

Geographic location of health facility and immunization program performance in Hoima district, western Ugandan

Nicholas Magambo Kwikiriza (✉ kwikiriza@gmail.com)

KIKUUBE DISTRICT <https://orcid.org/0000-0003-4639-6250>

Francis Bajunirwe

Mbarara University of Science and Technology

Fred Bagenda

Mbarara University of Science and Technology

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Abstract

Background Globally immunization coverage for childhood vaccines is below the immunization target of achieving at least 90% coverage with the pentavalent vaccine. In Uganda, a recent survey shows 80% of districts had poor immunization program performance. However, there is significant variation in performance within and between districts. We hypothesized that geographic location of health facility may influence performance of their immunization programs. Therefore, the purpose of this study was to examine whether geographical location of health facility within a district is associated with performance of the immunization program in Hoima district, western Uganda.

Methods We conducted a cross sectional study using a mixed methods approach. The study unit was a health center and we interviewed health workers in-charge of the facilities and reviewed their health facility records. We reviewed the Uganda Health Management Information System (HMIS) 105 reports of six months to obtain data on immunization program performance. Performance was categorized using World Health Organization's Reach Every District (RED) criteria and classified as poor if a facility fell in category 3 or 4 and good if 1 or 2. We also conducted key informant interviews with immunization focal persons in the district. We examined the association between dependent and independent variables using Fisher's exact test.

Results We collected data at 49 health facilities. Most of the health units (55.1%) had poor immunization program performance. Proximal location to the central district headquarters was significantly associated with poor immunization program performance ($p < 0.05$). Inadequate commitment and competing interests of health workers in the more urban areas were suggested as possible explanations.

Conclusions Proximal location to the urban setting near district headquarters was strongly associated with poor immunization program performance. To be able to reach larger numbers of children for vaccination, interventions to improve performance should target health facilities in urban settings.

Background

According to the World Health Organization (WHO), immunization coverage for childhood vaccines is still below the optimum immunization target of achieving 90% or more for coverage with 3 doses of pentavalent vaccine. [1, 2] The WHO also approximates that two million children die every year due to vaccine preventable diseases and approximately 30% of children globally lack access to vaccines. Children in sub-Saharan Africa are ten times less likely to access vaccines than children in developed countries. [3] In Africa 81% of unvaccinated infants were found in ten countries Uganda inclusive. [4] In Uganda, only 22 out of 112 districts or 20% had good access and utilization of immunization services. [5] In only 20% of the districts, at least 80% of the targeted children in these districts were given all the recommended doses of the lifesaving childhood vaccines

Several studies have been conducted to examine the factors associated with immunization program performance (IPP) and the challenges of vaccination programs in resource limited settings. [6-10] The key factors identified include individual factors such as access to information on maternal and child health, socio-demographic characteristics of parents or guardians and level of education. Religious beliefs, traditional remedies and mistrust of western medicine also influence program performance. [11] Health system factors such as funding constraints, human resource factors such as health worker shortages, training deficiencies, poor attitude of health workers and vaccination teams, inadequate infrastructure and equipment, and structural factors such as long distance from health facility are critical for successful programs. [12, 13]

Although these several studies have shed light on the multiple factors that may influence immunization performance, there is limited data on how geographic distribution of health facilities may influence immunization performance. Data show that even within the same district where health facilities share common structural barriers, there is variation in performance. [14, 15] We hypothesized that geographic distribution of the facilities may influence their performance. The DPT3 coverage for the rural district of Hoima on the shores of Lake Albert in Uganda was recently reported to be 19%, way below the national level. [16] Therefore, the aim of this study was to examine whether geographic distribution of health facilities influences immunization program performance by health facilities in this rural district of western Uganda.

Methods

Study design and setting

We conducted a cross sectional study with both quantitative and qualitative methods of data collection. First, we collected the quantitative data, and then the qualitative data were collected last to provide meaning and explanation to the quantitative findings. The study was conducted at both public and private health centers in Hoima district, a predominantly rural district in western Uganda, bordering with the Democratic Republic of Congo. The district has 49 public and 5 private health facilities that offer immunization services and all contribute information to the District Health Information System version 2 (DHIS2) list. The sampling unit was a health facility. We included all the 49 public and private health facilities on Hoima district HMIS reporting list that offered immunization services in the previous six months prior to the study. In Uganda, health center II are units at the parish level, health center III at sub-county and health center IV is at county level.

