

Establishment of a New Level 4 Hospital Facility in Machakos County, Kenya

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INTRODUCTION

Access to medicine, according to the World Health Organization (WHO), is characterized by its availability in sufficient quantities, suitable dosage forms, and quality, all at a cost that is affordable for both individuals and communities. Furthermore, it encompasses the availability of essential medicines as a fundamental component of a health system.¹ In Sub-Saharan Africa, there are variabilities in the availability and accessibility of health facilities. Rural populations face obstacles in reaching high-quality healthcare institutions due to factors like geographical, political, environmental, and infrastructural challenges.^{1,2,5,6} In addition, service availability and service quality challenges due to shortages of equipment and staff are highly reported. This contributes to higher rates of morbidity and mortality in these rural regions.^{1,2} To obtain appropriate medical care, many rural populations need to travel long distances to access urban health centers, thus leading to overcrowding of these health facilities.^{5,6}

Like many rural areas, there are significant barriers to healthcare in rural Kenya. Yatta sub-county is one of eight constituencies within Machakos County, with a total population of approximately 1.1 million, made up of approximately 264,500 households and covering an area of about 2,397 mi² (6,208 km²) in central Kenya.³ Table 1 describes the healthcare facilities available in Kenya and their associated capacity. Machakos County is serviced by approximately 71 level 1 to level 4 facilities and 1 level 5 facility (Machakos town level 5 Hospital). Level 1 and level 2 healthcare facilities are outpatient-only facilities, operated by clinical officers, and offer basic screening services and treatment of common, low-acuity conditions. Level 3 and 4 facilities offer inpatient services, designed to be staffed with doctors and nurses and offer ancillary services such as radiology, laboratory, maternity, and have an operating theatre for treating common surgical emergencies. Level 5 facilities are

referral hospitals that offer advanced services and access to specialists, while level 6 facilities represent national referral hospitals usually affiliated with an academic institution.^{3,4} Although these facilities are present, they are not easily accessible to residents of Machakos County. This is especially the case for level 5 and level 6 facilities. For many of the residents in Machakos, the closest level 5 facility requires a two-hour travel time. In addition, the operational capacity of rural health facilities is often limited, and service disruptions are common, leaving the rural population without timely access to critical advanced healthcare services.^{4,7} One of the key challenges in accessing healthcare in rural Yatta Sub-County is the requirement for patients to purchase their own medical supplies before receiving treatment. At dispensaries, patients must often first buy essential materials such as gloves, syringes, and bandages before care is provided. This financial burden exacerbates existing barriers to healthcare access and underscores the urgent need for improved medical infrastructure.

The utilization of medical services is overwhelming at the limited healthcare facilities in Machakos and warrants increased support to existing facilities, as well as the creation of new ones.⁷ To mitigate this challenge, a new level 4 hospital facility is being built in Yatta Sub-County to service Yatta and other neighboring Machakos' rural constituencies. To adequately plan for infrastructure development, medical service provision, and ancillary services, an understanding of the population health needs, health priorities, and expected challenges is critical. The purpose of this study is to conduct a rapid health needs assessment survey of the population in Yatta sub-County to describe the health needs of the population for which this hospital is being built, and to identify health priorities and focus points for resource allocation.

