Application of Bottleneck Analysis (BNA) Methodology for Primary Healthcare Review in Kebbi State Nigeria

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Abstract: **Strengthening service delivery is a key strategy to achieve the Sustainable Development Goals. This includes the delivery of interventions to reduce child mortality, maternal mortality, and the burden to HIV/AIDS, tuberculosis and malaria. Service provision is a product of three key determinants - Health Workforce; Commodity (including infrastructure, equipment, medical supplies, and finances for their synergetic functioning); and accessibility (including geographical and financial accessibility to services by clients). While applying a linear simplistic perspective, inputs lead to commensurate outputs within an enabling environment, and increased input lead to increased output – or in this context, increased capacity for service delivery and enhanced access to services. It is therefore imperative that health system actors conduct periodic review of the health system to enable them draw counter-intuitive insights on what constraints exist and to what degree, which hinder achievement of predetermined goals. The bottleneck methodology provides a model for health managers to review the adequacy of inputs (supply-side determinants) in relation to set standards and the performance of the outputs (demand-side determinants) in relation to uptake expectation per target population. The European Union-funded Maternal, Neonatal & Child Health plus Nutrition (MNCH+N) program in Nigeria supported the Kebbi State Primary Health Care Development Agency to conduct the first quarterly PHC Review using the revised Nigerian Bottleneck Analysis model in third quarter of 2018. The review also focused on the development of plans of action aimed at addressing some of the identified gaps. Findings show that coverage for under-five-year-old expected cases as follows; 22,497 diarrhoea new cases, 4,845 pneumonia new cases and 70,423 fever cases were identified and managed by health care workers at fixed and mobile posts. This represents 3.63%, 11.11% and 10.56% cases for Diarrhoea, Pneumonia and Fever respectively were identified, out of expected episodes per child in 2019.**

Keywords: **Coverage, Kebbi, Health facility, Plans, Disease, Intervention**.

I. INTRODUCTION

There are numerous definitions of bottlenecks described in literature. All definitions agree to the fact that the bottleneck has a negative impact on the output of the production system. The negative impact is commonly described as: "constraining the system". A few of these definitions are; Processes that limit output (Krajewski, Ritzman, & Malhotra, 2009); Processes whose isolated production rate has the highest sensitivity of the system's performance compared to all other processes (Kuo, Lim, & Meerkov, 1996); The stage in a system that has the largest effect on slowing down or stopping the entire system (Roser, Nakano, & Tanaka, 2004). In reference to organizational processes, a bottleneck is a resource working at full capacity and which cannot handle additional demand placed on it (Alex, 2016). A bottleneck is the point of a process where the flow is constrained, and can be an impediment to the overall process performance (Whybark & Williams, 1976). A bottleneck may be suspected when work input is piling up during a process step, and workers in later stages stand idle or work under capacity. Becoming a lean organization requires orienting the workplace and adjusting the work tasks so that the product or service is always in a state of constant value-adding mode. Efficient operations contribute to bottom-line results, client satisfaction, and employee motivation. Identifying and minimizing bottlenecks is key to an organization's best interests, because this will improve operational results and satisfy clients.

The Process Bottleneck Analysis tool is used when process performance in a system is not meeting expectations, or a process does not keep up with demand. In the context of this research, it is used for both purposes; As a performance appraisal technique for determining efficiency and effectiveness of the two sets of determinants within the system, as well as the dependency of the demand-side efficacy on the adequacy of the supply-side determinants.

Research objective

The objective of this research is to conduct an in-depth review of the primary health system in Kebbi State using the eight tracer interventions to determine where constraints exist including their extent, support the operational planning to address identified bottlenecks, and institutional PHC Reviews into the Kebbi Health System.

II. LITERATURE REVIEW

Roser and Nakano (2015) expand the definition of bottleneck to include both multiple bottlenecks and a measure of influence on the system: "Bottlenecks are processes that influence the throughput of the entire system. The larger the influence, the more significant is the bottleneck." (Roser & Nakano, 2015)

Bottlenecks in dynamic systems are not stable as they can shift due to machine downtime such as faults or preventive maintenance. A shifting bottleneck means that the location of the bottleneck changes over time. The more balanced the system, the more the capacity of all parts within the system at that point in time(Bernedixen, 2018). This increases the influence of temporary downtime on the location of the bottleneck. Thus, the more balanced the system, the more probable it is that the bottleneck will shift. These shifting bottlenecks are the system's constraint for only a certain period of time, so they are momentary bottlenecks. It can occur that the high level of balance within a system results in a different bottleneck every minute. This is called a continuously shifting bottleneck.

There are two types of bottlenecks. Short-term bottlenecks, also called momentary bottlenecks, are caused by temporary problems. For instance, an employee who becomes ill and the work cannot be done by someone else. This causes a backlog of work until the person is back. Or, an accident at a machine can lead to an unplanned stop. This also causes a backlog of work until the situation is resolved and the machine is turned back on. Long-term bottlenecks are blockages that occur regularly (Cox III & Schleire 2010). For instance, general inefficiency of a machine. Both short-term and long-term bottlenecks can shift over time, which results in multiple bottlenecks. Each bottleneck has a certain amount of influence on the throughput of the entire system. The bottleneck with the largest influence is the most significant bottleneck.

Furthermore, bottlenecks can be internal or external to the system (Cox III & Schleier, 2010). An internal bottleneck occurs when the market demands more from the system than it can deliver. If this is the case, we deal with an operational bottleneck and the focus of the organization should be on identifying and improving the bottleneck within the system. An external bottleneck exists when the system can produce more but cannot sell it. This can be a market constraint or a sales process constraint. If this is the case, then the focus should be on creating more demand (Kuo, Lim & Meerkov, 1996)

In complex and dynamic systems, it is expected that there are multiple bottlenecks. We cannot look at all the bottlenecks at 1. once, thus we start with analyzing the most significant one. The bottlenecks can move over time, because of improvements, changes in demand, etc. If there is a new most significant bottleneck, we want to determine the location of that bottleneck. Thus, we want to be able to continuously monitor and identify the bottlenecks. There exist a theory Theory of Constraints: a concept that continuously analyzes the bottleneck. The identification of the bottleneck is a part of this concept (Betterton & Silver, 2012).

III. THEORY OF CONSTRAINTS

In the seventies, Eliyahu Goldratt criticized the operations management methods that were used in that time and work as if it were true that "optimizing each part of the system causes the system as a whole be optimized". Goldratt developed a new method, called Theory of Constraints (TOC). Goldratt and Cox convey the concepts of TOC in the book The goal (Goldratt & Cox, 1986). This management concept recognizes that there are limitations to the performance of a system caused by a very small number of elements in the system. TOC emphasizes a five steps process of ongoing improvement, see Figure 1.

STEP 1: Identify the system's constraint(s), also called bottlenecks. Constraints may be physical (e.g. materials, machines, people, demand level) or managerial.

