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EAHRC
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ORIGINAL ARTICLE

An Exploration of COVID-19 Management Policies across Nine African Countries

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ABSTRACT

Background: The Coronavirus disease 2019 (COVID-19) has registered more than 16 million cases and has been declared a global pandemic. Social distancing measures have been recommended as part of health policies aimed at reducing the transmission of the disease. These have resulted in adverse social and economic implications; many countries are therefore discussing exit strategies for the relaxation of COVID-19 restrictions.
Aim: To explore the COVID-19 management policies and their outcomes among 9 African countries in order to guide the upcoming and ongoing relaxation of containment and mitigation measures.
Methods: Daily COVID-19 statistics were obtained from the World Health Organization between12th March 2020 and 17th July 2020). Data on government policies was obtained from the Human Data Exchange Program between 20th January 2020 and 24th July 2020, a service operated by the United Nations Office for the Coordination of Humanitarian Affairs (OCHA). Data analysis was conducted using the Python (version 3) programming language modules: Pandas, NumPy, Matplotlib, Seaborn and SciPy.
Results: The most common containment and mitigation measures were under the categories of; health systems strengthening, enhanced detection measures, implementation of quarantine measures, movement restrictions and social distancing. Countries with low cases and low deaths prioritised social distancing and movement restriction policies, while countries with high cases and high deaths focused on quarantines, closures of public places and borders and public communication. High cases with low death areas implemented health systems strengthening, social distancing, detection and logistics/ security improvement. Low cases with high death countries focused on public communication and improved detection measures.
Conclusion: The current study found that social distancing measures remain an effective method of controlling COVID-19. However, coordination between government and organisations to develop social distancing protocols within businesses and specialist organisations such as the military, prisons, educational facilities and the transport industry was observed in countries with better control of the disease.

BACKGROUND

The Coronavirus disease 2019 (COVID-19) caused by the severe acute respiratory syndrome Coronavirus 2 (SARS-CoV2) emerged in Wuhan, China in the late 2019[1]. The disease has since been declared a global pandemic with more than 16million confirmed cases and 644,000 deaths globally[2]. Africa registered its first case of the disease in Egypt on the 14th of February, 2020[3]. It took 90 days for the continent to register 100,000 confirmed cases of COVID-19 (April-May, 2020), and the only 31 days to reach 300,000 confirmed cases (June 2020)[2].

COVID-19 is transmitted through respiratory droplets and contaminated surfaces with potential for airborne transmission. In the absence of effective pharmacological interventions for COVID-19, the World Health organization (WHO) and the Centres for Diseases Control and Prevention (CDC) recommended social distancing as part of collective measures to reduce disease transmission. This translated into management policies that revolved around movement restrictions, health systems strengthening and public communication across Africa, and globally.[4, 5]

COVID-19 management policies have resulted in unsustainable social and economic implications including job loss and economic downturns. In Africa, unique problems surround the protection of rural population, slum dwellers and people facing humanitarian crises. Furthermore, an effective treatment for the disease may not be available until later in 2020. This combination of factors indicating prolonged disease presence has led to discussions about relaxation of COVID-19 restrictions in many countries.[6, 7]

WHO has projected that up to 44 million cases could be confirmed and up to 190,000 people could die of COVID-19 in Africa[8] by the end of the first year of the pandemic. This prediction is based on the weaker health systems found in Africa and the large numbers of people who cannot access medical treatment. Due to this unique situation in African countries, it is imp-

ortant to assess the effectiveness of the current COVID-19 management policies to guide the relaxation of the restrictions currently in place.[8]

Aim of the Study

The current study aimed to explore the COVID-19 management policies and their outcomes among 9 African countries in order to guide the upcoming and ongoing relaxation of containment and mitigation measures.

METHODS

Daily records of COVID-19 data (number of confirmed cases and number of deaths) were obtained from the WHO website[2] (WHO, 2020 – 12th March 2020 to 17th July 2020). Data on government actions in developing countries was obtained from the Human Data Exchange program[9] (HDX, 2020 – last updated 24th July 2020), an online service provided by the United Nations Office for the Coordination of Humanitarian Affairs (OCHA). At the commencement of data analysis on the 24th July 2020, these databases which were aggregated by international organisations provided open access to COVID-19 statistics and control measures that were otherwise difficult to access.

The control measures recorded in the HDX dataset consisted of 12 categories; Decontamination of Physical Spaces, Detection, Economic and Social Measures, Government Coordination and Legal Authorisation, Logistics/ Supply Chains and Security, Movement Restrictions - At National Borders, Movement Restrictions - Within the Country, Public Communications and Education, Quarantines, Social Distancing - Closures, Social Distancing - Physical Distancing Between People, Strengthening the Healthcare System. Within these categories, there were a total of 101 specific measures to control the spread of COVID-19.

The study assessed the policies implemented in the 9 African countries listed below; Cote d'Ivoire, Ethiopia, Guinea, Kenya, Nigeria, Rwanda, Senegal, South Africa and Morocco.

Analysis was conducted using the Python (version 3) programming language modules; Pandas, NumPy, Matplotlib, Seaborn and SciPy. Ethical approval was not required since the analysis involved secondary data abstraction.

