



Determinants of Underweight among Children of Adolescent Mothers in Western Kenya

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Abstract

Background: Underweight among adolescent mothers' children remains a significant public health issue, especially in Low and middle-income countries [LMICs]. Understanding context-based determinants of underweight is important in the formulation of specific interventions necessary for addressing it. Therefore, this study investigated the determinants of underweight among children of adolescent mothers in Vihiga County, Western Kenya.

Methodology: This hospital-based cross-sectional study was carried out across 25 health facilities in Vihiga County. A total of 121 adolescent mothers were interviewed using a semi-structured questionnaire to obtain their children's health status data. Additional information was obtained from the antenatal, postnatal and maternity records. Data was analysed using descriptive statistics, bivariate analyses, and multivariable logistic regression models in STATA version 18.

Results: Overall, 15.3% of children born to adolescent mothers were undernourished, with 4.7% underweight and 10.6% severely underweight. Maternal primary-level education was associated with higher odds of child underweight [aOR = 6.66, 95% CI: 2.02–21.96, $p = 0.002$]. Preterm delivery emerged as the strongest predictor [aOR = 17.6, 95% CI: 3.24–96.44, $p = 0.001$]. Additional determinants included lack of parental support and guidance [aOR = 7.31, 95% CI: 1.89–28.38, $p = 0.004$] and limited access to healthcare [aOR = 4.86, 95% CI: 1.26–18.71, $p = 0.021$].

Conclusion: Maternal education, parental support, preterm delivery and challenges in accessing health services are key determinants of underweight in children of adolescent mothers in Vihiga. There is an urgent need for programmatic interventions to address these determinants to promote these vulnerable children's health outcomes.

Keywords: Adolescent mothers, Pregnancy, Underweight, Determinants

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Introduction

Undernutrition is a major contributor to child morbidity and mortality worldwide, with underweight serving as a key indicator of acute and chronic nutritional deprivation. The World

Health Organisation estimates that 45 million children under five suffer from wasting and 149 million from stunting. In sub-Saharan Africa, underweight remains a pressing public health challenge, driving a substantial share of preventable childhood illnesses and deaths

[1]. This burden is further compounded by the fact that Adolescent pregnancy and motherhood remain a significant global public health concern.

Each year, about 21 million girls aged 15–19 years in low- and middle-income countries [LMICs] become pregnant, with nearly half of these pregnancies unintended [2]. Complications related to adolescent pregnancy and childbirth have been reported as the leading cause of mortality among teenage girls globally [3]. Furthermore, adolescent mothers face several postpartum vulnerabilities compared to older women due to their physical and emotional immaturity, lack of income sources, limited education, inadequate family support, and restricted access to quality healthcare services [4].

Adolescent pregnancy is linked to adverse child health outcomes such as low birth weight, preterm birth, neonatal mortality, stunting, and undernutrition [5]. Early-life undernutrition critically harms physical and cognitive development, as the first two years are vital for linear growth and brain development, worsening long-term child health outcomes [6].

Childhood underweight, defined as low weight-for-age, occurs when a child weighs less than an adequately nourished child of the same age and gender. It serves as an indicator of wasting, stunting, or both [7]. Therefore, stunting is characterised by growth retardation due to sustained nutritional deprivation, often resulting in reduced intellectual capacity and delayed mental development [8]. Wasting, on the other hand, is caused by insufficient dietary intake or repeated episodes of infectious diseases such as diarrhoea [9]. Notably, underweight impairs the immune system, increasing susceptibility to infections, and contributes to impaired physical and cognitive development [10].

In Kenya, undernutrition persists as a critical challenge contributing to approximately 35,000 deaths among children under five annually [11]. However, there is a paucity of data

on the determinants of underweight among children of adolescent mothers in Western Kenya.

Empirical evidence from Western Kenya has shown that stunting is the most prevalent form of undernutrition, followed closely by underweight [12]. Several contributing factors to child undernutrition include: low birth weight, preterm birth, limited parental education, recurrent infections such as diarrhoea and upper respiratory tract illnesses, prolonged illness lasting more than six days, poor dietary diversity, absence of the mother as the primary caregiver, inadequate household income, and unsafe water sources [13]. It is crucial to understand determinants of underweight among children of adolescent mothers, who face unique socio-economic and health challenges [14,15]. In Kenya, adolescent pregnancy prevalence is 19.9%, especially in rural Western regions, driven by poverty, early marriages, limited sexual education, and socio-cultural factors [16]. There are several contributing factors, including early marriages, proximity to lakes and mining sites, poverty, and inadequate sexual education, all of which are particularly dominant in Western Kenya [17]. Understanding the determinants of underweight among these vulnerable children is essential to inform the development of targeted, context-specific interventions.