STEP 2: Exploit the constraint(s). We decide how to optimize the system's constraint(s). The goal is to achieve the highest throughput possible at the constraint(s) with the system's resources.

STEP 3: Subordinate everything else to the above decision, i.e. adjust the other processes to support the constraint(s). Because constraints determine a firm's throughput, having the right resources at the right time at the constraint is vital. Thus, every other process in the system (i.e. non-constraints) must be adjusted to support the maximum effectiveness of the constraint. If the effectiveness of the constraint increases, so does the effectiveness of the system. Any resource produced that is not needed will not improve throughput but will increase unnecessary inventory. Thus, the other processes should support the constraint, but should not overproduce.

STEP 4: Elevate the constraint(s), i.e. improve the system's constraint(s). If the existing constraints are still the most critical in the system, capacity can be added. Eventually, the constraint is broken and the system will encounter a new constraint.

STEP 5: Prevent inertia. If in any of the previous steps a constraint is broken, go back to Step

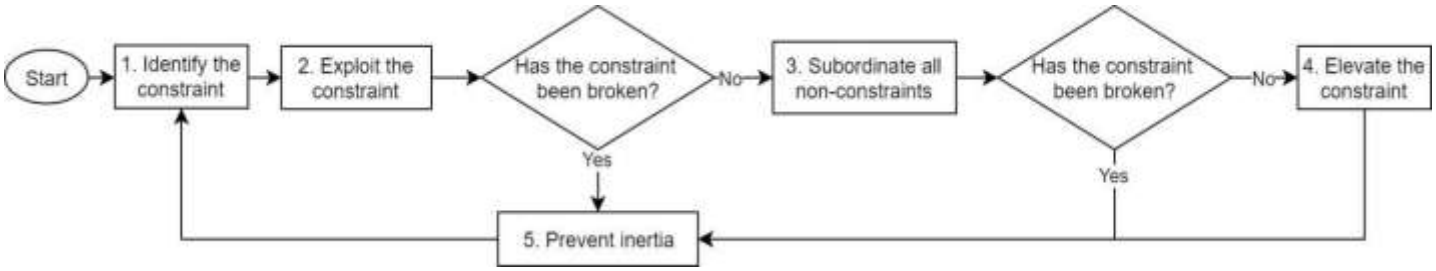


Figure 1. Flowchart of the five steps of ongoing improvement (Goldratt & Cox, 1986).

Operational performance measures defined by TOC are throughput, inventory and operating expense. According to TOC, throughput is the rate at which the systemreduces mortality due to certain diseases.

The revised PHC Review methodology is systematic, flexible, outcome -based approach to equitable programming and real-time monitoring that strengthens the LGA health system, complementing and building on what exists (e.g. Minimum Standards of PHC). The Revised PHC Methodology is applicable to the entire health system(Yong, Ling &Yi, 2003).

The major objectives (Alex, 2016) of the revised methodology is to address significant gaps (harmonization of indicators, coverage stagnation, inequity); aim to build the capacity of LGA Health Managers to assess, analyze, act and be accountable for equitable service delivery so as to strengthen decentralized health systems; increase the capacity of LGAs management teams, monitoring in real-time and local data use timely course correction; and to engage communities and stakeholders as key partners in improving the health of children and women (Lowrence & Buss, 1994).

The Tanahashi coverage model developed in 1978 is one model introduced to monitor and evaluate health systems. The model consists of five distinct and indispensable stages required in sequential order to predict quality coverage (a measure of the proportion of people with health benefits). The model highlights the need for availability of essential commodities and human resources (availability coverage) as the first step for the attainment of Universal Effective Coverage, followed by the development of strategies aimed at mitigating barriers to health intervention accessibility (accessibility coverage). Once availability and accessibility coverage are in place (Lemissi et al., 2012), Tanahashi proposed that other factors such as affordability, values, and beliefs be addressed, to increase a population's willingness to use an intervention (acceptability of coverage). Sequential execution of processes intended to address each of these stages is expected to increase a population's initial and continued interaction with the service providers and essential commodities (contact coverage) that will culminate in quality coverage (effectiveness coverage). In Tanahashi's view, the gap in health systems delivery, which he identified as the difference between effectiveness coverage (the proportion of the target population that interacts with all five stages) and nominal coverage (the proportion of the target population that interacts with only the first three stages), needs to be filled (Roser, Nakano & Tanaka, 2003).

The revised methodology assesses the effectiveness and equity of health interventions using six determinants. These determinants are major health system functions that DETERMINE the level of coverage possible for an intervention. Each determinant is a sub-set of the preceding determinant.

- Supply-side determinants:
  - Availability of essential commodities.
  - Availability of human resources.
  - Geographical accessibility.
- Demand-side determinants:
  - Initial use: the first contact
  - Adequate and complete use
  - Effective, or Quality, Coverage that gets IMPACT

IV. DATA COLLECTED, ANALYSIS AND RESULTS.

State Profile

Kebbi state is estimated to have a total population of 4,671,594 and a population of children under five years of 934,319 by 2019 (DHIS2). For Children under five years, the state prevalence (MICS5) of fever (as a proxy to Malaria) is 31.0% with an estimated 5.76 episodes per child per year. The prevalence for diarrhoea is 23.6% with number of episodes per child per year [1] at 5.11, and prevalence for acute respiratory infection 4.0% with an estimated episode per child per year of 0.69.

Health Work Force

Health workforce is an integral part of health system playing a critical role in achieving effective health care delivery. It is basically made up of health workers, which has been defined as all people engaged in the promotion, protection or improvement of the health of the population. According to World Health Organisation (WHO) health workforce are people who are "primarily engaged in action with the primary intent of enhancing health" diagnosing illnesses, healing, caring for people, monitoring health outcomes, supporting treatment adherence, providing medical information and preventing diseases. Health workforce consists of physicians,

nurses, midwives, dentists, pharmacists, laboratory workers, environment & public health workers, community health workers, other health workers and health management and support staff (Srudgarab & Lsforge, 1989).

The availability of health workforce has been shown to have a strong positive correlation with positive health outcome. Hence its availability and composition are used as an important indicator of the strength of health system. However, there is no general consensus on the optimal level of health workers needed for a population or that highest density levels of health workforce are not necessarily better. The WHO recommended critical threshold for minimum required workforce density is 23 Doctors, Nurses and Midwives per 10,000 populations. The threshold is required for an 80% coverage of services.

Health Facility Density

This performance indicator measures the number of health facilities per population of 10,000 or the number of health facilities per total population living in a designated area. Health facilities include all public, private, non-governmental and community-based health facilities defined as a static facility (i.e., has a designated building) in which general health services are offered. Health posts can be counted as static facilities, but because they are generally small with minimal supplies, they may need to be disaggregated for interpretation purposes. The indicator does not include mobile service delivery points and non-formal services such as traditional healers. The required number of health facilities per population is two health facilities per 10,000 population (DHIS2) see table 1.