RESULTS

South Africa registered substantially higher numbers of COVID-19 cases compared to other African countries; this was followed by Nigeria and Morocco (Table 1). The general trend was that countries with a large number of cases registered a large number of deaths, exceptions were observed in Côte d'Ivoire, Kenya and Senegal. Côte d'Ivoire reported a low number of deaths in comparison to the total number of cases in the country, while Kenya and Senegal reported a high number of deaths relative to the total confirmed cases. (Table 1)

Case fatality rates (calculated as number of deaths/total number of cases) were highest in Nigeria, Kenya, Senegal and Ethiopia. Despite having a high number of cases, Morocco, South Africa and Côte d'Ivoire reported lower case fatality rates compared to other countries.
Cumulative frequency graphs were drawn for each country to assess the reduction of infection cases as shown in the figure below (Figure 1). No country appeared to be 'flattening the curve';however, there were clear differences in the rates of infection and the total number of cases. (Figure 1)

Overall, these data indicated that the 9 African countries could be categorised in 4 ways based on the total number of cases and the case fatality rate. The high death category was classified as a case fatality rate above 1.7, while high case load was defined as cases above 13,000 by 24 July 2020.

1) High Case - Low Death (HCLD): Côte d'Ivoire, Morocco, South Africa

2) High Case – High Death (HCHD): Nigeria

3) Low Case - High Death (LCHD): Kenya, Senegal, Ethiopia

4) Low Case – Low Death (LCLD): Guinea, Rwanda

The 9 countries implemented measures from the 12 categories of containment and mitigation measures for COVID-19 noted from the HDX dataset. The categories with the highest number of actions were:Health Systems Strengthening (13), Detection Measures (11), Quarantine Activities (11), Movement Restriction (12), Social Distancing and Logistics/ Supply Chain and Security Improvements (10). The countries with the largest numbers of cases implemented the largest number of actions against the 101 total measures to control the disease i.e. South Africa (75), Morocco (64) and Nigeria (60). Ethiopia implemented the least number of measures with 43. Some measures were implemented partially in some countries; Guinea (17), Ethiopia (16) and Nigeria (16) implemented the largest number of partial actions.

The figure (Figure 2) shows on average, the measures that were adopted by the categories of countries listed above.

Countries within the HCLD category focused on social distancing (physical distancing between people), improvement of detection systems, health systems strengthening, logistics and security enhancement. HCHD countries focused on social distancing closures, quarantines, movement restriction at borders and public communication/ education. LCHD countries appeared to have uneven distribution of actions with no focus on specific containment and mitigation measures. In general these countries responded by implementing government legislation, improving detection and engaging in public communication and education measures. LCLD countries focused on social distancing closures and physical distancing, movement restrictions at national borders and within the country.

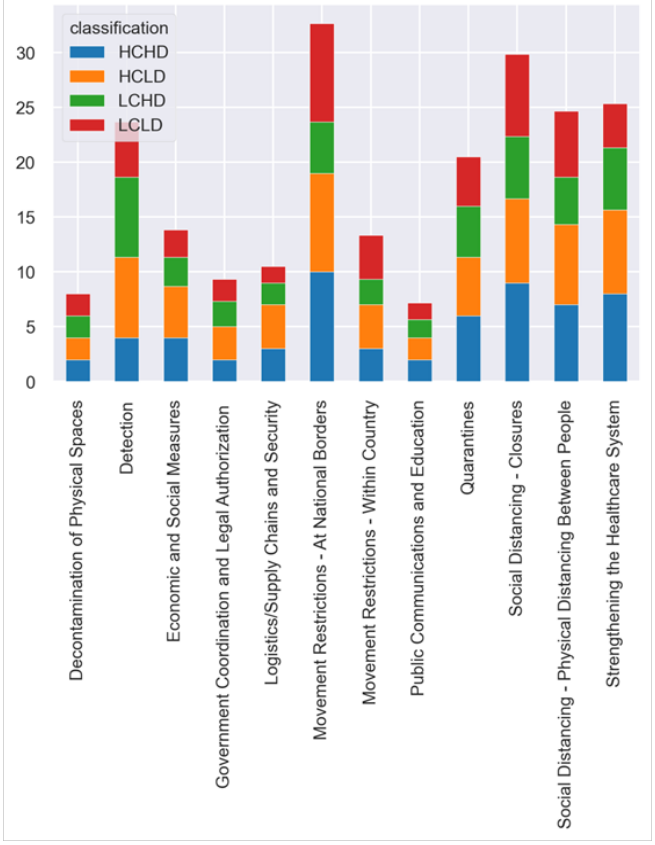
DISCUSSION

The COVID-19 pandemic has continued to spread globally and in the absence of effective pharmacological interventions. The containment and mitigation measures implemented to control the spread of the disease have resulted in adverse socioeconomic implications that are unsustainable in the long term for global economies[3]. Various exit strategies have been proposed[6], but Africa faces a unique situation where the healthcare systems are not robust and capacity is lacking to effectively manage-

COVID-19.[10,11,12]

Social distancing and movement restrictions within the country were associated with lower cases and lower deaths due to COVID-19. Movement restrictions imposed by HCLD and LCLD countries appeared to be stricter than in other countries, travel was only allowed for a range of reasons and surveillance of transport systems was enforced. HCLD and LCLD countries also developed special control measures for prisons and the military. It appeared that countries with improved capacity or organisation (e.g. South Africa and Rwanda) were better placed to enforce stricter measures while supporting both healthcare providers and the general public. This was evident in the implementation of economic and social control measures where these countries provided extended medical leave for COVID-19 patients, special payments and support for those made redundant due to the pandemic and partial coverage of wages for businesses that did not lay off workers[5, 10]. In these countries the requirement to stay home was implemented as an additional control measure; however, this could be difficult to sustain because many Africans rely on day-to-day business for sustenance.

