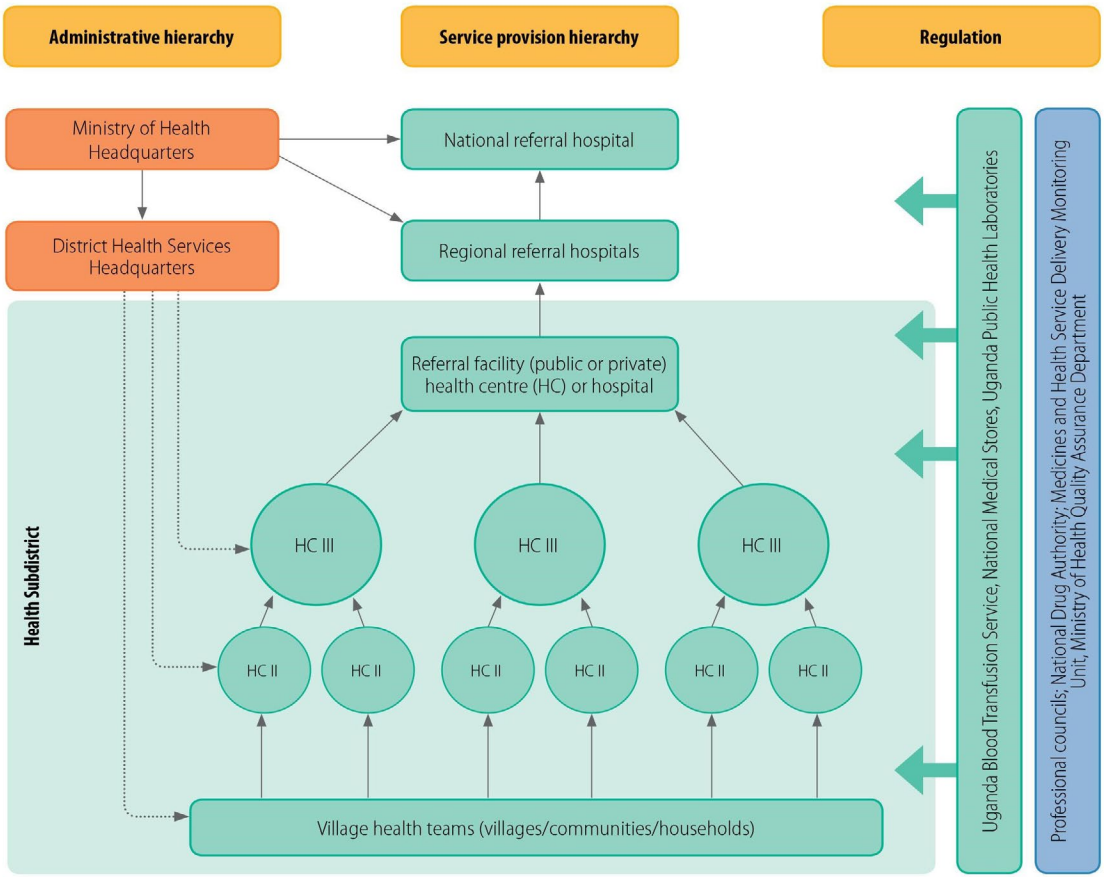
IMPROVING EQUITABLE ACCESS TO ESSENTIAL MEDICINES AND HEALTH SUPPLIES USING A NEEDS-BASED ALLOCATION FORMULA

BACKGROUND

A good health system ensures equitable and consistent access to quality essential medicines and health supplies (EMHS) to help save lives and improve health. Ensuring equitable access requires the provision of health care based on actual need, including meeting the needs of the most vulnerable populations.

Health equity is prioritized in Uganda's National Medicines Policy, but the allocation of funds for procurement of EMHS remains highly inequitable. A one-size-fits-all approach for resource allocation has resulted in some health facilities having insufficient resources to meet local health needs and patient flow or volume. Uganda currently uses a combined push and pull system to supply medicines to health facilities.

Figure 1. Health care system of Uganda



Source: World Health Organization. 2017. Primary health care systems (PRIMASYS): Case study from Uganda, Abridged version. Geneva: License: CC BY-NC-SA 3.0 IGO.

Higher-level facilities/health centers (HC IV and hospitals) have a "pull" (order-based) system while lower-level facilities (HC II and III) have a "push" (kit-based) system. In the pull system, facilities prepare EMHS orders every other month on the basis of their needs and on the available EMHS allocation in the budget line at the National Medical Stores (NMS). In the push system, HC II and HC III facilities receive pre-packed EMHS kits equivalent to the value of their EMHS allocation every other month.