Data collection and measurements

Data to assess immunization program performance were obtained by reviewing Health Management Information Sheets (HMIS) 105 reports in District Health Information System version 2 (DHIS2) that

spanned a period of six months from January to June 2017. The variables collected from HMIS reports included number of Expanded Program for Immunization (EPI) outreaches conducted, number of children who received the first and third dose of pentavalent vaccine and DPT3. The DPT1 and DPT3 data were used to calculate immunization program performance according to the Reach every district (RED) categorization criteria. [17, 18] The RED strategy was introduced by the WHO in 2002 with a goal of increasing immunization coverage to at least 90% with all vaccines in every district and country. It uses the pentavalent vaccine coverage and dropout rate to determine immunization program performance of health facilities. There are four categories in this classification namely; Category 1 = high coverage (>90% coverage) + low dropout rate (<10%), Category 2 = high coverage (>90%) + high dropout rate (>10%), Category 3= low coverage (<90%) + low dropout rate (<10%) and Category 4= low coverage (<90%) + high dropout rate (>10%). Health facilities in categories 3 and 4 are classified as having poor immunization performance, while categories 1 and 2 have good immunization performance.

HMIS 105 reports the monthly attendance for child immunization for every health centre. Health centres compile monthly reports that are entered in a Ministry of Health online electronic database, the (DHIS2) and we reviewed these reports to assess immunization program performance.

We also conducted interviews with health workers in-charge of the health facilities in Hoima district using structured questionnaires to assess facility level factors that support immunization such as support supervision, organization of outreaches, financing, payment for outreaches, stock out of vaccines and cold chain maintenance. We collected data on demographic characteristics of health center in-charges like age, sex, marital status, years of experience, education level, and EPI training.

We also collected data on the characteristics of the health facility such as level of health centre, ownership and geographic location, presence of EPI outreach schedule, functional EPI fridge and its maintenance, means of transport, community mobilizer, payment of allowances for EPI activities, staffing level, conducting outreaches, discussing EPI performance in staff meetings, maintenance, stock out of vaccines and stock out of gas for EPI fridges,

After preliminary analysis of quantitative data to assess immunization program performance at the health facilities, we conducted key informant interviews with district EPI focal persons, EPI focal persons for Bugahya and Buhaguzi health sub district using open ended questionnaires.

Data analysis

We checked the data for completeness, coded and entered them into Epi-Info version 7 and exported to Stata version 11 for analysis. The primary outcome for the analysis was immunization performance as assessed based on the WHO's RED category. The number of facilities was small and therefore to assess the association between dependent and independent variables, we used Fisher's exact test. This test is

robust for analysis involving small sample sizes where the contingency tables have expected number of observations in the cells is less than five. [19]

Qualitative data were transcribed and no translations were necessary as data were collected in English. We manually read the transcripts and analyzed them using a thematic approach. We did not have any *a priori* themes. We also looked to the qualitative data to plug the gaps observed from the quantitative data.

Ethical considerations

The study was approved by Mbarara University of Science and Technology (MUST) Faculty of Medicine Research Committee and MUST Research Ethics committee (MUST REC Protocol number 07/05-17). We obtained administrative clearance from Hoima district health office before initiation of the data collection process. Participants provided written informed consent before participating in the study.

Results

Characteristics of the health facilities

Forty nine health centers were included in the study, 17 HC II (34.7%), 28 HCIII (57.1%), 3 HC IVs and 1 Regional referral hospital as shown in Table 1 below. Majority (81.6%) of health centers were government owned and the rest (18.4%) were private health facilities.

We found that 89.8% of the health centers had fridges for storage of vaccines. Most (87.76%) health centers reported to have experienced stock out of vaccines. All health centers had EPI focal persons. Immunization outreach schedules were present in 81.63% of health centers. Allowances for EPI had been paid in 77.55% Of health centers.. Support supervision had been conducted at least once in the previous six months in 89.80% of the health centers. Details are in table 1 below.