FIGURE 2. Action Taken by the Categories of Countries



Health systems strengthening and improvement of healthcare logistics/ supply chains and security were linked to a reduction in case fatality rate. However, a similar trend was observed in more resourceful countries that were able to mobilise more workers faster. Countries with better control of COVID-19 were able to deploy the military to assist with various functions in the control of the disease. Temporary hospital and care facilities were built to manage increased patient numbers, there was increased recruitment of healthcare/ key workers and increased pay in some countries[9]. Overall, only countries such as South Africa and Rwanda implemented these measures consistently highlighting the inadequacy of resources. From a logistics perspective, countries with lower deaths due to COVID-19 reported coordinated planning between the government and supermarkets, pharmacies and providers of other essential services in order to ensure acquisition of these services/ products while conforming to social distancing regulations.

The immediate indication is that it may be possible to develop safe methods of relaxing COVID-19 restrictions in African countries. Although African countries would struggle to strengthen health systems, many of the measures implemented in HCLD and LCLD countries could be classified as social determinants of health (hygiene, social distancing, use of masks et cetera) which could be replicated at low cost in other countries. The results indicate that a combination of physical social distancing, the use of face masks and controlled movement within the country could potentially reduce the risk of a huge outbreak. Stricter measures such as allowing travel for a limited range of reasons and the coordination between government and providers of essential services may also be necessary. Other measures such as health systems strengthening, the improvement of healthcare supply chains and continuous public communication and education remain important even though the capacity to implement them may be low.[13, 14]

TABLE 2: Recommendation of Control Measures

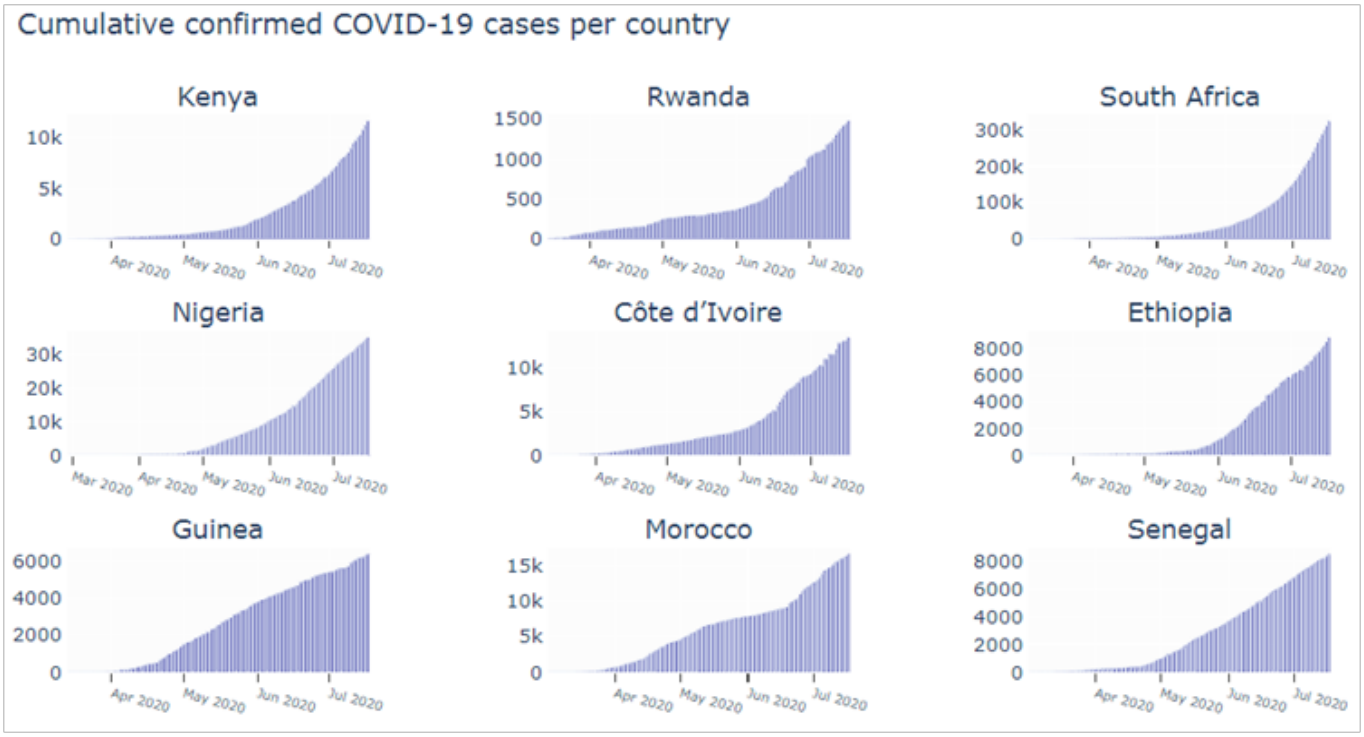
Physical social distancing in public areas and the use of masks
Restricting travel to a limited number of reasons
Coordination between government and common businesses to uphold control measures e.g. pharmacies, restaurants
Development of specific control measures for the military, prisons and educational facilities
Establishment of temporary health facilities to reduce overcrowding
Surveillance of covid-19 especially in urban areas to assess
Training of community health workers to ensure adherence to control measures at the local level

Two additional measures may be critical for the successful lifting of lockdown measures in Africa. Firstly, capacity for surveillance research should be increased in order to monitor the potential for a new wave of infections. This would thereby determine whether the relaxation of containment and mitigation measures was conducted in an optimal manner. The initial slow growth of cases and low mortality/ case fatality rate of COVID-19 in Africa have been attributed to reduced travel and exposure to China,