The push system and allocation of resources for EMHS at HC IIs and HC IIIs results in a wide variation in stock levels across health facilities. Some facilities are faced with low allocation compared to their patient load and activity and run the risk of frequent stock-outs, while facilities with allocation above their needs experience overstock and the potential of expired medicines. When health facilities experience recurring stock-outs, the communities they serve resort to purchasing medicines from private suppliers, resulting in higher out-of-pocket expenditure on EMHS and health care costs.

Studies show that using a needs-based approach can promote equity in resource distribution between geographical locations and health facilities (Maharaj, 2018; Smith, 2008; Green et al, 2000). Between 2015 and 2018, the USAID-funded Uganda Health Supply Chain (UHSC) project, implemented by Management Sciences for Health (MSH), worked with the Ministry of Health (MoH) to address the recurrent inequity in the allocation of resources for EMHS by revising the National Medicines Policy, establishing an equity committee at the MoH, and developing a needs-based formula for the allocation of EMHS.

STUDY DESIGN

To address inequities is health resource allocation, we conducted a mixed-methods study that included a desk review of published literature on health care resource allocations, a qualitative assessment of stakeholder perspectives and views on EMHS allocations, and an analysis of quantitative data collected on EHMS allocations and needs-based indicators. A validation workshop with stakeholders was held to generate consensus on the most appropriate resource allocation formula among the alternatives assessed during the study.

The study had three objectives:

1. Review EMHS allocations over the past three years; estimate the EMHS allocation per capita by level of care (HC II, HC III, HC IV, general hospitals, and regional referral hospitals); and highlight current inequities
2. Develop an equitable EMHS allocation formula for health centers and hospitals based on stakeholder consultations and a literature review
3. Develop a template that can be used to apply the formulae and simulate changes in assumptions that would affect EMHS budget allocations to health facilities

FINDINGS

Allocation of essential medicines and health supplies by level of care

The first objective of the study was to analyze the existing inequities in EMHS budget allocations. Using EMHS budget allocations to health facilities from the NMS and patient load (outpatient and inpatient department attendance), the team computed median, mean, maximum, and minimum per patient allocations for the past three fiscal years (FYs) by level of care. Equity ratios based on allocation per patient by level were computed to show the existing inequities. These results were used as a reference point to assess how the proposed formula would be an improvement toward reducing existing inequities in EMHS budget allocations at the facility level.

The EMHS per capita allocations are computed for fiscal years 2016/17 and 2017/18 for health centers. The NMS data on EMHS budget allocations to health centers for fiscal years 2016/17 and 2018/19 are shown in table 1.[1]

Table 1. EMHS budget allocations by level of care (UGX)

Facility level	FY2016/17	2017/18	FY 2018/19
HC II (n=1,788)	7,567,557	7,427,487	8,633,388
HC III (n=969)	22,427,656	22,241,717	22, 229,172
HC IV (n=180)	51,587,110	56,541,185	70,135,449
GHs (n=47)	297,398,362	316,404,405	406,024,276
RRHs (n=15)	998,534,921	988,593,176	1,216,563,362

Source: NMS EMHS budget allocations to health facilities

The current criterion to allocate EMHS funds is such that health facilities at the same level of care receive the same budget allocation. However, there is considerable variation in the number of patients served by health facilities at the same level of care (table 2).

[1] The allocations to HC IVs, general hospitals, and regional referral hospitals are slightly different within and across districts. The figures shown are averages.

Table 2. Annual patient load by level of care

Facility Level	HC II (n=1,498)		HC III (n=861)		HC IV (n=159)	
Variable	2016/17	2017/18	2016/17	2017/18	2016/17	2017/18
Mean	7,569	6,213	15,826	13,577	33,143	28,883
Median	7,339	5,760	13,986	11,762	32,942	27,005
Min	299	221	1,117	893	11,290	9,443
Max	52,544	66,035	112,945	188,299	84,147	77,499
Max/min	175.7	298.8	101.2	210.9	7.5	8.2

Source: UHSC computations based on NMS and MoH (DHIS-2) data, 2016/17–2017/18

Complete data on patient load (outpatient and inpatient department attendance) from the DHIS-2 database for fiscal years 2016/17 and 2017/18 were available for 1,498 of 1,695 HC IIs, 861 of 916 HC IIIs, and 159 of 170 HC IVs. Table 2 shows wide variations in the number of patients in facilities at different levels of care. Variations in patient load are greater at lower-level facilities (HC II and HC III) than at HC IVs. The highest HC II patient volume is approximately 175 time greater than that of the lowest-volume facility.