Seven out of twenty-one LGAs have the required health facility density for accessibility coverage. Fourteen of the LGAs will require (in different degrees) a scale up in number of facilities serving the population for an adequate accessibility to health care.

. Table 1: Distribution of Population against various LGA and Health Facility Density

S/N	LGA	POPULATION	# OF HFs	Health Facility Density
1	ALIERO	95,163	22	2.31
2	AREWA	265,456	48	1.81
3	ARGUNGU	281,978	46	1.63
4	AUGIE	169,182	37	2.19
5	BAGUDO	343,042	56	1.63
6	BIRNIN KEBBI	387,185	67	1.73
7	BUNZA	175,203	35	2.00
8	DANDI	208,108	27	1.30
9	DANKO-WASAGU	382,545	74	1.93
10	FAKAI	174,844	37	2.12
11	GWANDU	217,839	45	2.07
12	JEGA	278,903	41	1.47
13	KALGO	123,190	31	2.52
14	KOKO BESSE	223,012	31	1.39
15	MAIYAMA	253,420	39	1.54
16	NGASKI	179,970	47	2.61
17	SAKABA	129,731	38	2.93
18	SHANGA	183,403	36	1.96
19	SURU	216,701	36	1.66
20	YAURI	143,924	23	1.60
21	ZURU	238,795	36	1.51
	State	4,671,594	852	1.82

Source: PHC (2018).

The above results showed that the workforce density is far below the critical threshold of 23 Doctors, Nurses, and midwives per 10,000 populations. Based on the standard of the World Health organization (WHO, 2016)

Service Provision

Strengthening service delivery is crucial to the achievement of the health-related Millennium Development Goals (MDGs), which include the delivery of interventions to reduce child mortality, maternal mortality and the burden of HIV/AIDS, tuberculosis and malaria. Service provision or delivery is an immediate output of the inputs into the health system, such as the health workforce, procurement and supplies, and financing. Increased inputs should lead to improved service delivery and enhanced access to services. Ensuring availability of health services that meet a minimum quality standard and securing access to them are key functions of a health system. To monitor progress in strengthening health service delivery, it is necessary to determine the dimensions along which progress would be measured. Yu and Matta(2014) sets out eight key characteristics of good service delivery in a health system. These ideal characteristics describe the nature of the health services that would exist in a strong health system based on primary health care.

The table 2 show the aggregation of facilities par service provision across eight tracer intervention areas. Out of the 852 facilities 726 (84%) provide IMCI services, 357 (41.9%) provide ANC services, 303 (35.6%) provide delivery services and 132 (15.5%) provide CMAM services.

Table 2: Service Provision Status against each LGA. Source: (PHC, 2019)

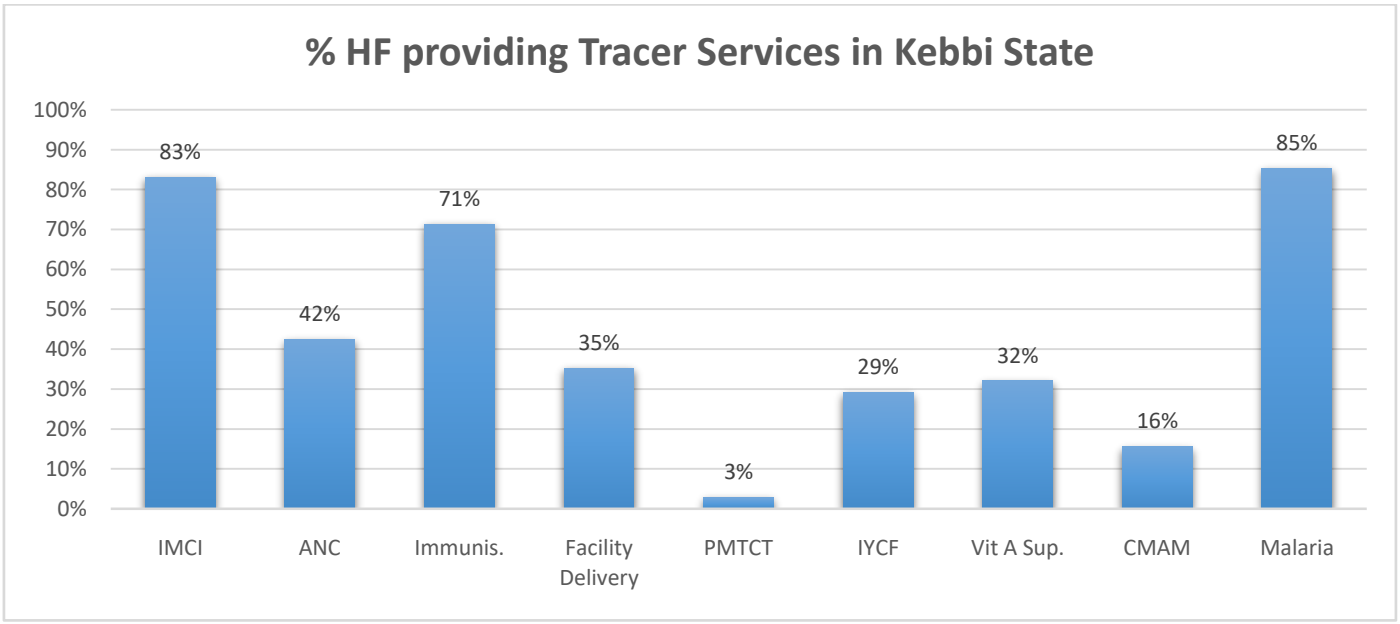
STATE	LGA	Service Provision status as at Q12018									
		# HFs	IMCI	ANC	Immunis.	Facility Delivery	PMTCT	IYCF	Vit A Sup.	CMAM	Malaria
Kebbi	Aleiro	22	22	13	22	10	1	11	0	9	22
Kebbi	Arewa	48	15	11	22	11	1	5	26	5	25
Kebbi	Argungu	46	46	13	42	11	2	14	7	5	46
Kebbi	Augie	37	37	13	32	12	1	21	31	10	37
Kebbi	Bagudo	56	54	15	27	13	0	13	7	8	31
Kebbi	Birnin Kebbi	67	58	33	47	24	4	22	43	20	27
Kebbi	Bunza	35	11	11	22	11	1	11	11	5	23
Kebbi	Dandi	27	28	17	22	16	1	14	3	5	28
Kebbi	Danko/Wasagu	74	56	23	42	23	1	11	11	5	56
Kebbi	Fakai	37	43	14	22	12	2	10	11	5	43
Kebbi	Gwandu	45	43	15	44	9	0	10	0	5	43
Kebbi	Jega	41	26	23	31	29	5	11	0	5	42
Kebbi	Kalgo	31	33	17	27	6	0	5	30	5	34
Kebbi	Koko/Besse	31	33	15	25	12	1	5	14	5	33
Kebbi	Maiyama	39	37	13	32	9	1	11	15	5	36
Kebbi	Ngaski	47	26	17	46	14	1	14	11	5	37
Kebbi	Sakaba	38	34	14	20	13	0	10	10	5	49
Kebbi	Shanga	36	36	16	27	11	0	18	5	5	35
Kebbi	Suru	36	23	15	21	18	0	10	10	5	23
Kebbi	Yauri	23	26	26	22	17	1	10	22	5	26
Kebbi	Zuru	36	39	23	23	22	2	10	14	5	39
Total Provision		852	726	357	618	303	25	246	281	132	735

The results from the data showed that most of the service provision are lacking or inadequate, considering the population and the critical threshold as suggested by WHO, 2016)

The Table 3 show the percentage of facilities providing each tracer intervention per LGA. The three-color scale shows this performance using a middle 50% -80% range projected in Yellow fill. The interventions with the least performance are PMTCT, CMAM, IYCF and ANC as the interventions with the lowest performance, in that ascending order (MICS5). Drastic improvement is needed in that aspect.