TABLE 1: Summary COVID-19 Statistics

Country	New cases	New deaths	Case fatility rate	Number of measures adopted
South Africa	324221	4669	1.44	75
Nigeria	34854	769	2.21	60
Morocco	16545	263	1.59	64
Cote d'Ivoire	13403	87	0.65	53
Kenya	11673	217	1.86	46
Ethiopia	8803	150	1.7	43
Senegal	8481	156	1.84	47
Guinea	6359	39	0.61	45
Rwanda	1473	4	0.27	54

FIGURE 1. Cumulative Frequency Graph by Country



climate and the presence of a younger demographic in the more populated urban centres among other reasons[15]. The younger population within urban communities in particular could mean that surveillance systems could be focused in urban settings allowing for reduced cost of implementation.

Secondly, equitable provision of healthcare is an important consideration in African countries. A majority of Africans live below the poverty line and rely on daily business activities in order to survive. These include rural populations, slum dwellers and people facing humanitarian crises[11, 15, 16]. It is therefore difficult for the African population to uphold closures and movement restriction measures[16, 17]. This could provide a potential explanation for the finding that Nigeria (HCHD) implemented closures, social distancing and health systems strengthening but maintained a High Case High Death profile. A ground roots approach involving trained community health workers may be necessary to evaluate medication access, and compliance with containment and mitigation measures especially in impoverished areas.

CONCLUSIONS

Based on these findings, the following recommendations are provided to lessen the possible negative effects of the-

lifting of lockdown rules (Table 2). These measures were adopted variably across the African countries studied but were more common in countries with good control of COVID-19. (Table 2)

However, direct enforcement of these measures through coordination between government and common businesses and organisations produced better control of the disease. This coordination involved development of specific protocols within businesses and specialist organisations such as the military, prisons, educational facilities and the transport industry.

Limitations

COVID-19 statistics are largely driven by the rate of testing within countries. In the absence of complete and detailed data including patient and disease it is difficult to make projections or to suggest specific control policies. Furthermore, with different policy-making and resource mobilisation capacities between countries it is difficult to judge the extent of implementation of the policies within the HDX dataset. These factors effectively hinder more comprehensive statistical analyses. Nevertheless, currently available data have to be used in order to guide decision making. The present study bypasses these challenges by adopting a simple exploratory or observation based methodology that does not require comprehensive data. The number and type of control measures adopted in each country in relation to the resulting cases of infections and deaths are used to provide a rationale for lifting disease control restrictions.

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ORIGINAL ARTICLE

HIV Community-Level Stigmatizing Attitudes in Tanzania: Perspectives from Antenatal Care

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ABSTRACT

Introduction: Stigma significantly impacts retention in HIV care and quality of life among people living with HIV. This study explored community-level HIV stigma from the perspective of patients and healthcare workers in antenatal care (ANC) in Moshi, Tanzania.

Methods: We conducted in-depth interviews with 32 women (20 living with HIV), key-informant interviews with 7 ANC clinic employees, and two focus group discussions with 13 community health workers.

Results: Themes emerged related to drivers and manifestations of stigma, resilience to stigmatizing attitudes, and opportunities to address stigma in ANC. Drivers of stigma included a fear of infection through social contact and associations of HIV with physical weakness (e.g., death, sickness) and immoral behaviour (e.g., sexual promiscuity). Manifestations included gossip, physical and social isolation, and changes in intimate relationships. At the same time, participants identified people who were resilient to stigmatizing attitudes, most notably individuals who worked in healthcare, family members with relevant life experiences, and some supportive male partners.

Conclusion/Recommendations: Supportive family members, partners, and healthcare workers can serve as role models for stigma-resilient behaviour through communication platforms and peer programs in ANC. Manifestations of HIV stigma show clear links to constructs of sexuality, gender, and masculinity, which may be particularly impactful during pregnancy care. The persistence of stigma emphasizes the need for innovation in addressing stigmatizing attitudes in the community. Campaigns and policies should go beyond dispelling myths about HIV transmission and immorality to innovate peer-led and couples-based stigma reduction programming in the ANC space.

BACKGROUND

Prevention of mother-to-child transmission (PMTCT) of HIV programs, which include HIV testing and counselling for all pregnant women at their first antenatal care (ANC) visit, are an important component of comprehensive HIV care. In 2012, the World Health Organization (WHO) recommended the global adoption of the Option B+ protocol, which indicates that all pregnant women living with HIV (WLHIV) should initiate antiretroviral (ARV) therapy at the start of ANC and continue for life.[1] Tanzania adopted Option B+ in 2013, and studies have demonstrated subsequent increases in the rates of HIV diagnosis and linkage to care.[2,3] However, a meta-analysis of studies in Africa showed that retention in PMTCT care is lower than in the general population of people living with HIV (PLWH), threatening the effectiveness of PMTCT programs and the goals of the Option B+ protocol.[4] Multiple studies conducted in East Africa have identified HIV stigma as a primary factor influencing retention in PMTCT care.[5–8]

In Tanzania, record reviews of PMTCT programs suggest that 19% of women enrolled in PMTCT did not return after their first visit, and by two years postpartum, 59% of patients were lost to follow up.[2] Similarly, in a longitudinal study following pregnant WLHIV in the Kilimanjaro region, 21% of participants were identified as having poor care engagement outcomes in PMTCT at six months postpartum.[5] Qualitative work in Tanzania suggests that HIV stigma is a significant contributor to poor care engagement in PMTCT.[9]