The large variations in patient numbers for health facilities that receive the same EMHS allocation reflects significant inequities in per patient EMHS allocations (table 3).

The intralevel variations in allocations per patient were largest for HC IIs, for which the equity ratios ranged from 344:1 to 175:1, followed by HC IIIs. Except for 2015/16, the mean and median per capita allocations for HC IVs were larger than for HC IIIs, reflecting some degree of vertical equity since the EMHS package (and level of service) at HC IVs is more comprehensive than at HC IIIs. Similarly, the level of inequality in EMHS allocations was lower at higher levels of care. These figures suggest that horizontal inequities in EMHS budget allocations are higher at lower-level health facilities.

The key indicators of need for EMHS identified from the literature and during the stakeholder consultations were patient load of the facility, poverty level, district population, and number of health facilities within the district. The analysis focused on EMHS budget allocations to health centers (II, III, and IV) with relatively high inequities. Allocation to hospitals was excluded in this study because the current level of inequity based on per patient allocation for general hospitals and regional referral hospitals is minimal.

Proposed EMHS allocation formulae for health centers

Based on the literature review of resource allocation formulae for health and expert opinion, the study identified five alternative formulae, each of which was assessed for its feasibility in terms of the resultant EMHS budget allocation compared to current levels and for improvements in horizontal equity.

Simulations were performed for each formula using data for fiscal year 2016/2017 on patient load extracted from the DHIS-2 database and EMHS national budget allocations for each level of care from the NMS database. District population and poverty indices were derived from the National Population and Housing Census 2014 (Uganda Bureau of Statistics, 2016) and Uganda National Household Survey 2016 (Uganda Bureau of Statistic, 2017) reports. Data on the number of public health facilities in a district were based on the NMS EMHS allocations database. Analysis was done for HC II, HC III, and HC IV facilities.

Table 3. EMHS allocation per patient by level of care: FY 2015/16–2017/18

Description	2015/16					2016/17					2017/18				
	HC 2	HC3	HC4	GH	RRH	HC 2	HC3	HC4	GH	RRH	HC 2	HC3	HC4	GH	RRH
Mean	1338	1905	1747	4675	4408	1231	1785	1857	4912	4753	1752	2207	2760	7024	6891
Median	1098	1702	1583	3651	4193	1018	1577	1637	4038	4056	1511	1946	2569	5798	6221
Min	94	157	652	1241	2733	141	194	668	1611	2737	131	118	895	2849	3520
Max	32202	16914	3868	27727	7551	24765	19485	4748	24885	8185	39154	24896	7342	35550	11876
Equity ratio	344.04	107.66	5.93	22.34	2.76	175.51	100.7	7.1	15.44	2.99	299.57	210.8	8.21	12.48	3.37

Source: UHSC computations based on NMS and DHIS-2 database

Formula 1: Based on health facility patient load only

This formula considers the patient load of the health facility as a proportion of the total patient load for all facilities at the same level of care. The Ministry of Finance, Planning, and Economic Development allocates separate budgets for EMHS to each level of care at the national level. Given the total budget allocated to health facilities at a particular health center level, the final allocation to a specific health center would be a multiple of the total EMHS budget and the proportion of the patient load of that particular health facility out of the total patient load for all health facilities at that level of care. For example, assume the total budget for EMHS to all HC IIs in a given FY is equivalent to GB-$EMHS_{HC2}$. If the patient load for HC II (i) is $PL_{HC2i,}$ and the national total patient load for all HC IIs is $PL_{HC2N,}$ then the EMHS allocation to HC II (i) $EMHS_{HC2i}$ would be expressed as:

$$EMHS_{HC2i} = GB\text{-}EMHS_{HC2}*(PL_{HC2i}/PL_{HC2N})$$

As shown in table 4, the EMHS per patient will be the same for all facilities with no inequities in per patient allocations. In practice, this would imply that a patient visiting any facility at the same level of care, regardless of location, would have available the same budget for EMHS and ideally receive the same quantity and quality of EMHS. From an equity dimension, this formula would result in the most equitable EMHS allocation with an equity ratio equal to one. For purposes of illustration, allocations to a sample of HC IIs based on this formula vis-à-vis the allocations for 2016/17 are shown in table 4.