Table 3 Tracer Interventions and their Bottlenecks with Bar chat displaying their distribution

STATE	LGA	% Service Provision status as at Q12018								
		IMCI	ANC	Immunis.	Facility Delivery	PMTCT	IYCF	Vit A Sup.	CMAM	Malaria
Kebbi	Aleiro	100%	59%	100%	45%	5%	50%	0%	41%	100%
Kebbi	Arewa	22%	16%	33%	16%	1%	7%	39%	7%	37%
Kebbi	Argungu	100%	28%	91%	24%	4%	30%	15%	11%	100%
Kebbi	Augie	100%	35%	86%	32%	3%	57%	84%	27%	100%
Kebbi	Bagudo	100%	28%	50%	24%	0%	24%	13%	15%	57%
Kebbi	Birnin Kebbi	95%	54%	77%	39%	7%	36%	70%	33%	44%
Kebbi	Bunza	31%	31%	63%	31%	3%	31%	31%	14%	66%
Kebbi	Dandi	100%	61%	79%	57%	4%	50%	11%	18%	100%
Kebbi	Danko/Wasagu	77%	32%	58%	32%	1%	15%	15%	7%	77%
Kebbi	Fakai	100%	33%	51%	28%	5%	23%	26%	12%	100%
Kebbi	Gwandu	98%	34%	100%	20%	0%	23%	0%	11%	98%
Kebbi	Jega	62%	55%	74%	69%	12%	26%	0%	12%	100%
Kebbi	Kalgo	97%	50%	79%	18%	0%	15%	88%	15%	100%
Kebbi	Koko/Besse	100%	45%	76%	36%	3%	15%	42%	15%	100%
Kebbi	Maiyama	100%	35%	86%	24%	3%	30%	41%	14%	97%
Kebbi	Ngaski	57%	37%	100%	30%	2%	30%	24%	11%	80%
Kebbi	Sakaba	69%	29%	41%	27%	0%	20%	20%	10%	100%
Kebbi	Shanga	90%	40%	68%	28%	0%	45%	13%	13%	88%
Kebbi	Suru	51%	33%	47%	40%	0%	22%	22%	11%	51%
Kebbi	Yauri	100%	100%	85%	65%	4%	38%	85%	19%	100%
Kebbi	Zuru	95%	56%	56%	54%	5%	24%	34%	12%	95%
Total & % Average Service Provision		83%	42%	71%	35%	3%	29%	32%	16%	85%



Source: (PHC, 2019)

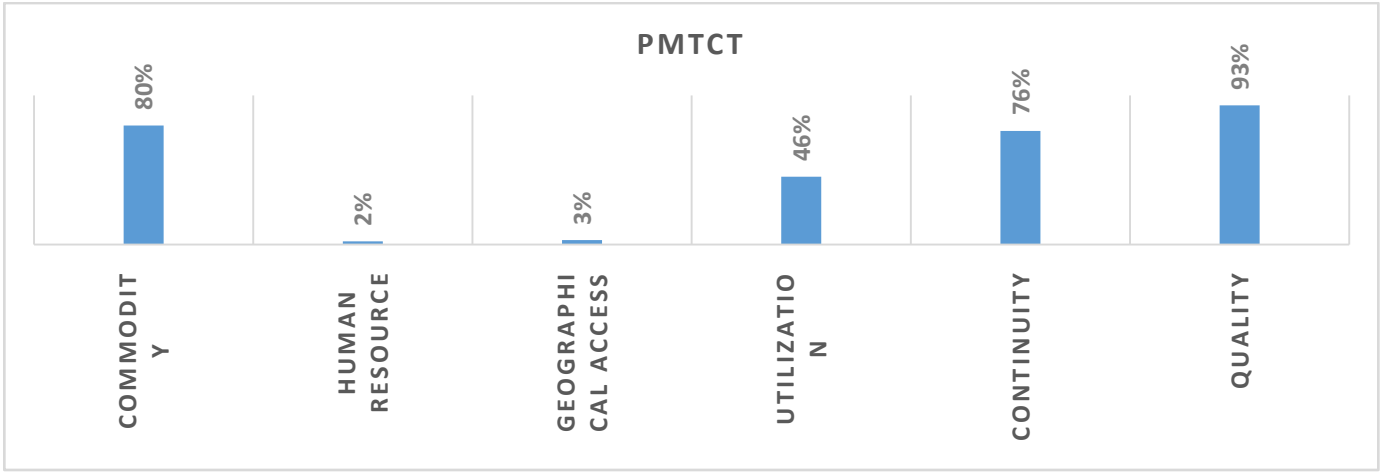
Prevention of Mother-to-Child Transmission of HIV/AIDS (PMTCT)

Table 4 showed two of the six determinants show an acceptable level of performance. All facilities providing PMTCT did not experience stock-out of ARV required for PMTCT in the reporting period. The tracer intervention also recorded a commendable coverage of pregnant women attending ANC who were counselled, tested and received results. Continuity determinant measure the number of women who were found positive and Quality determinant measure number of infants born to a HIV+ mother who received ARV prophylaxis, both indicators show a good performance.

The bottleneck for PMTCT coverage across all 21 LGA is in number of PMTCT sites (geographical access), with all PHCs reporting to provide only HCT. Number of personnel trained to provide PMTCT was also reportedly low compared to the WHO standard in the reporting period is also a key bottleneck hampering performance.