Table1: Characteristics of health centers in Hoima District

Characteristic		Frequency (%)
Health Sub District	Bugahya	16 (32.7)
	Buhaguzi	23 (46.9)
	Hoima Municipality	10 (20.4)
Level of Health Centre	Regional Referral	1 (2.1)
	Health center IV	3 (6.1)
	Health center III	28 (57.1)
	Health center II	17 (34.7)
Distance from District Headquarters	Less than 25KM	27 (55.1)
	25-50KM	13 (26.5)
	More than 50KM	9 (18.4)
Presence of EPI fridge	No	5 (10.2)
	Yes	44 (89.8)
EPI Fridge maintenance	No	10 (20.4)
	Yes	39 (79.6)
Stock out of Vaccines	No	6 (12.2)
	Yes	43 (87.8)
Stock out of Gas for EPI fridge	No	21 (42.8)
	Yes	9 (18.4)
	N/A*	19 (38.8)
Presence of EPI outreach schedule	No	9 (18.4)
	Yes	40 (81.6)
Received funding for EPI activities	No	5 (10.2)
	Yes	44 (89.8)
EPI allowances paid timely	No	11 (22.4)
	Yes	38 (77.6)
Presence of Community mobilizer	No	1 (2.0)
	Yes	48 (98.0)
Presence of means of transport	No	34 (69.4)
	Yes	15 (30.6)

EPI performance discussed in staff meetings	No	10 (20.4)
	Yes	39 (79.6)
Attend EPI performance review meeting	No	25 (51.0)
	Yes	24 (49.0)
Have support supervision	No	5 (10.2)
	Yes	44 (89.8)

* Health centers do not have gas fridge

Demographic characteristics of respondents/health center in-charges

We interviewed one health worker per health facility included in the study and the demographics are shown in Table 2 below. Almost 50% of them were aged 30 years or less. Only 6 health workers with a degree headed a health facility and at least 60% of the health facilities were headed by diploma holders. Majority (n=38 or 77.5%) were trained in EPI. Also majority of these health workers were male.

Table 2: Demographic characteristics of health facility in-charges

Characteristic		Frequency (%)
Age	≤30years	23 (46.9)
	>30years	26 (54.1)
Years of experience	≤5years	25 (51.0)
	>5years	24 (49.0)
Gender	Male	27 (55.1)
	Female	22 (44.9)
Title position	Medical doctor	3 (6.1)
	Clinical Officer	24 (48.9)
	Nursing Officer	7 (14.3)
	Enrolled Nurse or Midwife	13 (26.6)
	Others	2 (4.1)
Level of Education	Certificate	13 (26.5)
	Diploma	30 (61.2)
	Bachelors or Masters	6 (12.3)
Marital Status	Single	10 (20.4)
	Married	38 (77.5)
	Divorced	1 (2.1)
Trained in EPI	No	11 (22.5)
	Yes	38 (77.5)

Performance and distribution of health facilities in Hoima district

Thirteen or 26.5% of the health facilities scored in the highest RED category and 11 scored in the lowest as shown in Table 3 below. Over, at least 55% of the health facilities were rated as having poor immunization performance. The distribution of health facilities by their immunization performance is shown in Figure 1 below in the map of Hoima. The map shows the clustering of health facilities with poor performance around or near the district headquarters, and those with good performance away from the headquarters.

Table 3: Performance of Health centers in Hoima district.

Characteristic		Frequency (%)
WHO RED Category	1	13 (26.5)
	2	9 (18.4)
	3	16 (32.7)
	4	11 (22.4)
Immunization performance	Good	22 (44.9)
	Poor	27 (55.1)

—————Insert figure 1 here—————

Bivariate analysis of factors associated with immunization performance

Several factors related to vaccine delivery were not significant and included among others presence of an EPI fridge at the health facility, history of stock out of vaccines, funding for EPI activities and paid allowances and these factors are shown in Table 4 below. Although majority of the health facilities reported they received support supervision, we observed that facilities that received no support supervision were more likely to report good performance.

Discussion of EPI performance is staff meetings, attendance of EPI performance review meetings, community mobilization and having means of transport for vaccination outreaches were not related to immunization program performance.