Formula 2: Based on a weighted index of population and number of health facilities and patient load

This proposed formula involves two steps. The first step is to allocate EMHS resources at the district level using a weighted average of district population as a proportion of national population, the number of health facilities in the district at a particular level of care as a proportion of the total number in the country, and the relative poverty index of the district. In the second step, the district EMHS allocation would be distributed among the health facilities based on their relative patient loads.

Step 1: Allocation of EMHS funds to districts

A weighted average of the district population and the number of health facilities will be applied to distribute the national budget allocation for EMHS at each level of care to the districts. For example, the district budget allocation for EMHS resources for HC II facilities $\{D_{EMHS}(HC2)\}$ will be equal to the weighted average of the district population (D_{iPop}) relative to the national population and the number of HC IIs in the district (D_{inHC2}) relative to the total number of HC IIs in the country.

Thus, given a national EMHS budget allocation for HC IIs (GB_{HC2}):

$$D_{EMHS}(HC2) = GB_{HC2}*\{(D_{iPop}/\text{National Pop})+(D_{inHC2}/\text{total number of HC IIs})*1/2\}$$

Table 4. EMHS allocations to HC IIs based on formula 1 versus current criterion

HF activity level	District	Facility name	Average patient load	Current NMS allocation	Proposed allocation (formula 1)	Per patient allocation (current formula)	Per patient allocation (formula 1)
Low	Rakai	Bitabago HC II	271	7,567,557	288,254	27959	1065
	Kyankwanzi	Emmanuel HC II	467	7,567,557	497,770	16191	1065
	Sheema	Rweibare HC II	482	7,567,557	513,674	15689	1065
	Buvuma	Namiti HC II	895	7,567,557	953,509	8452	1065
	Rukungiri	Bucence HC II	909	7,567,557	967,709	8328	1065
Meduim	Rakai	Kayonza Dwaniro HC II	5912	7,567,557	6,296,140	1280	1065
	Tororo	Amoni HC II	5917	7,567,557	6,301,110	1279	1065
	Mitooma	Kyeibare HC II	5920	7,567,557	6,304,305	1278	1065
	Agago	Lamiyo HC II	5920	7,567,557	6,304,660	1278	1065
	Yumbe	Okuyo HC II	5922	7,567,557	6,307,145	1278	1065
High	Isingiro	Rubondo HC II	38586	7,567,557	41,093,212	196	1065
	Adjumani	Bira HC II	52073	7,567,557	55,456,440	145	1065
	Arua	Ocea HC II	53175	7,567,557	56,629,760	142	1065
	Adjmani	Nyumanzi	54665	7,567,557	58,216,716	138	1065
	Isingiro	Juru HC II	56156	7,567,557	59,804,488	135	1065

Step 2: Allocation of EMHS resources at health facility level

Given the district budget allocation for EMHS funds for each level of care obtained in step 1, the final allocation to each facility would depend on the average patient load of the facility for the past three years relative to the total average patient load of the district at the respective level of care over the same period. For example, an HC II with average patient load PLa in a district where the total average patient load for all HC IIs is equal to $DiPL_{CH2}$ will receive an allocation ($EMHS_{HC2i}$) equivalent to:

$$EMHS_{HC2i} = D_{EMHS}(HC2)* \{PL_a/D_iPL_{CH2}\}$$

To illustrate the allocations to health facilities based on this formula, we used the population estimates from the 2014 national census and the number of health centers at each level of care in each district to generate a weighted average index. We then multiplied the weighted index with the national budget for EMHS in fiscal year 2016/17 to generate district EMHS budget allocations for each level of care. This is the first step to determine the allocations to each district. We then used the average patient load for each facility as a proportion of the total patient load of the district at HC III level (multiplied by the district allocation obtained in step 1 to estimate the allocation to each HC in each district).

Table 5 gives estimates of health facility allocations and allocation per patient for a sample of HC IIIs. The sample is selected to include HC IIIs with a range of patient loads.

Formula 3: Based on a weighted index of population and number of health facilities, the bare minimum required for a facility to function at that level of care and patient load

This formula also comprises two steps. In step 1, district allocations are obtained as in formula 2 (based on a weighted average of district population and number of health facilities). However, to obtain health facility allocations, a portion of the district budget is allocated equally among all health facilities at a given level of care (e.g., HC IIIs) and another portion is distributed based on the patient load of the facility relative to the total patient load of all facilities within the district at the same level of care.

