that has formally utilized a validated instrument and five formal indicators for a program-based evaluation. Earlier efforts have only been restricted to using a single indicator, or just being an informal internal evaluation. Our work has, therefore, succeeded to fill knowledge-gaps to some extent.

A total of 1,718 facilities were found to be operational in our province, which implies that (assuming a normal distribution) each facility is expected to cover only about 3,371 individuals. This is a critical system-related "opportunity" that may help in providing a structured decentralized program-based objective-driven health care services for possible sustained performance and patient benefits [25]. In total, we surveyed 57.22% of the existing facilities. Thus, our work is reasonably representative of public health activities that are taking place, either as a national or a provincial program. For instance, we surveyed 78.9% and 71.1% of all facilities where HIV and tuberculosis and leprosy respectively services are provided.

The choice of our province was also appropriate. For instance, Hausa, the predominant ethnic group of Katsina, is 29.0% of the total Nigerian population. Both Katsina and the Nigerian population are similarly young (49.0% and 43.0% respectively are <15 years of age). Islam is the predominant religion of Katsina, and about 50.0% of Nigerians practice it. There can be numerous such examples. Thus, our results may be considered to fairly reflect current public health program-based healthcare delivery situation that is being carried out in a Nigerian cultural context, as a whole.

For any program evaluation and optimal performance, data accuracy is an essential parameter. None of our programs had a data deficiency, although numeric differences were found between programs. These differences might be due to various factors, such as differences in the "individual capacity" (e.g. quality and length of staff experience) and "compensation" (e.g. better dedication towards work), or "operational convenience factors" (e.g. distance to home, training facilities), or "donor-related factors" (e.g. funding input for better infrastructure), or "political factors" (e.g. centralized or decentralized drug supply), etc [26-30]. Elsewhere, data quality issues have been reasonably noted which may be due to incessant stock-outs, poor donor engagement, inadequate capacity building of personnel, complexity in supply procedures, etc [31-33]. Here, absence of difference in data discrepancy between programs could probably be methodological (e.g., inadequate sample size for detecting such a difference). This may also be probably because all of our facilities undergo the same kind of staff training and uses the same kind (and number) of health products for implementing their part of public health programs. Moreover, our field staff was systematically trained for two days, and each indicator was reasonably defined and comprehensively evaluated. This may have caused some difference than elsewhere, but this can only be speculated.

The disparity between the quantity of products ordered and those received is a core logistics indicator. In the LIAT, this indicator is tracked going by the name, a discrepancy that implies that the lesser

the values obtained, the better the performance. Due to the practice of the push system, both malaria and Free Medicare programs recorded 100% discrepancy indicating that whatever quantities the facilities requested were not the issued amounts to them. For the malaria program, the main reason was due to program expansion without corresponding quantification and increased funding while for the Free Medicare, it is purely due to insufficient financing which could not afford to buy commodities to satisfy 100% of client burden.

The FP program recorded 8% discrepancies between what they ordered and what they were issued. HIV/AIDS, tuberculosis, and routine immunization reported 2%, 2%, and 1% discrepancies. On average, the state has 36% discrepancies, but this was caused principally by malaria and Free Medicare programs that operate on a push system of issuing commodities to health facilities. Storage conditions form a core indicator and are a range of best practices that should be in place to store health commodities. Proper storage conditions are undoubtedly required to preserve the potency and efficacy of all products intended for use as medicines, diagnostics, or consumables.

There are many critical things to look at to conclude that storage conditions have been met. In this study, up to 17 other indicators have been evaluated to assess this particular indicator. Having adopted an 85% recommended pass score for the core indicator; it is evident that all the public health programs assessed have passed the assessment. The least scores were 85% scored each by malaria and routine immunization programs. Tuberculosis & leprosy, family planning, HIV/AIDS, and Free Medicare are performing optimally at 91%, 93%, 96%, and 96% respectively. Overall the state has an average of 91% pass for this indicator, and it appears that it is working across the entire state.

Stock status is a core logistics indicator. All public health programs assessed operate within a maximum and minimum inventory control window. This indicator is the flipside of the stock out indicator. The percentage pass for stock out having been fixed at not exceeding 20%, a stock status of not less than 80% is expected to be maintained for a program is considered as passing the indicator. The study found that at the time of the assessment, there were high stock levels across all programs. Malaria and tuberculosis & leprosy programs had recorded 83% each, Free Medicare program had 92% stock availability, HIV/AIDS program maintained stock levels at 96%, and both routine immunization and family planning programs maintained 100% stock availability. Overall, public health programs had an average stock availability of 92%.