Methodology

Study design and setting

A hospital-based cross-sectional study conducted in 25 health facilities in Vihiga County, Kenya, involving 121 adolescent mothers, interviewed using a semi-structured questionnaire programmed on the CommCare HQ application to capture data on the health status of their children [18].

Study population

Adolescent mothers [married and unmarried] aged 10–19 years with children aged 0–59 months attending antenatal and postnatal clinics at the 25 selected health facilities were

enrolled into the study. Although adolescence is conventionally defined from age 12 years, mothers as young as 10 years were included due to documented cases of pregnancies in this age group in the county.

Sample size determination

The minimum required sample size was calculated using the Cochran formula:

$$n = \frac{Z^2 \times P \times (1 - P)}{d^2}$$

Where:

n = minimum sample size

Z = Standard normal deviation corresponding to the desired confidence level [1.96 for 95% confidence]

P = Estimated prevalence of adolescent pregnancy among girls aged 10–19 years in Vihiga County [7.7%] [30]

1-P = Complementary proportion [92.3%]

d = margin of error [0.05]

Substituting values:

$$n = \frac{(1.96^2) \times 0.077 \times 0.923}{0.05^2} = 109.2 \approx 110$$

After adjusting for a 10% non-response rate, the final sample size was 121 participants.

Power calculation: Assuming $\alpha=0.05$, a power of 80%, and an expected effect size of OR = 2.5, the study was adequately powered to detect meaningful associations between key determinants and underweight among children of adolescent mothers.

Sampling

A multistage sampling was used to enrol participants. First, all the sub-counties in Vihiga were sampled owing to their diverse socio-economic and demographic profiles. Thereafter, the 25 health facilities were randomly drawn from all the 75 health facilities in the county, with replacement in cases where the selected facility had no functional ANC/PNC unit. Proportional random sampling was then used to allocate and draw 121 adolescent mothers for each of the 25

facilities based on their catchment population. This method ensured that each member of the target population had an equal chance of inclusion [19].

Variables

Outcome Variable. Weight-for-age [WFA] was used to determine the outcome variable [underweight]. WFA is a widely used anthropometric indicator that reflects both acute and chronic malnutrition in children under five. It combines the effects of wasting and stunting [20]. Weight-for-age was calculated in STATA using the *zscore06* package [21] and classified according to WHO standards [22] and WHO-recommended cut-offs: Normal weight WAZ $\geq -2SD$, underweight WAZ $< -2SD$ and $\geq -3SD$, and severe underweight $< -3SD$. For further analysis, WFA was categorised into a dichotomous outcome variable, where severe underweight and underweight were combined as “underweight” [coded as 1], while normal weight was coded as 0, aligning with previous research methodologies [23].

Independent Variables. The literature highlights several predictors of child growth outcomes, including underweight. One key factor is preterm delivery, defined as birth before 37 weeks of gestation, which in this study was verified from maternity registers or maternal and child health [MCH] handbooks. Parenting support was assessed based on whether mothers received advice on childcare, nutrition, or hygiene, coded as 'Yes' or 'No.' Access to healthcare was evaluated in terms of barriers such as distance, cost, and waiting time. Maternal education was categorised into "low" [no/primary] and "high" [secondary/post-secondary] depending on the level of education attained. Antenatal care [ANC] visits were grouped as <4 or ≥ 4 , with the first ANC classified by trimester. Delivery complications were recorded as present/absent, while parental survival was coded as both alive and dead. Religion was grouped as Christian, Muslim, or

Other; parity into primipara or multipara; and marital status recoded as married versus not married.

Data collection procedures

Data were collected in March 2025 across 25 health facilities by six trained assistants after intensive training. A pre-tested questionnaire captured socio-demographics, maternal health, healthcare access, feeding, and growth outcomes. Anthropometric data followed WHO standards. Data quality was maintained through daily calibration, CommCare checks, mandatory fields, supervisor spot-checks, and interim reviews.

Anthropometric data were collected to assess child nutritional status using weight-for-age [WFA] as the primary indicator. All measurements were taken by trained research assistants with prior experience in child growth monitoring. The weighing was conducted using UNICEF-recommended digital infant scales [Seca 354] with a precision of ± 10 g. The equipment was calibrated daily before use, and periodic spot-checks were carried out by the field supervisor to ensure accuracy [24].