Table 4: Determinants of Acceptable Level of Performance for PMTCT with a Bar underneath displaying their percentage Distribution

PMTCT	Commodity	Human Resource	Geographical Access	Utilization	Continuity	Quality
Aliero	100%	3%	3%	100%		
Arewa	0%	1%	1%			
Argungu	50%	9%	6%	37%		
Augie	100%	4%	4%	3%		
Bagudo		0%	0%			
Birnin Kebbi	75%	1%	7%	6%	100%	100%
Bunza	100%	12%	5%	100%	100%	
Dandi	100%	2%	5%	100%	100%	100%
Danko/Wasagu	100%	1%	1%	100%	24%	100%
Fakai	100%	3%	4%	7%		
Gwandu		0%	0%			
Jega	40%	1%	2%	28%	100%	67%
Kalgo		0%	0%			
Koko/Besse	100%	0%	6%	59%		
Maiyama	100%	1%	3%	7%		
Ngaski	100%	1%	1%	15%		
Sakaba						
Shanga		0%	0%			
Suru		0%	0%	0%		
Yauri	33%	3%	7%	21%		
Zuru	100%	2%	5%	100%	33%	100%
STATE AVERAGE	80%	2%	3%	46%	76%	93%



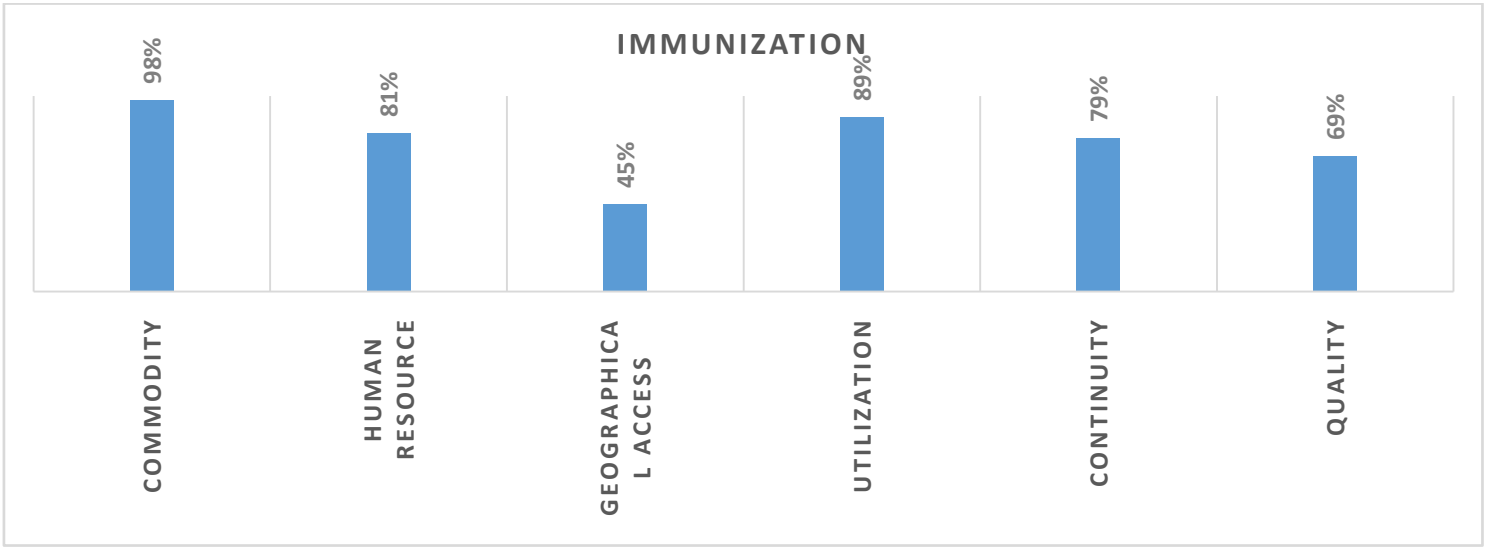
Source: (PHC, 2018)

Immunization

The tracer intervention shows the most performance compared to the others. The reports show availability of vaccines, adequacy of personnel, effective first contact and continuity. The bottleneck for immunization services is in number of facilities providing immunization services as well as completion of routine immunization among children.

Table 4: Determinants of Acceptable Level of Performance for Immunization with a Bar underneath displaying their percentage Distribution

Immunization	Commodity	Human Resource	Geographical Access	Utilization	Continuity	Quality
Aliero	95%	91%	63%	72%	72%	68%
Arewa	100%	64%	13%	57%	60%	33%
Argungu	100%	100%	67%	100%	83%	83%
Augie	72%	75%	83%	91%	80%	60%
Bagudo	100%	78%	8%	78%	77%	78%
Birnin Kebbi	96%	93%	51%	96%	81%	69%
Bunza	100%	100%	77%	87%	81%	84%
Dandi	100%	77%	61%	76%	56%	56%
Danko/Wasagu	86%	100%	55%	97%	83%	77%
Fakai	100%	59%	22%	92%	89%	83%
Gwandu	100%	80%	77%	98%	81%	72%
Jega	100%	94%	13%	96%	68%	45%
Kalgo	100%	74%	36%	84%	70%	70%
Koko/Besse	100%	87%	0%	74%	74%	98%
Maiyama	100%	50%	13%	96%	87%	69%
Ngaski	100%	9%	40%	95%	72%	47%
Sakaba	100%	100%	56%	100%	89%	87%
Shanga	100%	77%	49%	74%	68%	64%
Suru	100%	100%	19%	76%	50%	32%
Yauri	100%	100%	97%	116%	107%	76%
Zuru	109%	91%	40%	119%	121%	105%
STATE AVERAGE	98%	81%	45%	89%	79%	69%



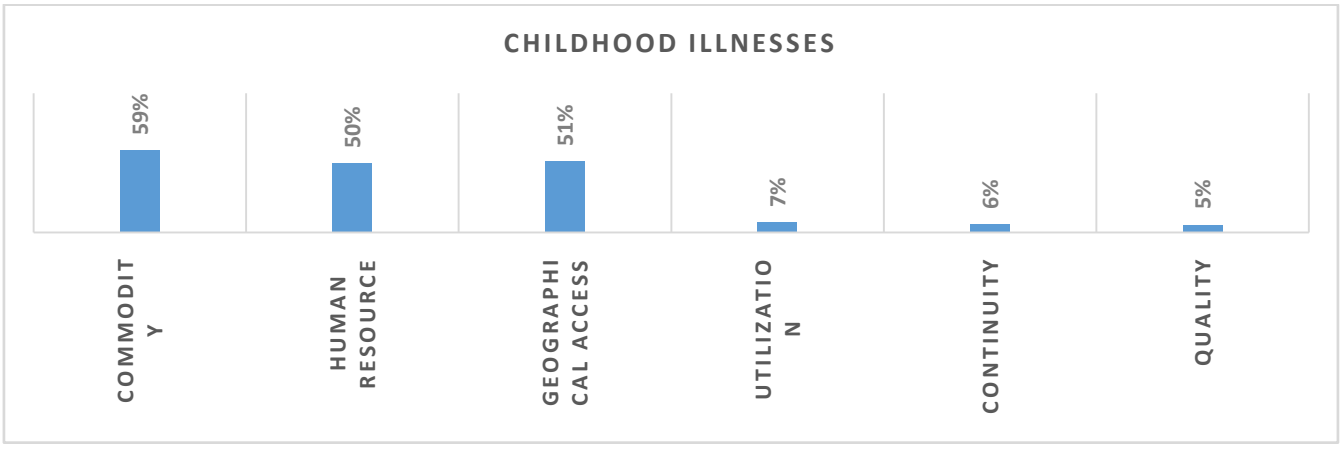
Source: (PHC, 2018)