Level (no. available in Machakos County)	Facility Type / Focus	Services Provided	Staffing	Accessibility Notes
Level 1 (42)	Community Level Facilities	- Community-based services - Health promotion and disease prevention - TB screening, home visits, contact tracing - Treatment of minor ailments (e.g., diarrhea) - Health education	Community health workers or clinical officers	Often in remote areas, limited resources and capacity
Level 2 (4)	Dispensaries / Primary Care Clinics	- Outpatient care - Basic maternity and emergency services - General primary healthcare	Nurses, clinical officers, and other healthcare professionals	More accessible than higher levels; still outpatient-focused
Level 3 (14)	Health Centers / Maternity Homes / Sub-District Hospitals	- Inpatient and outpatient care - Emergency services, maternity care - Basic surgeries and referrals to Level 4	Doctors and nurses (ideally)	Increasing availability, but still limited in rural areas
Level 4 (9)	Sub-County Hospitals / Primary Referral Hospitals	- Comprehensive care - Specialized services - Radiology, laboratory, maternity, operating theatre	Doctors, nurses, specialists	More advanced care; gaps in staffing or equipment are common in rural areas
Level 5 (2)	County Referral Hospitals	- Advanced specialized services - Serves as a referral center for Level 4	Specialist doctors and multidisciplinary teams	Limited number; often require long travel times (e.g., 2+ hours for many in Machakos)
Level 6 (0)	National Referral Hospitals	- Tertiary and highly specialized care - Teaching and academic hospitals	Highly specialized staff and academic faculty	Typically located in urban centers, inaccessible for many rural populations

Table 1. Kenyan healthcare facility levels.

METHODS

Study Type/Design

This observational, cross-sectional study is designed to inform stakeholder decisions regarding appropriate planning and resource utilization in anticipation of establishing a new level 4 healthcare facility in Yatta Sub-County. The study was designed with and approved by the Kenya-based study team (Mully Children's Family) and reviewed and approved by the Northeast Ohio Medical University institutional review board. The study was conducted in Yatta Sub-County in Machakos County, Kenya, using a door-to-door approach with local translators and our team. 17 households were interviewed and were selected by a convenience sample. A standardized questionnaire was used. Semi-structured household interviews were conducted in May of 2022, in 4 selected rural communities including Illumanthi, Kisiiki, Muusini, and Itangini. Participants provided

consent and individual assent for participation. Head-of-households were interviewed using both open-ended questions and yes/no categorized questions. The participants' answers were categorized into eleven categories (indexed themes), focusing on existing barriers to accessing healthcare, to elicit community perceptions of service delivery, and improvement priorities. These indexed themes include socio-economic information, mental health and drug abuse, travel to health care facilities, healthcare access to medication, maternal and child health, communicable diseases, non-communicable diseases, food and water security, disability, health insurance coverage, and healthcare services.

Study Team

The team consisted of medical students, an internal medicine resident physician, and a trained pediatric physician alongside a local health systems coordinator

and other community and local partners from Mully Children's Family.

Study Timeframe

The study design was conducted over several weeks during the month of May 2022.

Study Tools

We created a standardized household needs assessment tool based on previous similar studies conducted in low-resource environments.⁶ A semi-structured interview guide was used for in-depth qualitative individual conversations with families in the Yatta Sub-County and neighboring constituencies in Southern Kenya. In addition, we created a semi-structured interview and assessment guide for medical facilities in Yatta Sub-County to describe the operational status and health provider needs perception.

Survey Topics/Themes

The index themes include socio-economic information, mental health and drug abuse, travel to health care facility, healthcare access to medication, maternal and child health, communicable diseases, non-communicable diseases, food and water security, disability, health insurance coverage, and healthcare services.

Survey

Semi-structured household interviews in 4 selected rural communities (Illumanthi, Kisiiki, Muusini, and Itangini) in Yatta Sub-County, Machakos, Kenya, in May 2022. 17 households were chosen based on a convenience sample.

Selection of Household Criteria

Canvassing teams interviewed the heads of household of 17 families at their homes. Homes were chosen randomly in Illumanthi, Kisiiki, Muusini, and Itangini. Participants provided verbal consent and individual assent for study participation.

While 17 households participated in this study, some households declined to take part. Reasons for non-participation included time constraints, concerns about sharing personal health information, and general mistrust of research teams. No household was excluded based on predetermined criteria, and participation was entirely voluntary.

Data Reporting

Data reporting is descriptive and follows the qualitative study methodology of indexed themes, which group answers into common "themes". Findings were organized into eleven categories (Socio-economic information, maternal and child health, communicable and non-communicable diseases, mental health and drug

substance abuse, food and water security, disability, health insurance coverage, travel to healthcare facility, healthcare services, hindrance to healthcare access, and medications) according to a socio-economic framework to highlight the healthcare needs and accessibility barriers of residents of rural Yatta Sub-County of Machakos County.