Standardisation procedures were implemented following WHO guidelines for anthropometric measurements [25]. Children were weighed with minimal clothing and without shoes. Infants unable to stand were weighed while being held by their mothers, and the mother's weight was subtracted accordingly. For each child, duplicate weight measurements were taken; if the two readings differed by more than 100 g, a third measurement was obtained, and the closest two values were averaged for analysis [26].

Study setting and design

The study was conducted in 25 health facilities [Appendix I] in Vihiga County. Vihiga is a highly populated rural county with an estimated population of 590,013, according to the 2019 Kenya Population and Housing Census [27]. The county has five sub-counties: Vihiga,

Emuhaya, Hamisi, Luanda, and Sabatia. Health systems in Vihiga County comprise public, faith-based, and private facilities, community health units and dispensaries. The study was conducted in Vihiga County due to its high burden of adolescent pregnancies and documented challenges in maternal and neonatal health [28].

Validity and Reliability

To ensure the validity of the tool, a comprehensive literature review was conducted, and the questions were aligned with WHO standards [28]. The tool was also reviewed by subject matter experts to ensure that all the factors were included and it could measure the intended variables [29]. A pilot study at Kapkangani Health Centre involved 15 adolescent mothers. Cronbach's alpha test of reliability was done after the pre-test study in one facility that was not sampled for the study, which produced a coefficient of 0.83. This was considered a high level of internal consistency for the study [30].

Data analysis

Data were cleaned for completeness, consistency, and outliers, with missing patterns addressed. Descriptive statistics summarised socio-demographic and health characteristics. Bivariate analysis assessed independent variables against underweight status, retaining those with $p < 0.25$ for multivariate modelling. Backward elimination finalised the model at $p < 0.05$. Logistic regression generated crude and adjusted odds ratios [ORs, aORs] with 95% CIs. Multicollinearity [VIF < 5], model fit [Hosmer-Lemeshow], and explanatory power [pseudo R^2] were assessed. All analyses were conducted in STATA 18 using `zscore06`, `esttab`, and `vif` packages.

Ethical considerations

Ethical approval was obtained from the Institutional Scientific Ethics Review Committee of the University of East Africa, Baraton; B2424072024. A research permit under licensed number NACOSTI/P/24/38154 was then obtained from NACOSTI. Permission to access



hospital records was obtained from the Vihiga County Ministry of Health and the management of the 25 participating health facilities. Written informed consent was sought before data collection. Girls below 18 years of age who were pregnant, married, parents or heads of household were considered mature minors.

Results

Sociodemographic characteristics

The study aimed to describe the socio-demographic and reproductive characteristics of adolescent mothers alongside the health profiles of their children. The results are presented in Table 1.

Clinical characteristics

Table 2 presents clinical characteristics of deliveries. Table 2 shows that most deliveries [71.9%] were spontaneous vaginal, 24.8% required forceps or vacuum extraction, and 3.3% were caesarean. Nearly all children [98.3%] had never been hospitalised, indicating good health or underreporting, while 1.7% had prior admissions. A positive HIV test was observed in 1.6% of tested children. Additionally, 4.1% experienced poor breastfeeding, and 3.4% were unable to breastfeed during the first week after birth.

Table 1:
Socio-Demographic Characteristics of the Adolescent Mothers and their Children

	Variables	N	%
Participant's age Mean[SD]= 18.1 [1.1]			
Marital status	Single	89	73.6
	Married staying together	32	26.4
	Totals	121	100
Education Level	Primary	28	23.1
	Secondary	93	76.9
	Totals	121	100
Employment status	Self/ Informally employed	5	4.2
	Student	35	28.9
	No employment	81	66.9
	Totals	121	100
Religion	Christian	99	81.8
	Indigenous African Religion	21	17.4
	Muslim	1	0.8
	Totals	121	100
Both parents alive	No	30	24.8
	Yes	91	75.2
	Totals	121	100
Primi-gravida	No	4	3.3
	Yes	117	96.7
	Totals	121	100
Gender of the child	Male	63	52.1
	Female	58	47.9
	Totals	121	100
Age of the child, Median[IQR]=6[3,12] months			
Birth weight	<2.5 kg [Low birth weight]	22	18.2
	≥2.5 kg [Normal birth weight]	99	81.8
	Totals	121	100
Gestational age at delivery	Preterm [<37 weeks]	19	15.7
	Term [≥37 weeks]	102	84.3
	Totals	121	100