Step 1: District level allocation

Given a national EMHS budget allocation for HC IIs (GB_{HC2}), district allocation D_{EMHS} (HC II) will be equivalent to:

$$D_{EMHS}(HC2) = GB_{HC2}*\{(D_{iPop}/\text{National Pop})+(D_{inHC2}/\text{total number of HC IIs})*1/2\}.$$

Step 2: Health facility level allocation: 30% of the distributed budget is distributed equally and 70% is allocated based on the facility patient load.

Thus, allocation to a given HC II (i) $EMHS_{HC2i}$ would equal to:

$$\{(0.3*D_{EMHS}(HC2)/\#\ \text{of HC IIs in the district}\}+0.7*D_{EMHS}(HC2)*\{PL_a/D_iPL_{CH2}\}$$

Table 5. EMHS Allocations to HC IIIs based on formula 2 versus current criterion

HF activity level	District	Facility name	Average patient load	Current NMS allocation	Proposed allocation (formula 2)	Per patient allocation (current formula)	Per patient allocation (formula 2)
Low	Sironko	Masiyompo HC III	1300	22,427,646	2,104,727	17250	1619
	Kasese	Kinyabwamba HC III	1416	22,427,646	2,122,149	15838	1499
	Pader	Rackoko HC III	2235	22,427,646	2,372,651	10037	1062
	Bushenyi	Katungu HC III	2239	22,427,646	3,479,519	10015	1554
	Arua	Anyiribu HC III	3026	22,427,646	3,360,341	7412	1111
Meduim	Masindi	Kijunjubwa HC III	11228	22,427,646	25,960,786	1997	2312
	Mbale	Malukhu HC III	11236	22,427,646	19,614,652	1996	1746
	Lyantonde	Mpumudde HC III	11253	22,427,646	21,535,314	1993	1914
	Bududa	Bufuma HC III	11256	22,427,646	13,503,587	1993	1200
	Hoima	Mukabara HC III	11275	22,427,646	14,327,077	1989	1271
High	Kampala	Kiswa HC III	78883	22,427,646	169,076,880	284	2143
	Kiryandongo	Panyadoli HC III	89987	22,427,646	82,762,504	249	920
	Yumbe	Barakala HC III	90811	22,427,646	66,614,136	247	734
	Isingiro	Nakivale HC III	97547	22,427,646	108,917,288	230	1117
	Kamwenge	Rwamwanja HC III	108426	22,427,646	107,743,848	207	994

By having a fixed budget for all facilities, this allocation criterion ensures that small facilities (with low patient numbers) have a given minimum budget allocation for EMHS to enable them to function and attract more patients in subsequent periods, assuming other factors remain the same.

Simulations indicated that allocating 30% of the district EMHS budget as a fixed budget across all health facilities at a given level results in the lowest level of inequity (lowest equity ratio) for which facilities would also receive a budget allocation to guarantee they can receive the basic EMHS kit to function. For example, when we considered ratios of the fixed budget above 30%, inequity in per patient allocations increased, while a ratio below 30% would result in more equitable allocation but some facilities would receive less than what would enable them to function. Therefore, 30% was considered the optimum fixed percentage level of fixed allocation beyond which the equity ratio increase and below which absolute budget allocations to some facilities would be inadequate for them to function at all.

Formula 4: Fixed and variable budget proportions at the national level

This proposed formula is similar to formula 3, except that the proportions are applied to the national EMHS budget allocations toward a given level of care.

In this example, the national budget allocation for EMHS for all HC IIIs in the country is expressed as GB-EMHS$_{HC-3}$ and total number of HC IIIs in the country as N$_{HC-3}$. Total patient load for all HC IIIs is PL$_{NHC-3,}$ and patient load for a specific HC III is PL$_{HC3i.}$

The EMHS allocation to a specific facility, expressed as EMHS$_{HC-3i,}$ will be:

$\{0.3*(\text{GB-EMHS}_{HC-3}/N_{HC-3})+0.7*\text{GB-EMHS}_{HC-3}*(PL_{HC3i}/PL_{NHC-3})\}$

The resulting EMHS allocations based on this formula for a sample of facilities are shown in table 6. As was the case in formula 3, this allocation criterion would guarantee some fixed budget for a health facility regardless of its patient volume in previous periods.

Formula 5: Allocations based on a weighted average of population, poverty, and health facility distribution index

This allocation formula is similar to formula 2, but a district poverty index has been added as a needs indicator. Literature (Sachs et al, 2002; Stevens, 2004; Wagstaff, 2002) suggests that poverty levels are closely associated with disease incidence, and populations that are poorer will tend to become sick and require treatment and more EMHS.