Stigma impacts retention to PMTCT in a variety of ways.[5] During pregnancy and the postpartum period, WLHIV in Tanzania describe feeling uniquely vulnerable to stigma, particularly in the form of fear of abandonment or mistreatment by their partner or the loss of other key social supports.[6,10,11] Pregnant WLHIV commonly note manifestations of stigmatizing attitudes in the community, including gossip, social avoidance of the woman and her children, anger and disapproval of family members, and a fear of abuse or abandonment by the father of the child.[8,12–14] These forms of HIV stigma are unique to pregnant women; therefore, the anticipation of stigma may have a strong impact on pregnant women's willingness to disclose their HIV status, in turn influencing social support for care engagement. PLWH who lack social support systems may miss clinic visits due to a fear of being seen at the clinic or due to an inability to explain a need to go to the clinic.[9] They may also miss medication doses if they are not able to discreetly take their medication.[9]

Community education and universal access to HIV services have had an impact on community stigma, but stigmatizing attitudes still persist and present a barrier to PMTCT care.[15] In order to better understand the experience of community stigma among WLHIV in the antenatal setting, we conducted qualitative interviews with a variety of stakeholders. We aimed not only to understand the dimensions of community-level stigma within this setting, but also to identify opportunities within the ANC setting to mitigate HIV stigma and its unique impact on pregnant and postpartum women. The objectives of this study were three-fold: 1) to explore the drivers and manifestations of HIV stigma, 2) to identify examples of resilience in coping with HIV stigma, and 3) to inform opportunities to address HIV stigma in the ANC setting.

This data can contribute important insights to inform strategies to reduce stigma within the ANC setting and improve HIV prevention and care outcomes among pregnant women, their male partners, and infants.

METHODS

Setting

This study was conducted in the Kilimanjaro region of northern Tanzania. In 2016, the HIV prevalence in this region among people aged15-49 was 1.1% among males and 3.1% among females.[16] In the Kilimanjaro Region, 52 health facilities offer PMTCT services,[17] following the national guidelines for provision of care.[18,19]

This study was conducted at two government health facilities in the Moshi Urban District of the Kilimanjaro Region. The two study clinics see the largest volume of clients in the region[20]; combined, they serve over 2500 pregnant women per year, with approximately 4.8% living with HIV.[21] Both facilities have ANC clinics that provide routine HIV testing and counselling for all pregnant women at their first ANC visit. Women are strongly encouraged to bring their male partners to the first visit, so that they can receive HIV testing and counselling together. Pregnant women and partners receive the test result the same day, and those who test positive for HIV receive additional post-test counselling, same-day handoff to the PMTCT clinic (or adult HIV clinic, for partners who test positive), and initiation of ARVmedication. PMTCT services include prescription of maternal ARV prophylaxis or treatment and counselling on infant feeding, as recommended by the Tanzanian Ministry responsible for-Health.[18] All HIV services are provided free of charge with support from the Tanzanian National AIDS Control Program.

Sample and Procedures

To understand the experiences of community stigma that may influence PMTCT, we interviewed a variety of stakeholders who were recruited from the ANC setting. Semi-structured in-depth interviews were conducted with 20 pregnant and postpartumWLHIV, 12 pregnant HIV-negative women, and 7 reproductive and child health care (RCH) registered nurses (HIV care nurses and PMTCT coordinators). Two focus group discussions (FGDs) were conducted with 13 community health workers (CHWs), who are clinic-based volunteers who offer education and support for people newly initiating HIV care. WLHIV were recruited from a larger cohort study of pregnant and postpartum WLHIV.[22] HIV-negative women were recruited from the ANC program at the study clinics, either by phone or in-person when presenting for a routine clinic visit. Healthcare workers and CHWs were recruited in-person at the clinic sites. All participants provided written informed consent prior to their interview. Interviews and FGDs were conducted in Kiswahili by a trained research assistant and duration ranged from 45 to 60 minutes. Interviews were recorded with the participant's consent, and audio files were transcribed and translated into English by research assistants and local translators. All identifying data were removed upon transcription.

Ethical Consideration

Informed consent was obtained from all individual participants prior to inclusion in the study. All study procedures were conducted in accordance with the ethical standards of the national and institutional research committees. The study received ethical approval from the Tanzanian National Institute for Medical Research (protocol #2183), the Kilimanjaro Christian Medical Centre (protocol #915), and the Duke University Institutional Review Boards (protocol # D0371).

Interview and Discussion Guides

The interview and discussion guides consisted of a series of open-ended questions reflecting the overarching research objectives, followed by a list of possible probes for further exploration. In the interviews, WLHIV were asked about their past experiences with stigma as well as fears they might have of experiencing stigma in the future. HIV-negative participants were asked to describe their feelings about HIV and how they thought people in their community perceived PLWH. Provider interviews and CHW FGDs explored experiences with providing HIV testing, counselling, and support, the role of stigma in patient decision-making related to uptake of and retention in PMTCT care, and patient experiences of stigma. All participants were also asked about suggestions for opportunities to address HIV stigma more generally, as well as within a hypothetical counselling intervention to be implemented within ANC.