SD-standard deviation; IQR-interquartile range

Table 2

Clinical Characteristics of the Adolescent Mothers Recruited into the Study

		N	%
Mode of delivery [n = 121]			
	Spontaneous Vaginal	87	71.9
	Assisted Vaginal	30	24.8
	Caesarean Section	4	3.3
	Totals	121	100
Child was ever admitted to the hospital [n = 121]	No	119	98.3
	Yes	2	1.7
	Totals	121	100
HIV status of the child [n = 96*]	Not exposed [mother HIV negative]	29	30.2
	Exposed-Reactive	2	2.1
	Exposed -Non-reactive	52	54.2
	Exposed-status Unknown	13	13.5
	Totals	96	100
Exclusive breastfeeding [n = 121]	No	26	21.8
	Yes	95	78.2
	Totals	121	100
Breastfeeding of the child after delivery [n = 121]	Well	111	91.7
	Poorly	5	4.1
	Unable to breastfeed	4	3.4
	Don't know	1	0.8
	Totals	121	100
Chronic condition [n = 121]	No	118	97.5
	Yes	3	2.5
	Totals	121	100

Footnote: HIV testing results were available for 96 children, while 25 participants had incomplete or missing HIV records. "Not exposed" refers to children born to HIV-negative mothers. "Exposed – Status unknown" refers to children of HIV-positive mothers whose HIV test results were not documented.

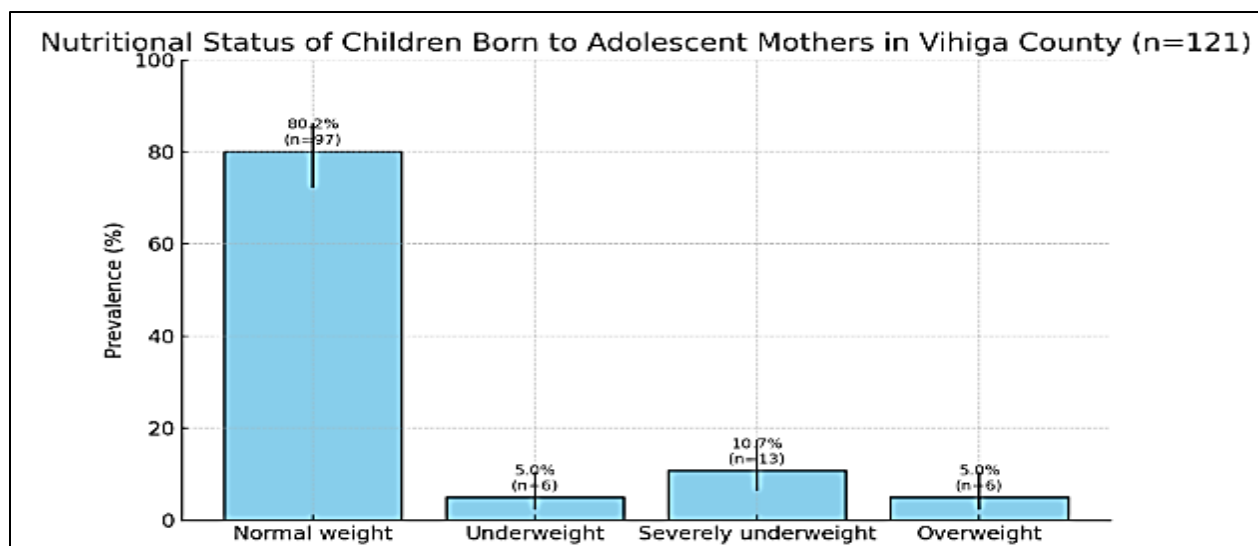


Figure 1:

Nutritional Status of the Children of Adolescent Mothers in Vihiga County



Child health outcomes

Figure 1 presents nutritional outcomes of children. The majority of the children [80%] had normal weight, indicating that most children had

a healthy weight for age. However, 4.7% were underweight while 10.6% were severely underweight, translating to 15.3% cases of undernutrition per the WHO guidelines. (Figure 1)

Table 3:

Bivariate and Multivariate Analyses for the Determinants of Health Outcomes of Children of Adolescent Mothers