Table 4: Bivariate analysis of factors associated with immunization performance

Characteristic		Total (n=49)	Good performance n=22 (%)	Poor performance n=27 (%)	p value
Presence of EPI fridge	No	5	2 (40.0)	3 (60.0)	0.82
	Yes	44	20 (45.5)	24 (54.5)	
Stock out of Vaccines	No	6	2 (33.3)	4 (66.7)	0.54
	Yes	43	20 (46.5)	23 (53.5)	
Stock out of gas for EPI fridge	No	21	11 (52.4)	10 (47.6)	0.60
	Yes	9	3 (33.3)	6 (66.7)	
	N /A*	19	8 (42.1)	11 (57.9)	
Presence of EPI outreach schedule	No	9	5 (55.6)	4 (44.4)	0.48
	Yes	40	17 (42.5)	23 (57.5)	
Received funding for EPI activities	No	5	2 (40.0)	3 (60.0)	0.82
	Yes	44	20 (45.5)	24 (54.5)	
EPI allowances paid	No	11	6 (54.5)	5 (45.5)	0.46
	Yes	38	16 (42.1)	22 (57.9)	
Have community mobilizer	No	1	0 (00.0)	1(100.0)	0.36
	Yes	48	22 (45.8)	26(54.2)	
Have means of transport	No	34	14 (41.2)	20 (58.8)	0.43
	Yes	15	8 (53.3)	7 (46.7)	
EPI performance discussed in staff meetings	No	10	5 (50.0)	5 (50.0)	0.72
	Yes	39	17 (43.6)	22 (56.4)	
Attending EPI performance review meeting	No	25	12 (48.0)	13 (52.0)	0.66
	Yes	24	10 (41.7)	14 (58.3)	
Support supervision	No	5	5 (100.0)	0 (0.0)	0.009
	Yes	44	17 (38.6)	27 (61.4)	
Staffing level	=<75%	39	18 (46.2)	21 (53.8)	0.73
	>75%	10	4 (40.0)	6 (60.0)	
Number of EPI outreaches conducted in 6 months	=<20	30	11 (36.7)	19 (63.3)	0.145
	>20	19	11 (57.9)	8 (42.1)	
Proportion of planned	=<75%	12	5 (41.7)	7 (58.3)	0.796

outreaches conducted (%)	>75%	37	17 (45.95)	20 (54.05)
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* Not applicable. Health centers do not have a gas fridge.

Bivariate analysis of health facility characteristics and with immunization performance

There was no significant difference in the performance by the level of the health facility or ownership type and the results are shown in Table 5 below. However, facilities located in the Municipality or the more urban part of the district were more likely to perform poorly compared to those located distally such as Buhaguzi (p=0.026).

The facilities that were located within 25km of the district headquarters were more likely to perform poorly compared to those that were located much further away (p=0.023 using Fisher's exact test). At least 70% (n=19) of the health facilities within 25km performed poorly compared to only 36.4% (n=8) of those more than 25km from the district headquarters.

Table 5: Bivariate analysis of Health center type and geographical location with immunization program performance

Characteristic		Total (n=49)	Good performance n=22 (%)	Poor performance n=27 (%)	p value*
Level of health facility	HC II	17	7 (41.2)	10 (58.8)	0.91
	HC III	28	13 (46.4)	15 (53.6)	
	HC IV or higher	4	2 (50)	2 (50)	
Ownership	Government	40	17 (42.5)	23 (57.5)	0.71
	Private	9	5 (55.6)	4 (44.4)	
Health Sub District	Bugahya	16	4 (25.00)	12 (75.00)	0.026
	Buhaguzi	23	15 (65.22)	8 (34.78)	
	Municipality	10	3 (30.00)	7 (70.00)	
Distance from District Headquarters	< 25KM	27	8 (29.6)	19 (70.4)	0.023
	>25KM	22	14 (63.6)	8 (36.4)	

*Using Fishers exact test

Results of key informant interviews

We interviewed four key informants and these included the district EPI focal person, district cold chain technician, and 2 Health sub district focal persons. Overall three themes emerged from the analysis to explain the performance of the immunization program namely 1) health worker attitude 2) outreach site selection and 3) community mobilization as shown in Table 6 below.

Table 6: Emerging themes from key informant interviews

Themes	Sub themes
Health workers' attitude	Competing interests in urban areas
	Less time committed to immunization activities
Outreach site selection	Convenient selection of outreach sites
Community mobilization	Outreaches conducted in the morning hours when clients are still in the gardens
	Less support for community mobilization
	VHTs don't reach all households with information on immunization dates
	Dates and time for outreaches not well known

Health worker attitude

Inadequate planning

The RED strategy requires that Health Centres conduct immunization outreaches to communities in hard-to-reach areas or villages located more than 5 km from the health center. KIs indicated that, health centres in the urban and peri-urban areas tended to select immunization outreach sites closer to the health center for their convenience.