Analysis

Data were analysed using applied thematic analysis, which is a rigorous and systematic approach to identifying empirically driven themes in qualitative data.[23] Initially, the first author read a small sample of interviews (n=6) to orient to the data. From this initial reading, four domains of enquiry emerged: drivers of stigmatizing attitudes, manifestations of stigmatizing attitudes, resilience to stigmatizing attitudes, and opportunities to address stigmatizing attitudes. A codebook was created, which defined each domain as a code. Initially, four interview transcripts were coded onto the four domains using QSR International's NVivo software (Version 12).[24] Each transcript was coded independently by two investigators, and the coded transcripts were compared and discussed to reach consensus on the code definitions and criteria for use. Thereafter, all transcripts were coded in NVivo using the four domain codes.

Additional coding was conducted in two phases. First, inductive themes were identified and applied to the domains using summarizing annotations in NVivo about each coded piece of text. Queries in NVivo retrieved the coded text and the related annotations in each domain. Based on the query output, we identified emerging themes in each domain. Second, child codes were established for emergent themes in each of the domains, and coding was conducted in NVivo to apply the child codes to the text. After the second-round coding, memos were written for each domain and separately for each population (WLHIV, HIV-negative women, and CHWs), in order to organize the emerging themes for comparison. Representative quotes were selected to best capture the data. The memos were reviewed across the participant groups, and themes were synthesized to elucidate commonalities and differences among groups.

RESULTS

The sample included 20 WLHIV (11 pregnant and 9 postpartum) and 12 HIV-negative pregnant women. Women were on average 29 years old (range: 20-40, with the WLHIV about five years older on average). Nearly all of the HIV-negative women were married, while WLHIV were more commonly unmarried but in a relationship. About half of the women were employed in a salaried position or receiving income through informal activities (e.g., selling vegetables or second-hand clothes). Thirteen (13) CHWs participated in the two FGDs. Additional demographic data can be found in Table 1. A summary of the four domains and emergent subthemes can be found in Table 2.

Drivers of stigmatizing attitudes

Fear of HIV infection

Fear of acquiring HIV infection through personal contact (e.g., sharing a spoon or a razor for shaving) was described as the primary driver of stigmatizing attitudes. As one participant described: *"They think you have left your infection there…Even the spoon they gave you – after finding that you have (HIV) infection, they will throw away that spoon (WLHIV, postpartum, 31 years old)."* These attitudes often extended to the children of WLHIV. A woman living with HIV recalled: *"People might think, 'I don't want your child to play with my child.' [The HIV-positive child] might bite [the HIV-negative child], and then she is infected (WLHIV, postpartum, 29 years old)."* Several participants mentioned that parents tell their children not to play with the children of people who were known or rumored to have HIV, and WLHIV frequently described that they did not want to disclose their HIV status due to concerns that their children would be stigmatized.

At the same time, individuals who associated with a person living with HIV could be labelled as having HIV themselves. A woman living with HIV stated that she was socially isolated by hercommunity simply because she had a friend who others thought had HIV. Even though this was before she herself was diagnosed with HIV, people assumed she had HIV by association:

> *"There was this man who was a friend of mine who died, but it was not because he was HIV-infected; after his death, they thought he was infected with HIV, but he was not. So, they assumed that because he was my friend, obviously I would be infected as well (WLHIV, postpartum, 39 years old)."*

Perception that HIV is associated with physical weakness

Another common driver of HIV stigma was the perception that HIV infection was associated with dependence on medication and/or physical weakness. Although participants acknowledged that HIV was treatable, some expressed that a fear of being dependent on medications led people to avoid HIV testing or HIV care: *"It's because you will not be able to live without medications. That is what worries them a lot (WLHIV, pregnant, 30 years old)."* This perception that PLWH are physically weak was cited as a driver of "othering"these individuals. HIV was also associated with being unattractive, undesirable, and physically frail, including looking sickly or thin:

> *"To them (the community), when they see someone has become thin, they don't even think that maybe they are stressed or depressed, or that the child hasn't gone to school or the child didn't pass the exams. They just say they are done; they have 'ngoma' (a pejorative word for HIV) (WLHIV, postpartum, 31 years old)."*

Perception that HIV is associated with immoral behaviour

Perceived immorality was also a driver of stigma. One woman living with HIV expressed the sentiment that people who were HIV-negative believed that they were superior to those living with HIV and looked down on those with HIV. She expressed the perception that HIV-negative people believed that PLWH were beneath them, and that they would never engage in such immoral behaviour that could put them at risk of contracting HIV: *"You have already been infected, so they talk about you because they (believe that they) cannot get it (WLHIV, postpartum, 29 years old)."* Additionally, some HIV-negative participants expressed that HIV was a punishment from God for immoral behaviour, and that living with HIV was almost worse than death: *"God has not loved them (PLWH) enough to take them (HIV-negative woman, pregnant, 23 years old)."*

HIV-negative participants often noted that communities associate HIV with sexual promiscuity. This stigmatizing attitude was described as common in faith communities, where people were often judged based on their morality. One HIV-negative woman stated that *"people believe that if one has HIV, they have been maybe prostitutes (HIV-negative woman, pregnant, 30 years old)."* Others expressed fear of being judged if they were diagnosed with HIV, because it could lead others to believe that their partner was unfaithful:

TABLE 1: Demographic Summary of in-Depth Interview Participants

	HIV-negative women (n=12)	Pregnant women living with HIV (n=10)	Postpartum women living with HIV (n=9)
Age, mean (range)	26(20-39)	31(24-40)	32(26-39)
Relationship status			
Married	11	5	4
Cohabitating/relationship but not married	1	4	4
Single	0	0	1
Widow	0	1	0
Education			
Form 4 (completion of secondary education)	5	3	2
Some secondary education	0	1	0
Standard 7 (completion of primary education)	5	6	6
Some primary education	0	0	1
Vocational school	1	0	0
Any employment	7	4	5