Childhood Illnesses

The determinants measure availability of Artemisinin-combined Therapy (ACT) in facilities offering Integrated Management of Childhood Illness (IMCI), percentage of health workers trained in IMCI, percentage of population living within 5km radius of health facilities offering IMCI, percentage of expected fever cases using these services, percentage of children given ACT and percentage tested with Rapid Diagnostic Test (RDT). The bottlenecks for this tracer intervention is the initial utilization by expected fever cases, showing an average of 7% of expected under-five fevers where presented at the facilities for treatment, in the quarter under review. This is below the expected value of 70% (WHO, 2011)

Table 5: Determinants of Acceptable Level of Performance for Childhood Illness with a Bar underneath displaying their percentage Distribution

Childhood Illnesses	Commodity	Human Resource	Geographical Access	Utilization	Continuity	Quality
Aliero	45%	49%	35%	6%	6%	6%
Arewa	73%	23%	13%	0%	0%	0%
Argungu	46%	53%	68%	18%	4%	4%
Augie	35%	69%	88%	5%	3%	3%
Bagudo	59%	55%	12%	4%	2%	1%
Birnin Kebbi	33%	12%	57%	8%	7%	7%
Bunza	82%	55%	44%	5%	25%	25%
Dandi	73%	64%	70%	4%	4%	4%
Danko/Wasagu	53%	93%	63%	4%	3%	3%
Fakai	49%	53%	24%	10%	6%	7%
Gwandu	67%	82%	76%	28%	15%	15%
Jega	100%	9%	11%	9%	9%	3%
Kalgo	30%	100%	38%	9%	6%	4%
Koko/Besse	36%	35%	72%	3%	2%	2%
Maiyama	100%	54%	93%	5%	3%	3%
Ngaski	77%	4%	25%	6%	5%	4%
Sakaba	50%	95%	41%			
Shanga	81%	45%	52%	3%	3%	3%
Suru	65%	29%	22%	6%	6%	6%
Yauri	19%	36%	106%	5%	4%	3%
Zuru	64%	26%	58%	8%	3%	3%
STATE AVERAGE	59%	50%	51%	7%	6%	5%



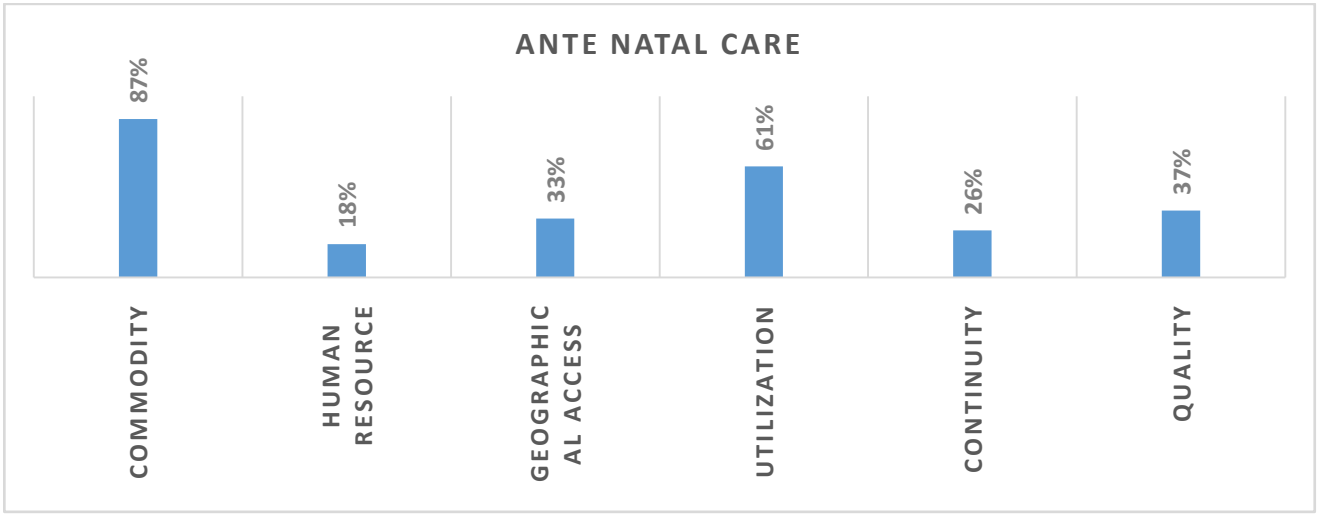
Source: (PHC, 2018)

Antenatal Care (ANC)

The bottleneck identified in the coverage of ANC is the percentage of the population living within 5km radius of facilities providing ANC services, number of health workers trained on provision of ANC in line with the Focused ANC guidelines, completion rate of ANC by pregnant women (at least 4 visits) and timely ANC. The key bottleneck identified is with completion rate by pregnant women. Quite a number of pregnant women hardly complete the expected number of visits in some LGAs as captured in the data in table 6.

Table 6: Determinants of Acceptable Level of Performance for Ante Natal Care with a Bar underneath displaying their percentage Distribution

ANC	Commodity	Human Resource	Geographical Access	Utilization	Continuity	Quality
Aliero	100%	19%	27%	109%	13%	109%
Arewa	82%	9%	8%	18%	4%	15%
Argungu	100%	6%	35%	82%	30%	71%
Augie	100%	26%	35%	51%	21%	11%
Bagudo	53%	14%	7%	62%	28%	16%
Birnin Kebbi	70%	4%	44%	83%	72%	52%
Bunza	91%	16%	44%	71%	22%	26%
Dandi	100%	28%	47%	49%	6%	36%
Danko/Wasagu	100%	25%	32%	25%	25%	25%
Fakai	100%	22%	14%	38%	14%	2%
Gwandu	87%	31%	37%	26%	24%	23%
Jega	78%	7%	9%	33%	23%	26%
Kalgo	100%	47%	27%	66%	23%	35%
Koko/Besse	100%	3%	35%	86%	1%	77%
Maiyama	100%	16%	46%	54%	13%	25%
Ngaski	88%	16%	20%	84%	20%	30%
Sakaba	100%	11%	24%	79%	75%	45%
Shanga	63%	39%	31%	55%	11%	27%
Suru	73%	13%	15%	17%	12%	21%
Yauri	50%	17%	106%	137%	77%	62%
Zuru	100%	17%	41%	62%	31%	43%
STATE AVERAGE	87%	18%	33%	61%	26%	37%