Table 6. EMHS allocations to HC IIs based on formula 4 versus current criterion

HF activity level	District	Facility name	Average patient load	Current NMS allocation	Proposed allocation (formula 4)	Per patient allocation (current formula)	Per patient allocation (formula 4)
Low	Rakai	Bitabago HC II	271	7,567,557	2,471,188	27959	9130
	Kyankwanzi	Emmanuel HC II	467	7,567,557	2,617,850	16191	5601
	Sheema	Rweibare HC II	482	7,567,557	2,628,982	15689	5451
	Buvuma	Namiti HC II	895	7,567,557	2,936,867	8452	3280
	Rukungiri	Bucence HC II	909	7,567,557	2,946,807	8328	3243
Meduim	Rakai	Kayonza Dwaniro HC II	5912	7,567,557	6,676,709	1280	1129
	Tororo	Amoni HC II	5917	7,567,557	6,680,188	1279	1129
	Mitooma	Kyeibare HC II	5920	7,567,557	6,682,424	1278	1129
	Agago	Lamiyo HC II	5920	7,567,557	6,682,673	1278	1129
	Yumbe	Okuyo HC II	5922	7,567,557	6,684,412	1278	1129
High	Isingiro	Rubondo HC II	38586	7,567,557	31,034,660	196	804
	Adjumani	Bira HC II	52073	7,567,557	41,088,920	145	789
	Arua	Ocea HC II	53175	7,567,557	41,910,244	142	788
	Adjmani	Nyumanzi	54665	7,567,557	43,021,112	138	787
	Isingiro	Juru HC II	56156	7,567,557	44,132,552	135	786

Source: Computations based on NMS EMHS allocations and MoH DHIS-2 database

DISCUSSION

Estimates of the EMHS allocations per patient resulting from each of the five formulae assessed showed that resource allocation Formula 4, which involves distributing a 30% portion of the national EMHS budget equally among health facilities at a given level of care and the remaining 70% based on the patient load of the facility, was found to be more equitable than the current allocation criteria.

It also resulted in total and average allocations that would be more acceptable given the current level of funding per facility, which is still generally low given the resources needed by facilities. This allocation formula guarantees a facility some fixed budget for EMHS regardless of its historical patient volumes, which might be the result of factors other than availability of EMHS. Compared to the current allocation criterion, the simulations showed that the suggested formula would improve the equity ratio from 207.4:1 to 11.6:1 for HC IIs, from 107.7:1 to 5.6:1 for HC IIIs, and from 6.5:1 to 1.8:1 for HC IVs. The results also revealed that in the future, if the budget envelope for EMHS increased, an allocation criterion based on facility patient load only would be more appropriate in addressing inequities in EMHS allocations.

Other alternative resource allocation formulae, which are based on other needs indicators such as district population, poverty level, and distribution of health facilities, were found to be more equitable than the current allocation criterion but inferior to the preferred formula in terms of equity ratios and average EMHS per patient. Considering demand-related indicators, such as population in resource allocations, when the available budget is insufficient to meet demand is not appropriate. The current levels of inequity in EMHS allocation per patient for general hospitals and regional referral hospitals are relatively minimal and the current EMHS budget allocation criteria for both levels of care could be maintained.

LESSONS LEARNED

The accuracy and reliability of formula 4 are dependent on the quality of patient data collected at health facilities. There were incomplete data on outpatient and inpatient department attendance in the DHIS-2 system. For effective implementation of the proposed formula, the MoH will need to further improve the data capture in the DHIS-2 system to have reliable data on outpatient and inpatient department attendance at all health facilities.

There is also the likelihood of health facility managers over-reporting outpatient and inpatient department attendance to secure higher budget allocations. However, using a three-year average of patient load as proposed would reduce the impact of over- or under-reporting on the final allocations. The recommended formula 4 will ensure that Ugandans receive similar amounts and quality of EMHS from facilities that provide the same level of care, ultimately contributing to commodity security and improved health outcomes. Allocating EMHS budgets based on need would reduce waste from overstock and expiries and lead to consistent commodity availability at health facilities.

WAY FORWARD

Implementation guidelines were developed to provide the MoH, NMS, and districts and health facilities with a reference manual on how to comprehensively allocate essential medicines and health supplies using the new formula. The NMS will use the formula starting in July 2020.

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