TABLE 2: Summary of Emergent Domains and Themes

Drivers	Fear of infection through social contact Associations of HIV with physical weakness Associations of HIV with immoral behaviour
Manifestations	Gossip Physical and social isolation Changes in intimate partner relationships
Resilient Individuals	Healthcare workers Supportive family members and partners Role of education in resilience
Opportunities	Education about HIV transmission Normalization of HIV as a chronic illness

"When I was told that I was to do an HIV test with my partner, who is [a long-distant truck driver], I said, 'Oh God, please help me.' If I have it, it will be an embarrassment, and everyone will talk about it (HIV-negative woman, pregnant, 24 years old)."

Manifestations of stigmatizing attitudes

Gossip

Gossip was the most commonly noted manifestation of stigmatizing attitudes in the community and was a primary reason that women with HIV did not want to disclose their HIV status to family members or the broader community. Many WLHIV discussed gossip in the form of being pointed at, laughed at, or talked about:

"They sit in groups and talk about you… they say that you have HIV… I am used to my neighbours – their conversations and types of things they say. I don't mind them anymore. I know that they are my enemies… (WLHIV, postpartum, 31 years old."

Another woman recalled community members pointing fingers at her in the context of their belief of her impending death due to HIV: *"They talk a lot, point fingers at you. They say he/she will die tomorrow… (WLHIV, postpartum, 25 years old)."*

In discussing the decision not to disclose one's HIV status, participants frequently spoke about women who chose not to disclose beyond a select few people (e.g., to extended family, neighbours, or workmates) for fear of their status spreading throughout the community via gossip. Several WLHIV identified specific people or groups who would not be able to keep their status a secret:

"I can't disclose to my workmates because I know when I disclose to one of them in the office, others will know… she will tell another person, and the other person will also tell others. At the end, all of them will know (WLHIV, postpartum, 26 years old)."

In some instances, there was a perception that people would gossip while drinking alcohol. One woman stated

that even if her father were alive, she would not disclose to him because of his drinking: *"I wouldn't have told [my father], because he was an alcoholic and if I disclosed, he could spread it (WLHIV, postpartum, 31 years old)."* Similarly, another woman statedthat she would not disclose to her siblings: *"My young ones and brothers, once you tell them and they are drunk, they can talk about you, or maybe they will tell their wives and their wives tell others (WLHIV, postpartum, 29 years old)."*

The decision to be selective with one's disclosure was often supported by healthcare workers: *"We don't advise you to share the information with everybody, because some people cannot keep secrets. You might share the news with one person and then she turns it into an announcement. You just look for someone whom you can trust with your secrets (Registered RCH Nurse)."*

Isolation

Both physical and social isolation were identified as manifestations of stigmatizing attitudes. Physical isolation included using separate dishes or eating separate food from someone with HIV, or not staying at the house of someone with HIV. Social isolation included the loss of friendships and ostracism by family and friends.

Women consistently gave examples of avoidance of physical contact by community members who knew the status of someone living with HIV. One woman living with HIV recalled a change in relationship with an HIV-negative friend, who refused to interact with her any longer after learning of her HIV-positive status: *"We were living very well. When she cooked, she would share with me. But now, even if I cook at my place, I can't give her food, because we would be sharing what we cooked (WLHIV, postpartum, 31 years old)."* One woman living with HIV described a relative who instructed her children to keep their belongings away from hers: *"She said to me that your sister restricts her children from coming to your house because you are sick, and tells them not to put their toothbrush next to yours (WLHIV, postpartum, 39 years old)."* One healthcare worker remarked that patients *"say that they are given special/separate dishes to use exclusively (Registered RCH nurse)."*

WLHIV also cited multiple examples of social isolation through loss of friendships and being ostracized by family and friends. One woman recalled a change in a close friendship: *"Her child was always coming to my room. Then, she told her child not to come interact with me… (now) she doesn't want any relationship with me….(WLHIV, postpartum, 31 years old)."* Another woman noted that relatives stopped visiting her after she was diagnosed with HIV:

> *"They were not telling me directly; they were telling their children. I was staying with my sister's child (15 years old) and they came to take her… They were telling her, 'don't go to sleep at your aunt's house; she will infect you because we think that she is sick...' (WILHIV, postpartum, 39 years old)"*

A small number of participants were afraid to disclose to their partners or others because they feared that they would lose care, support, or assistance in the pregnancy or postpartum period. One worker gave an example of a woman living with HIV: *"She's afraid that when she first shares it (her status), she won't get the care she used to… (people will think that) she is already dying (Registered RCH nurse)."*

Healthcare workers recalled two instances of women being kicked out of their houses because of their HIV status. In the case below, a healthcare worker describes how a woman living with her family was evicted.

> *"In the end, her family members found out (about her HIV status) … I am not sure if they saw the card or the medicine or what. They sent her away from the house, and she came here and asked for transport fare (to her home village) … There was a time that we were looking for her, but she never came back and we don't know how she is doing (Registered RCH nurse)."*

Relationship with Partner

Among healthcare workers, a commonly discussed manifestation of stigma was a change in a patient's relationship with her male partner. Healthcare workers noted that many female patients were fearful of disclosing their status to their male partners for fear of being stigmatized, ostracized, abused, or abandoned. Some shared examples of dissolutions of relationships that occurred once a male partner discovered his partner's HIV status. In some instances, males had tested negative (i.e., the results were discordant); in others, the men refused to get tested themselves. Healthcare workers felt that the anger and abandonment were driven by the perception that the first person to test positive for HIV was the one who *"brought the infection into the relationship,"* and that person was judged to be responsible for the infection.