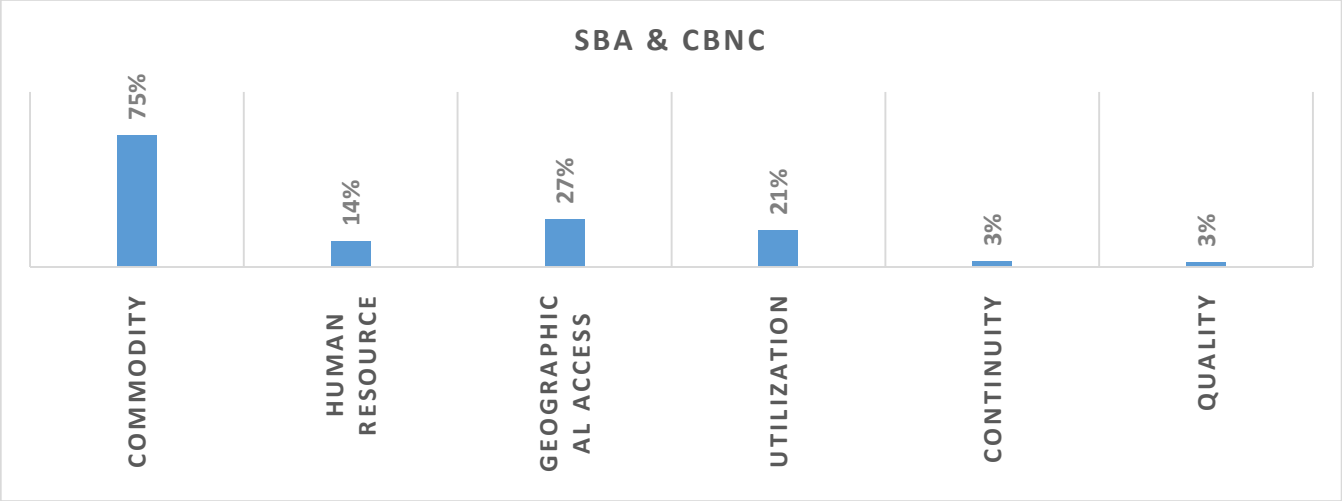
Source: (PHC, 2018)

Skilled Birth Attendant (SBA) & Community Based New-born Care (CBNC)

For the SBA & CBNC intervention, the percentage of personnel trained to provide Basic Emergency Obstetrics and Newborn Care (BEmONC) is 14%, percentage of population living within 5km radius of a service point is 27%, percentage of deliveries is 21%, and postnatal care within 24 hours and 48 hours is 3% on both instances. Which is still far from the recommended threshold (WHO, 2011)

Table . Determinants of Acceptable Level of Performance for SBA & CBNC with a Bar underneath displaying their percentage Distribution

SBA & CBNC	Commodity	Human Resource	Geographical Access	Utilization	Continuity	Quality
Aliero	100%	15%	23%	26%	0%	0%
Arewa	82%	9%	8%	7%	0%	7%
Argungu	0%	9%	28%	26%	3%	0%
Augie	78%	19%	32%	3%	0%	1%
Bagudo	62%	14%	7%	8%	2%	1%
Birnin Kebbi	28%	3%	31%	26%	2%	1%
Bunza	100%	10%	44%	33%	5%	3%
Dandi	100%	5%	46%	21%	9%	10%
Danko/Wasagu	61%	5%	32%	30%	0%	3%
Fakai	100%	13%	12%	16%	7%	0%
Gwandu	89%	30%	22%	11%	0%	0%
Jega	62%	3%	11%	8%	0%	0%
Kalgo	0%	45%	14%	14%	0%	0%
Koko/Besse	125%	5%	28%	2%	0%	0%
Maiyama	100%	0%	34%	11%	0%	1%
Ngaski	71%	19%	16%	47%	5%	2%
Sakaba	77%	8%	24%	43%	5%	15%
Shanga	100%	42%	21%	16%	2%	3%
Suru	72%	10%	17%	6%	0%	0%
Yauri	71%	23%	79%	46%	21%	8%
Zuru	100%	14%	38%	37%	0%	0%
STATE AVERAGE	75%	14%	27%	21%	3%	3%



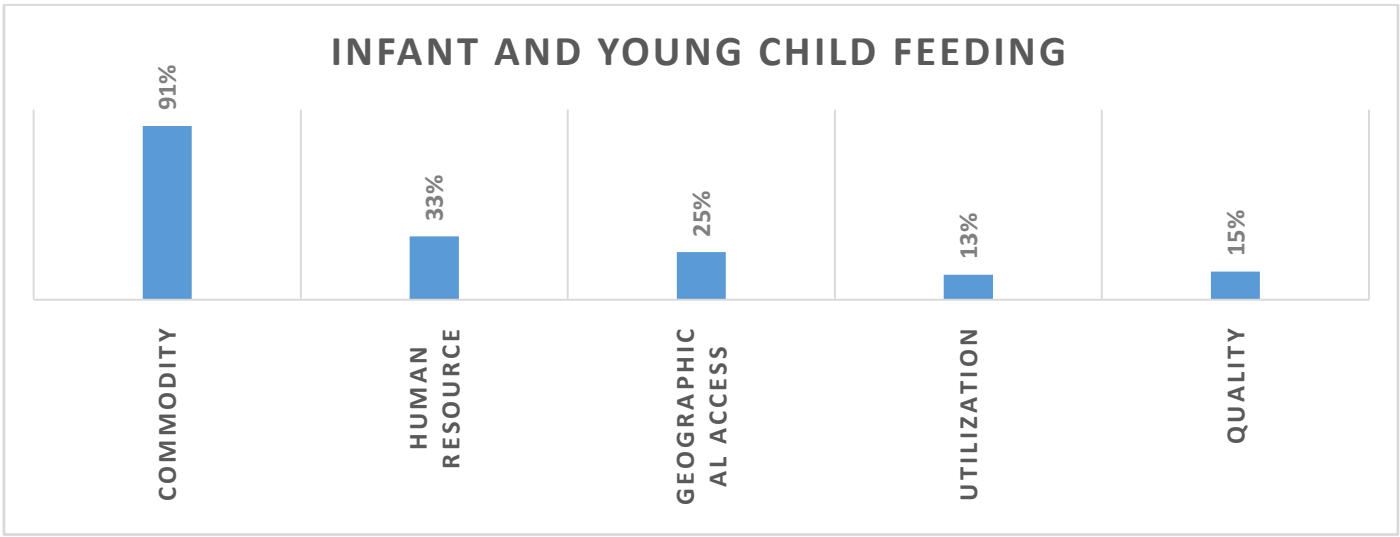
Source: (PHC, 2018)

Infant & Young Child Feeding (IYCF)

In the reporting period, the bottleneck identified for IYCF services is in percentage of mothers counselled on IYCF and the number of babies reported to be exclusively breastfed. Geographical access and human resource are also recorded as low performing determinants.