Variable	Underweight child	Bivariate analysis	Multivariate analysis		
	No [N=91]	Yes [N=30]	OR [95% CI]	P-value	aOR [95% CI]
Marital status					
Married	22 [24.2]	10 [33.3]	1.57 [0.64–3.85]	0.326	—
Single [Ref]	69 [75.8]	20 [66.7]	Ref	—	Ref
Education level					
Primary	15 [16.5]	13 [43.3]	3.87 [1.56–9.63]	0.004	6.66 [2.02–21.96]
Secondary [Ref]	76 [83.5]	17 [56.7]	Ref	—	Ref
Religion					
Indigenous African Religion	14 [15.4]	7 [23.3]	1.65 [0.60–4.58]	0.335	—
Christian [Catholic] [Ref]	76 [83.5]	23 [76.7]	Ref	—	—
Muslim	1 [1.1]	0 [0.0]	—	—	—
Both parents alive					
No	18 [19.8]	12 [40.0]	2.70 [1.11–6.61]	0.029	2.32 [0.73–7.34]
Yes [Ref]	73 [80.2]	18 [60.0]	Ref	—	Ref
Number of ANC visits					
<4 visits	23 [25.8]	16 [53.3]	3.28 [1.39–7.75]	0.007	2.85 [0.91–8.94]
4+ visits [Ref]	66 [74.2]	14 [46.7]	Ref	—	Ref
Gestational age at 1st ANC visit					
≥16 weeks	56 [62.9]	27 [90.0]	7.47 [1.66–33.55]	0.009	6.69 [0.99–45.16]
Don't know	2 [2.3]	1 [3.3]	7.75 [0.47–126.7]	0.151	5.06 [0.14–187.2]
<16 weeks [Ref]	31 [34.8]	2 [6.7]	Ref	—	Ref
Preterm delivery					
Yes	3 [3.3]	7 [23.3]	8.72 [2.09–36.41]	0.003	17.6 [3.24–96.44]
No [Ref]	86 [94.5]	23 [76.7]	Ref	—	Ref
Received parenting support					
No	12 [13.2]	9 [30.0]	2.82 [1.05–7.59]	0.040	7.31 [1.89–28.38]
Yes [Ref]	79 [86.8]	21 [70.0]	Ref	—	Ref
Challenge in accessing healthcare					
Yes	12 [13.2]	10 [33.3]	3.29 [1.25–8.70]	0.016	4.86 [1.26–18.71]
No [Ref]	79 [86.8]	20 [66.7]	Ref	—	Ref
Model diagnostics	—	—	—	—	Pseudo R² = 0.4613 Hosmer– Lemeshow p = 0.48

Footnotes: OR = Odds Ratio; aOR = Adjusted Odds Ratio; CI = Confidence Interval; Ref = Reference category.

Underweight = Weight-for-Age Z-score < -2; Preterm = Gestational age at delivery < 37 weeks; ANC = Antenatal Care.

Variables significant at $p < 0.05$ in bivariate analysis were included in the multivariate logistic regression model.

Variable selection was based on backward elimination with theoretical justification.

Missing data [<5%] were handled using case-wise deletion. Some variables [religion, complications during delivery, primigravida status] were excluded from the final adjusted model due to lack of statistical significance or multicollinearity.

Determinants of health outcomes among children of adolescent mothers

In the bivariate analysis, mothers with a primary level of education showed a higher likelihood of having underweight children compared to those with secondary education. [OR = 3.87, 95% CI: 1.56–9.63, P-value = 0.004]. Moreover, the odds of children of adolescent mothers being underweight were also high [OR = 2.70, 95% CI: 1.11–6.61, P-value = 0.029] among orphaned participants compared to those who had both parents alive. Children whose mothers attended fewer than 4 antenatal care visits were significantly more likely to be underweight compared to those with 4 or more visits [OR = 3.28, 95% CI: 1.39–7.75, P-value = 0.007]. Likewise, mothers who started ANC at 16+ weeks were significantly more likely to have underweight children compared to those who started earlier [OR = 7.47, 95% CI: 1.66–33.55, P-value = 0.009]. Preterm delivery [OR = 8.72, 95% CI: 2.09–36.41, P-value = 0.003], lack of support on parenting skills [OR = 2.82, 95% CI: 1.05–7.59, P-value = 0.040] and challenges in accessing healthcare [OR = 3.29, 95% CI: 1.25–8.70, P-value = 0.016] were also found to be significantly associated to underweight.