“Health workers in urban areas select outreach sites that they can easily access and many of them are located less than 5 km from their station, so they don’t delay to return.” KI, Hoima

Community mobilization

All the key informants indicated that rural areas seem to have better mechanisms for community mobilization compared to their urban counterparts through grass root mechanisms.

“The rural areas have implementing partners who support them in mobilizing communities using loud speakers and other local public address systems. In addition, these village women seem to have stronger interpersonal relationships and communication which they use to remind each other to attend immunization days”. KI, Hoima district

“Health centres in rural areas rely on VHTs to mobilize communities for immunization. I have visited many households in urban and peri-urban areas and mothers reported no visits from VHTs. I have interacted with mothers in these areas and they usually know the location of the immunization outreach sites in their locations but usually don’t know the exact dates and time when health workers go there.” KI, Hoima district

Discussion

In this cross sectional review of the immunization performance of health facilities in a district in western Uganda, over 50% of them were classified as having poor immunization performance. Proximal location of the health facility to the district headquarters and support supervision were associated with

performance. Several factors related to the program such as infrastructure to deliver the vaccines, human resources were not significantly related to performance.

The poor performance in immunization at these health centers implies that many infants in this region in Hoima district and other districts with similar performance remain unvaccinated. The performance supports the findings of Uganda Demographic and Health survey (UDHS) of 2016 which showed that at least one in three children in this region had not been received all basic vaccinations. [20]The same survey also found out that many regions in Uganda had significant proportion of infants who had not received all basic vaccinations. Our results are set in one district but may throw some light on performance on a much broader scale in the country. Several studies in sub Saharan Africa have reported less than the targeted levels for vaccination coverage. [21-23]

Our data showed the health facilities that were located more remotely from the district headquarters or the more rural part of the district were likely to perform better than those located closer to the district headquarters. This inverse distance and performance relationship is striking and needed to be explained. Most health workers from health centers located close to the central district headquarters were reported to reside near the town center and were more likely to pursue competing economic activities in the municipality. Key informants suggested that this may cause them to commit less time to immunization activities and health facility related activities in general. Our key informant interviews suggested that the health workers at the remote health facilities conduct immunization outreach sessions at flexible hours for the rural residents who mostly spend their morning times in the gardens. The health workers in the urban areas do not provide this flexible option to the peri-urban dwelling clients, hence the shortfall. Our results agree with other studies elsewhere that show health worker attitudes and access are key influencers of immunization programs. [24]

Studies elsewhere had shown rural-urban differences in performance of immunization programs. [25] Although urban areas are considered accessible and easy to reach, for immunization programs, populations in these areas should be considered among those with poor access to the services. For immunization to be successful, health workers need to maintain a certain level of contact with the recipient communities, [26] as a way to eliminate inequities.

The geographical differences in performance between the rural and urban counties may also be explained the role of VHTs. Buhaguzi health sub district is more rural but hosts a refugee settlement which attracts some organizations that facilitate VHTs to mobilize communities for immunization, which services are absent in the urban counties. Also, the absence of health facilities in some urban parishes

may play a role. For instance some divisions of Hoima municipality had many parishes that did not have a single health center. This implies that community members travel longer distances to access immunization sessions. Since most of immunization outreach sites were selected to the convenience of health workers, many children miss the opportunity to be vaccinated.

Our findings that health facilities in rural areas perform better than those in urban areas are supported by other studies elsewhere in sub Saharan Africa. For instance, a study done in the Gambia found that children in the rural setting were more likely to be immunized based on the three antigens namely BCG, measles, and DPT and full immunization by 12 months of age, as compared those children in the urban and peri-urban areas. [27] In the Gambia, poor performance in the urban areas was attributed to long queues at health facilities which served as a deterrent to attendance. In Indonesia, poor populations crowded in peri-urban clusters were less likely to be immunized, highlighting geographic distribution in immunization coverage. [28] Our study also shows the fewer health facilities in the urban parishes may be responsible for the poor performance. The fewer health facilities create inequalities in access to immunization services. Such inequalities were observed in a comparative study of immunization coverage in the urban slums of Ouagadougou and Nairobi and were responsible for the difference in vaccine coverage.[29]

According to studies on immunization coverage in sub Saharan Africa, factors that affected immunization programs include support supervision, organization of outreaches, financing, logistics and cold chain maintenance, advocacy and communication, planning and management and use of surveillance data for decision making. [30, 31] However, our study did not find a significant association between immunization program performance and these factors.