RESULTS

Of the 17 surveys completed, all 17 were female heads of household. The majority of the women interviewed were between the ages of 36-39, making up 8 of the 17 families. Seven out of the 17 interviewed families were individuals aged over 60, constituting the remaining majority. The largest number of families interviewed came from Illumanthi at 9, followed by Kisiiki at 4, Itangini at 3, and Muusini at 1. All the women were in heterosexual marriages. A substantial proportion, 11 out of the 17, had an elementary level of education. None had a tertiary education. 3 of the 7 women interviewed had no education at all. The majority of the women had 6-10 family members in their household. Mean daily household income was 615 KES (\$5.10 USD) with a range of 0-5000 KES (\$0-\$41.49) with two skewed outliers. If outliers were removed, 144 KES (\$1.20) was the average mean daily household, with a range of 0-400 KES (\$0-3.32).

Of the 17 households interviewed, 7 stated that there was drug/substance abuse in the home, with alcohol, chewing khat, and tobacco cigarettes as the drugs of choice. 2 of the 17 stated there was mental illness (outside of depression). 2 of the 17 reported depression. 2 of the 17 reported violence/crime. For these ailments, 15 of the 17 households reported that they were not on treatment, and two reported that they were.

Of the 17 households surveyed, all households reported at least one case of illness, with a total of 39 reported ailments across these households. Among these, individuals in 6 households received treatment for a total of 16 ailments, with the majority seeking care at the nearest private facility.

Table 2 shows socio-economic information and results of the survey topics, in terms of the quantity (n) and percentage (%) of responses, that highlight the barriers to adequate healthcare in the 4 rural communities interviewed in Yatta Sub-County, Kenya. Table 3 highlights the top healthcare-related needs of the 4 rural communities in Yatta Sub-County by quantifying the responses from the survey.

Socio-Economic Information (Household Monthly Income)	Mean	Standard Deviation	Range	Comment(s)
Skewed (N=17)	615 KES (\$5.10)	10,223 KES (\$84.84)	0-5000 KES (\$0-\$41.49)	This estimate includes the 2 outlier household incomes that greatly skew the overall data, as indicated by the high standard deviation.
Non-skewed (N=15)	144 KES (\$1.20)	137 KES (\$1.14)	0-400 KES (\$0-\$3.32)	After elimination of the 2 extreme outlier incomes ranging from 3000-5000 KES. 7/17 households either had no income or were unsure of the amount.
Topic		Respondents (n)	Percentage (%)	Comment(s)
Maternal and Child Health		17		
	Pregnant	1	6%	Attended ANC
	Recent births	9	53%	8/9 (89%) of the births were in a public facility, with 1 in a private facility and none at home. 89% vaginal deliveries 11% cesarean deliveries 33% had postpartum complications Most (56%) babies had complementary feeding, followed by 33% that were breastfed exclusively
	Practice family planning	7	41%	43% used an implant 29% used hormonal pills 29% had an injection
	Households with children under 5 yrs.	13	76%	All children were fully immunized. 77% participated in growth monitoring Some reported challenges in accessing de-worming tablets and vitamin A supplementation.
Communicable Diseases		14 cases		Due to cultural sensitivity to some of the diseases, questions regarding HIV and STIs were often withheld. Malaria was among the most prevalent (29%), tied by Other (29%), and followed by typhoid (21%).
	Treatment received	5	36%	Most (4 or 80%) received treatment from a private facility.
Non-Communicable Diseases		25 cases		Arthritis was most prevalent (32%), followed by a tie between hypertension (HTN) (24%) and Other (24%). 16% reported having diabetes, and none reported any incidence of cancer.
	Treatment received	9	36%	Most (6/9 or 67%) received treatment from a private facility.
Mental Health		6 cases		There was a 3-way tie between mental illness (general), depression, and violence/crime, with 33% response for each. No suicidal attempt was reported.
	Treatment received	2	33%	1 from a private facility and another from both private and public facilities. 1 respondent reported praying/counseling, while another once sought treatment but stopped when no improvements were seen.
Drug and Substance Abuse		7 cases		Included alcohol, chewing khat, smoking cigarettes, and tobacco
	Treatment received	0	0%	Most did not answer or consider this topic to be worthy of treatment
Disability		11 cases		11 cases from 8 households of hearing (36%), physical (27%), visual (18%), speech (9%), and other (9%) disability. Causes of disability were usually either birth or accident. Visual impairments were mostly age-related. Most reported challenges to family members in caring for the disabled.
Food and Water Insecurity		17 households		Most households obtained their food from farms and markets (47%), while 24% solely relied on farm produce. 6% relied on the market and food reliefs.
	3 Meals per day	12	71%	18% had 2 meals per day, 6% had either only 1 meal per day or more than 3 meals per day