This indicator is the flipside of stock out rate. In other words, if a stock level of 80% is desired, then stock out rate should not exceed 20%. The level of stock availability, the patient load of the different logistics system can be a measure of how much commodity security is available for each disease program. The routine immunization program had 100% commodity security for 330,353 children that are below the age of one year and need to be immunized in the state.

The family planning program has the second highest patient load with a total of 140,147 clients aged between 15–49 years that are using modern contraceptives in 2018. The FP program also had a record of 100% commodity security for over 140,000 clients accessing services. The next program in terms of the high patient load is the Free Medicare program with a record of 65,670 patients in April–June 2018 only. As at the time of this assessment, the Free Medicare had 92% availability of commodities. With stock availability of 95%, the HIV/AIDS program has 9,435 clients on treatment across 19 health facilities. Tuberculosis & leprosy program has 889 adult cases and 524 children cases on treatment, which represent a total of 1,413 clients' burden for the program and had 83% stock availability for all the clients. Lastly, the malaria program has the most significant number of facilities supported, but unfortunately, there is no established number of people on treatment because malaria is treated per episode of attack.

Of all indicators we evaluated, the most obvious challenge was in the stock-out, and therefore, in demand vs. receipt, of health products as shown in Table 3. This stock-out was visible for all programs except routine immunization and tuberculosis and leprosy. This might be interpreted in numerous ways. Firstly, nearly all of the facilities in these two programs were estimating their requirement themselves as shown in Table 3 which may have helped in part through better assessment of local scenarios. These two programs had a relatively low number of stock-out days as well as shown in Table 3. Secondly, the stock-out might be in part related to the number of health products being used in a program as shown in Table 3. For instance, Free Medicare uses 165 products, and 62.0% of its facilities were out of stock for six months as shown in Table 3. Thirdly, stock-out in Africa should not be unexpected because more than 90.0% of health products in Africa are imported from outside [34–40]. This, therefore, is subjected to external factors as well as in-country regulations and restrictions. To elaborate further, Nigeria has about 130 pharmaceutical companies, but only 8.0% of them have a sustainable operation. A formal evaluation of them has shown poor performance, for instance, capacity utilization of just about 40.0% [41]. Having no local availability of active ingredients is another significant hindrance towards a desirable level of availability and access to essential medications. No doubt, the pharmaceutical sector here accounts for merely 0.2% of Nigeria's GDP [42].

While comparing point (on the day of observation) and six-monthly stock-out, Table 3, there was not much subsequent decline in the stock-out. For instance, in malaria and family planning, the stock-out was for 222 and 135 days, respectively, Table 3. Thus, poor pharmaceutical scenario (e.g., stagnant supply, over-reliance on external stakeholders, in-country challenges) is a significant feature of the healthcare delivery system here in Nigeria. This again should not be unexpected since elsewhere it is shown that donor-funded programs do not lead to simultaneous broad “horizontal” development of local healthcare delivery system [42]. For instance, a centralized procurement does not always mean a timely transport of supplies to provinces. Fourthly, another reason of stock-out might be an abrupt change in caseload as it may be seen in emergency orders placed by the programs, Table 3, such as malaria. This should not be unexpected in population like ours where caseload may change by 52.0% over a relatively short period [3]. Moreover, in Nigeria, disease conditions such as malaria are generally treated per episode of attack and not by its total number of caseload.

Lastly, as far as we are aware, ours was the first comprehensive attempt to evaluate, and in turn identify challenges for, the delivery of public health programs in Africa. Our work visibly has its application across various interest areas including health policy making, critical decision and risk analysis, access and delivery of quality healthcare, health system evaluation, and is likely to strengthen our knowledge from a systems perspective; wherein everything is likely to be affected by everything else. Nevertheless, our work does not include those programs that are periodic or time-bound. Our work was not designed to identify predictors that may have affected performance between different programs and facilities. For instance, the military rule is common in Nigeria (until 1999 when democracy came to stay) that may affect the performance, benefit, and continuity of programs.

4. CONCLUSION

Positively, six sizeable public health programs were overall found to meet most of the key performance indicators in a systematic evaluation of 983 health facilities. Negatively, most programs (except routine immunization and tuberculosis & leprosy) fail in the parameter of stock-out of required health products. Our work also implies that program-based healthcare is of little long-term benefit for installing a “broad” improvement in the healthcare delivery system in the host country. Our work also implies that public health programs in Nigeria quite likely to follow a “push” system to meet their essential supplies. Lastly, our work calls policymakers to adopt a self-help model through strengthening the local pharmaceutical sector in order to bring better patient benefits and meet relevant public health and development goals.

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