After adjusting for other factors, level of education [aOR = 6.66, 95% CI: 2.02–21.96, P-value = 0.002], preterm delivery [aOR = 17.6, 95% CI: 3.24–96.44, p = 0.001], mother who did not receive support and guidance on parenting skills [aOR = 7.31, 95% CI: 1.89–28.38, P-value = 0.004], challenges in accessing health facilities [aOR = 4.86, 95% CI: 1.26–18.71, P-value = 0.021] were significantly associated to underweight. [Table 3]

Discussion

This study examined determinants of underweight among children of adolescent mothers in Vihiga County. The prevalence of undernutrition was 15.3%, with 4.7% underweight and 10.6% severely underweight. Although slightly lower than the 23% reported in

the Kenya Demographic and Health Survey 2022 [31], the burden remains considerable, particularly among vulnerable young mothers [31].

Preterm delivery emerged as a key predictor, with children born prematurely more likely to be underweight. This finding supports evidence from Kenya and Ethiopia showing that preterm infants face growth challenges due to immature organ development and higher infection risks [32]. Similarly, maternal education significantly influenced outcomes. Children of mothers with only primary education had higher odds of being underweight, consistent with studies from Nigeria and Tanzania, which highlight that education enhances nutritional knowledge and health-seeking practices.

The study also established that lack of parental support and guidance on childcare was strongly associated with child underweight. Adolescent mothers often face stigma, abandonment, or unstable relationships, reducing their capacity to provide adequate childcare. This concurs with a study done by Ngum Chi Watts, reported that family rejection and partner abandonment limit young mothers' access to financial and emotional support, thereby exacerbating adverse nutritional outcomes among their children. Comparable studies in Uganda and Ghana reported that limited family support compromises feeding practices and dietary diversity. Finally, inadequate access to healthcare services further contributed to underweight, with barriers such as poor accessibility, long distances to facilities, and the high cost of seeking care, echoing findings from rural Kenya and Malawi.

Study Limitations

This study faced limitations, including hospital-based sampling that may have excluded adolescent mothers not seeking care, a cross-sectional design restricting causal inference, and a modest sample size limiting statistical power. Nonetheless, the findings offer valuable insights into child nutrition among adolescent mothers



and call for broader longitudinal, community-based research.

Conclusion

The study identified underweight as a major health outcome among children of adolescent mothers. Significant determinants of underweight included maternal education level, preterm delivery, lack of parental support, and challenges accessing healthcare. Findings underscore the need for targeted interventions and policies to improve child and maternal health, considering their unique social, economic, and psychological challenges.

Recommendations

The study highlights the need for targeted interventions and policies integrating nutrition, education, and psychosocial support to address adolescent mothers' vulnerabilities and improve their children's immediate and long-term well-being.

Future comparative studies should examine outcomes between children of adolescent and older mothers, including mental wellness and socioeconomic influences.

Definitions of key terms

- **Adolescent mother:** A female aged 10–19 years who has given birth to a live child, regardless of marital status.
- **Underweight:** A nutritional condition in children defined as low weight-for-age [WAZ < -2 SD] according to WHO standards. It may reflect wasting, stunting, or both.
- **Determinants:** Social, economic, biological, and healthcare-related factors that influence whether a child of an adolescent mother becomes underweight.

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Appendix I:

Names and facility codes of Health facilities in Vihiga County Sampled and for the Study

No.	Names of sampled facilities in Vihiga County	Facility code	Facility level
1.	Kidinye Dispensary	26721	Level 2
2.	Musitinyi Dispensary	16052	Level 2
3.	Enzaro Health Centre	15879	Level 3
4.	Givigoi Dispensary	25285	Level 2
5.	Kimwenge Dispensary	28665	Level 2
6.	Emuhaya Sub County Referral Hospital	15876	Level 4
7.	Emusire Sub County Hospital	16979	Level 4
8.	Givudimbuli Health Centre	15889	Level 3
9.	Vihiga County Referral Hospital	16157	Level 4
10.	Emanaka Dispensary	26754	Level 2
11.	Serem Health Centre	15545	Level 3
12.	Bugamangi Dispensary	15814	Level 2
13.	Shamakhokho Dispensary	28667	Level 2
14.	Inavi Dispensary	20255	Level 2
15.	Kisiru Dispensary	25509	Level 2
16.	Epang'a Health Centre	29133	Level 3
17.	Ebusiratsi Health Centre	15866	Level 3
18.	Mbale Rural Health Training Centre	16012	Level 3
19.	Chanzaruka Dispensary	26753	Level 2
20.	Likindu Dispensary	15960	Level 2
21.	Lyanaginga Model Health Centre	15982	Level 3
22.	Mulundu Dispensary	24987	Level 2
23.	Givole Dispensary	17182	Level 2
24.	Kaptisi Dispensary	16457	Level 2
25.	Evojo Health Center	29614	Level 3