	Treated water	8	47%	3 (38%) boiled the water
	Latrines in compound	17	100%	Every household we visited had a roughly built latrine on their compound. 12% disposed of household waste in either latrine + farm or latrine + home waste pit. 41% disposed of household waste in home waste pits, while 29% disposed of the waste in farms.
Health Insurance Coverage		10 households	59%	50% of these households had NHIF 30% had other (usually M-TIBA) 20% had UHC 0% had private insurance
Availability of Transportation		8 households	47%	These households had access to either a moto or a bus, in addition to walking. The majority of the people (remaining 53%), however, only walked.
Access Barriers to Healthcare		17 households		
	Cost (in general)	9	53%	
	Transportation (cost, distance, lack of)	10	59%	Most have to walk long distances to get any type of healthcare service.
	Medication/Treatment (cost, availability)	12	71%	Some reported not seeking treatment due to the high out-of-pocket cost.
	Lack of services	3	18%	Such as maternity wards, laboratory equipment, emergency services, and access to specialty care.
	Long waiting times	1	6%	Some reported their trips being useless and a waste of money because the facility ran out of medications.

Table 2. Barriers to adequate healthcare in the 4 rural communities interviewed in Yatta Sub-County, Kenya.

DISCUSSION

Our findings highlight significant barriers to healthcare access in rural Yatta Sub-County, Machakos County, Kenya, reinforcing the urgent need for the establishment of a level 4 hospital to improve healthcare delivery. Several key themes emerged from the survey, including financial constraints, transportation difficulties, inadequate access to essential medications, and gaps in specialized care. Addressing these challenges will be critical in ensuring that the new facility meets the healthcare needs of the population it aims to serve.

We identified a significant burden of noncommunicable diseases (NCDs), particularly hypertension, arthritis, and diabetes. Despite their prevalence, only 36% of affected individuals received treatment, with a majority seeking care at private facilities. The limited access to affordable NCD management services highlights the importance of integrating chronic disease care into the new level 4 hospital's service offerings. Expanding preventive measures, routine screenings, and access to essential medications could significantly improve long-term health outcomes for the community. However, improving financial accessibility should also be made a priority.

The current cost of traveling to the nearest level 3 facility is approximately 800 Kenyan shillings (\$6.19), a significant expense given the average household income of 144 Kenyan shillings (\$1.11) per day. This cost disparity highlights the financial strain placed on families seeking healthcare and reinforces the need for affordable, accessible transportation solutions in the region.

Our studies showed that the cost of medication paired with the lack of affordable transportation are high priority areas for future improvement. Understanding this information will directly contribute to the development of the upcoming level 4 hospital. The findings from this study will assist in determining the necessary resources, ensuring optimal service for the community. For example, based on this survey, we know that access to medications is inequitable, and thus, more money can be allotted to this service. In addition, this study has helped to create a survey tool for assessment in other areas, like rural Kenya.

This study's strengths lie in its first-person data collection method, ensuring local relevance by interviewing the hospital that caters to the target population. Given the scarcity of published data, this

study is filling a crucial gap by providing this essential information.