Although support supervision has been associated with good immunization performance in studies from other sub Saharan African countries [30], our data show the opposite. We paradoxically found that facilities that did not have support supervision were all ranked as good performing. We consider this result spurious and to be taken with caution. The possible explanation for this unexpected finding is that majority of sites had regular support supervision, hence our data did not have sufficient variation to compare the sites with and without the supervision. To gain a better understanding of this finding, we triangulated these findings with qualitative data from key informant interviews and found out that support supervision was held irregularly. Also, we found that support supervision visits were integrated with other health programs and therefore never focused at details of immunization programs like review of performance data at the particular health facility. There is a potential bias in the assessment of the role of support supervision, if it was not being administered effectively. However, this finding could also have been due to bias arising from the possibility that support supervision might have targeted health

centers with poor performance. Interventional studies have provided the evidence to show the benefit of support supervision in the delivery of health interventions. [32]

The major strength of our study is we assessed health facilities in a remote district, and generated novel data for a district in an approach that has not been commonly conducted. Majority of studies have examined individual patient factors, but few have examined health facilities as a unit of observation. We have mapped the performance and showed the strong, albeit paradoxical association between proximity to the central district administration and immunization performance. Our study provided valuable data that will be used to inform immunization programs in many other districts of Uganda, and similar settings outside of Uganda. Our study has some potential weaknesses. First, this is not a national study, but a survey conducted in one district, hence the number of facilities assessed is small. For this reason, we were not able to conduct multivariable analyses as the models crashed; nevertheless the descriptive and map data remain informative. However, given the similar rural urban divide of the majority of Ugandan districts, our results provide valuable lessons for other districts in the country.

Conclusions and Recommendations

In conclusion, our study has shown that majority of health facilities in this district of western Uganda had poor immunization performance. The health facilities located closer to the urban setting near the district headquarters were associated with poorer immunization performance compared to those further away. Support supervision was negatively associated with immunization performance, although the data are small and should be interpreted with caution.

We recommend monitoring and evaluation of immunization program performance at sub county and health sub district level to identify poor performing areas and put in place targeted interventions. There should also be dialogue meetings between community members and health workers as a way of involving community members in planning for immunization services like selection of site, time and date of outreach visits with much focus on areas with poor immunization performance.

The district health team needs to be mentored or trained and supported to conduct regular and planned support supervision of immunization programs in health centres, and not simply targeting places when performance has already gone down. Interventions are needed to improve involvement of VHTs in urban areas in mobilization for vaccination.

Abbreviations

ANC; Antenatal Care, DHIS; District Health information system, DHO; District health officer, DHT; District Health team, DPT; Diphtheria, Pertussis and Tetanus, EPI; Expanded Program on Immunization, HC; Health Center, HIS; Health Information System, HMIS; Health management information systems, HSD; Health sub district, ICT; Information communication technology, M&E; Monitoring and Evaluation, MOH; Ministry of Health, p-value; probability value, REC; Reach Every child, RED; Reach Every District, UNEPI; Uganda National Expanded Programme on Immunization, UNICEF; United Nation Children's Fund, VHT; Village Health Team, WHO; World Health Organization

Declarations

Ethics approval and consent to participate

Ethical approval for this study was sought and obtained from the Research Ethics Committee at Mbarara University of Science and Technology.

Availability of data and materials

All data supporting our findings are contained in the paper. There are some restrictions to data access and reasonable requests will be considered after approval from Mbarara University Research Ethics Committee. Data requests may be made to Nicholas Magambo Kwikiriza (corresponding author), Department of Community Health, Mbarara University of Science and Technology, PO Box 1410, Mbarara, Uganda, email: kwikiriza@gmail.com Tel: +256783783288

Competing interests

The authors declare that there are no competing interests.

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Authors' contributions

NMK, FB1 and FB2 conceived and designed the study, NMK supervised the data collection, implementation of field activities, NMK led the analysis of the data, interpretation of the findings and drafting of the paper. NMK made the first draft of the manuscript. All authors interpreted the data, read and revised the first draft and approved the final version of the paper.

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Figures



Figure 1

Map of Hoima district with health facilities assessed for immunization performance. The pin shows the urban center of the district headquarters, stars represent facilities with good performance and raindrops are facilities with poor performance