Table 7: Determinants of Acceptable Level of Performance for Infant and Young Child Feeding with a Bar underneath displaying their percentage Distribution

Infant & Young Child Feeding	Commodity	Human Resource	Geographical Access	Utilization	Continuity	Quality
Aliero	91%	44%	24%	9%		35%
Arewa	100%	14%	4%	0%		0%
Argungu	100%	16%	37%	2%		11%
Augie	95%	36%	51%	10%		14%
Bagudo	38%	27%	7%	5%		4%
Birnin Kebbi	68%	8%	27%	38%		18%
Bunza	100%	21%	44%	17%		25%
Dandi	100%	24%	42%	18%		39%
Danko/Wasagu	100%	47%	20%	6%		49%
Fakai	100%	33%	10%	19%		0%
Gwandu	100%	20%	33%	45%		3%
Jega	100%	20%	4%	6%		13%
Kalgo	100%	93%	10%	13%		0%
Koko/Besse	100%	35%	17%	2%		6%
Maiyama	100%	15%	39%	23%		10%
Ngaski	79%	25%	18%	8%		21%
Sakaba	100%	60%	12%	23%		24%
Shanga	100%	60%	36%	13%		14%
Suru	50%	42%	10%	6%		6%
Yauri	100%	35%	60%	10%		17%
Zuru	100%	25%	21%	4%		2%
STATE AVERAGE	91%	33%	25%	13%		15%



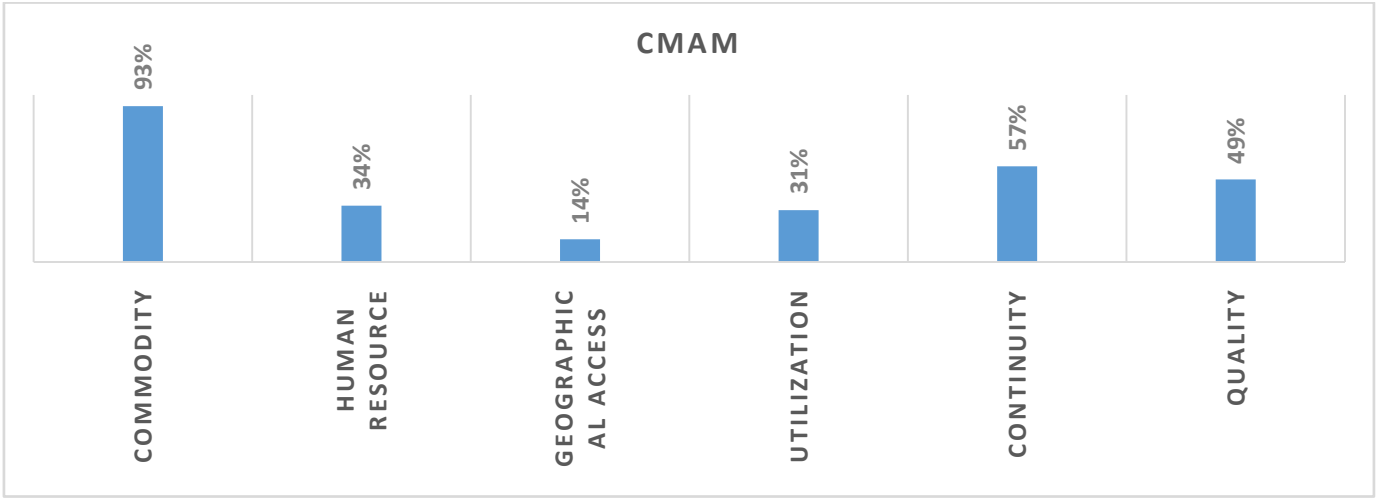
Source: (PHC, 2018)

Community-based Management of Acute Malnutrition (CMAM)

In the reporting period, the key bottleneck identified as hampering effectiveness of CMAM intervention is the geographical access. Only an estimated 14% of the population live within 5km radius of health facilities providing CMAM services. Other bottlenecks are human resource trained on CMAM and utilization of CMAM services by the estimated expected cases of severe acute malnutrition.

Table 8: Determinants of Acceptable Level of Performance for CMAM with a Bar underneath displaying their percentage Distribution

CMAM	Commodity	Human Resource	Geographical Access	Utilization	Continuity	Quality
Aliero	56%	39%	20%	48%	136%	60%
Arewa	100%	29%	4%	21%	0%	49%
Argungu	100%	16%	20%	17%	100%	94%
Augie	100%	92%	26%	60%	100%	50%
Bagudo	63%	27%	5%	20%	28%	35%
Birnin Kebbi	75%	13%	23%	34%	42%	50%
Bunza	100%	24%	20%	32%	25%	17%
Dandi	100%	27%	18%	39%	38%	41%
Danko/Wasagu	100%	14%	6%	27%	71%	61%
Fakai	100%	28%	6%	20%	53%	52%
Gwandu	67%	20%	15%	33%	52%	38%
Jega	100%	20%	1%	30%	56%	50%
Kalgo	100%	63%	12%	36%	97%	39%
Koko/Besse	100%	26%	15%	1%	100%	34%
Maiyama	100%	70%	19%	28%	51%	92%
Ngaski	100%	28%	7%	29%	21%	33%
Sakaba	100%	37%	5%	56%	55%	56%
Shanga	100%	52%	12%	31%	45%	57%
Suru	100%	32%	5%	40%	51%	53%
Yauri	100%	26%	32%	39%	48%	49%
Zuru	100%	25%	15%	10%	34%	28%
STATE AVERAGE	93%	34%	14%	31%	57%	49%



Source: (PHC, 2018)

V. SUMMARY AND CONCLUSION

Strengthening service delivery is a key strategy to achieve the Sustainable Development Goals. This includes the delivery of interventions to reduce child mortality, maternal mortality, and the burden to HIV/AIDS, tuberculosis and malaria. Service provision or delivery is an immediate output of the inputs into the health system, such as health workforce, procurement and supplies and finances. Increased inputs should lead to improved service delivery and enhanced access to services. Ensuring availability and access to health services is one of the main functions of a health system. Such services should meet a minimum quality standard. The application of the reviewed BNA has clearly been displayed in this paper. The results clearly show areas of needs that requires intervention based on the tracer services provided. This finding has a great role to play in planning, implementation and decision making.

Based on the findings of this study, efforts should focus on the formulation and implementation of effective policies designed to systematically and sustainably address the health workforce gap identified in each LGA, scale-up tracer interventions such as PMTCT, ANC and Skilled Delivery. Additionally, continuous capacity development of existing workforce should be maintained. While the supply-side determinants are drivers of the demand-side determinants, optimal use of existing supply-side inputs are not currently achieved. For this purpose, efforts to improve uptake of key life-saving services at public facilities must continue to ensure optimal use of existing resources. These efforts include advocacy and sensitization exercise to generate demand for public health maternal and child services. Furthermore, strengthening referral systems will stimulate the primary health system to achieve increased accessibility to primary health care among vulnerable and targeted population. Hard to reach areas should integrate the use of mobile phones and other pro-active means to reach the target population in those areas where access is lowest.

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