However, our study has some limitations, including the issue of mistrust towards outsiders. Our team comprises of U.S. citizens who traveled to a foreign nation to study its population, potentially leading to skepticism and the possibility of altered responses from interviewees.

Addressing trust barriers through community engagement and local leadership involvement may improve participation in future studies. Additionally, the study is constrained by the relatively small number of households interviewed and the gender of the heads of household. We primarily interviewed female heads of household, which may limit the generalizability of our findings. While the convenience sampling method was necessary due to logistical constraints, future studies should aim for a more balanced gender representation to capture the perspectives of male heads of household as well. This would provide a more comprehensive understanding of household decision-making regarding healthcare access and utilization in rural Yatta Sub-County.

CONCLUSION

Several prominent themes concerning the challenges encountered by rural communities like Yatta Sub-County include expenses related to travel and a shortage of transportation services, the cost and availability of medications, insufficient medical supplies, such as laboratory equipment, in nearby healthcare facilities, and the unavailability of specialized services (such as emergency, obstetrical, and surgical services), which are only accessible in a level 5 facility approximately 2 hours away.

A notable obstacle observed is the absence of medications at the hospital facilities. Survey participants noted challenges in obtaining prescription medications even when they managed to reach the facilities. Respondents also reported a lack of other supplies at the

hospitals. Some individuals recalled moments when they reached a healthcare facility only to be asked to first go to a dispensary to buy supplies, such as gloves, syringes, needles, bandages, and even blood for transfusions, before any aid was provided.

Though issues regarding the cost and availability of medications/treatment services (71%) were the most prominent concern, transportation (59%), distance, cost, and/or lack of were also an issues that most of the households expressed concern over. The average daily income for the respondents was 144 Kenyan shillings, but the cost of transportation to the closest level 3 facility was 800 Kenyan shillings. Although barriers regarding healthcare and pharmacological services will be considered during the development of the new level 4 facility in Yatta Sub-County, our team has postulated some ideas to close the gap regarding the transportation inequality in terms of distance differences and accessibility/affordability of “motos” or other advanced transportation services. We suggest implementing a program to minimize or completely remove the cost of transportation. One possibility would be the provision of a free scheduled shuttle from different parts of Machakos County to the hospital. We also suggest exploring the inclusion of hospital runners on motorbikes for patients who may benefit from telehealth visits but may not have access to a phone or computer. These runners could be clinical officers who already go into the communities often, and can go to patients’ homes with a phone or iPad to provide access to a healthcare professional at the hospital. The hospital will also need to allocate resources toward providing Wi-Fi services for the local communities. It will also be crucial to provide education to Level 1 facilities on screening, essential medications, and services for managing NCDs. This approach will enable the newly established Level 4 hospital to focus on more complex, high-acuity cases, ensuring a more efficient and cost-effective use of funding, staff, and resources.

Topic		Quantity (n) - Total of 54 responses from 17 households	Percentage (%) - out of 54	Comment
Health Services Availability				
	Maternal and Child	5	9%	A total of 31% of responses were regarding the need to have access to
	Emergency Services, and Specialist Access	12	22%	
	Sufficient staff and equipment	15	28%	
	Sufficient and Affordable Medication	15	28%	
Health Insurance Coverage		1	2%	
Other		3	6%	• Telehealth • Water supply • Jobs for community youth at the hospital • Sell farm crops to the hospital

Table 2. Top healthcare-related needs in Yatta Sub-County.

During our efforts to understand and address the barriers to healthcare in one sub-county in rural Kenya, we have developed a tool for assessing community health needs of a community that could also be used to determine the prominent and presenting illnesses at local hospitals and barriers to healthcare access and utilization in similar communities. From our experience in working with a rural Kenyan community, certain questions on the survey may elicit untrue answers from respondents if viewed through the cultural lens of the community, and acknowledging how certain topics may provoke a negative reaction (such as the discussion of HIV). It is therefore important to pick and choose the appropriate questions for each ethnographic study.

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CONFLICTS OF INTEREST

All authors declare no conflicts of interest.