WLHIV and HIV-negative women gave similar examples of relationship changes that occurred after the women were diagnosed with HIV; they described scenarios including women being abandoned by their partner after receiving an HIV diagnosis, male partners being unfaithful, or couples continuing to live together but the men isolating their partners.

Several healthcare workers noted that when women received the result of their HIV test at the clinic, some were adamant about not disclosing their status to their male partners out of fear that their partners would blame, stigmatize, or leave them:

> *"They are afraid that the men will leave them, so they tell you, 'Sister, if I tell this man, he will leave me, and the man is everything to me… so sister, you see? What do you think will happen if I tell him about it? (Registered RCH nurse)'"*

Nearly all interviewed healthcare workers brought up examples of women who disclosed their HIV status and were then left by their partner. One healthcare worker shared: *"We have discovered that most of the time, discordant results break marriages. Once they get to the gate, they part ways and each of them goes their separate way (Registered RCH nurse)."* Another worker describes the need for careful counselling in diagnosing discordant couples, saying that *"if wisdom is not applied, you could become the first nurse to break a marriage (Registered RCH nurse)."*

Several WLHIV discussed the impact that stigma by male partners had on their wellbeing, leaving them vulnerable during pregnancy and in the postpartum period. A woman recalled the lack of support she received from her partner upon disclosure: *"He left me at the hospital, and he didn't provide any support or pay the hospital bills. It was my mother who came to take me from the hospital (WLHIV, postpartum, 37 years old)."* A healthcare worker recalled a sim-

ilar abandonment by the man in a discordant couple:

"She brought him to the clinic, and they tested together. The man tested negative, and the woman was HIV-positive. They received their results well and the man said, 'there is no problem. I will be taking care of her.' He was really polite. But before the month was finished, he left her. The woman came to the clinic and said to me, 'Sister, if I had known this, I wouldn't have brought him to the clinic to be tested.' She said that she was no longer getting money for support and she didn't have any business that would give her an income. Can you imagine such situations as these? They are really painful (Registered RCH nurse)."

This healthcare worker also described a woman living with HIV being sent away from her home by her partner as a form of stigma:

"They arrived home, and the stigma started with the husband. The husband started to stigmatize her. He told her, 'I don't want to see you in my home anymore. Go to your parents' house.' To this day, I haven't seen that lady return to the clinic (Registered RCH nurse)."

Resilience to Stigma

Despite the common occurrence of harmful forms of HIV stigma, participants also identified individuals in their community who were resilient to stigmatizing attitudes; that is, individuals who were resistant to and did not perpetuate stigmatizing attitudes. These resilient individuals were typically those who worked in healthcare, family members who knew others living with HIV, and some supportive partners. Examples emerged of how community members developed resilience to stigma from HIV education.

Healthcare Workers

Healthcare workers commonly cited their responsibility as service providers as the reason they were role models for resilience to HIV stigma for their patients and community. One healthcare worker stated that she wanted to help patients fight and face stigma because it helped them properly take their medicine. There was a consensus among CHWs in an FGD that it made providers happy to see their clients living well, which drove their efforts to create a supportive and stigma-free environment for clients. Another participant said that her role as a CHW encouraged her to be resilient to HIV stigma in her own home:

"We do this job in the community, and the community begins in our houses, because this disease has touched the whole community. So, as you give service to the community, you'll find that you already started with your own family (CHW)."

Supportive Family Members and Male Partners

WLHIV cited examples of support they had received from trusted individuals in their lives, most often family members. One participant said that her sister provided emotional support and would help her financially, even though she lived in Kenya: *"When I have a problem, I call her. She asks how I am doing, and if I am taking medication. If I don't have money for milk, I ask her, and she provides (WLHIV, postpartum, 31 years old)."*

Several participants cited their mothers as a source of support. One participant, after being diagnosed with HIV, discovered that her husband had been previously married to someone who had died with HIV, but he had not disclosed his HIV status to her. This participant shared this information with her immediate family, disclosing her status as well. Her family was very protective of her, encouraging her to leave her husband and move in with them to seek HIV treatment:

"Before I started taking HIV medication, my mother was encouraging. She said, 'my daughter, don't worry. This has already happened but having the infection does not mean you will die. I will take you to the clinic and you will get counselling and medications. You will be fine, and the baby will be born without infection.' And she took me to the clinic (WLHIV, postpartum, 25 years old)."

A few healthcare workers also shared anecdotes of supportive male partners. One healthcare worker shared, *"The husband did not have the infection (HIV), but he said that he was ready to cope.… he said, 'I vowed to be with her for better or for worse.…I will take care of her until the end.' (Registered RCH nurse)"*

Role of Health Education in Resilience

Among HIV-negative participants, a common theme emerged that knowledge about HIV transmission was a key reason they did not perpetuate stigma in the community. In response to a question about how education helped her learn not to stigmatize others with HIV, one respondent remarked:

"When I see someone whom others point at because of HIV, I would like to talk to her, so she won't feel lonely. I will just tell her that is a normal situation, and make sure you do this and that… HIV-negative woman, pregnant, 32 years old"

One CHW gave an example of a husband who isolated his wife when he first learned of her HIV status, but then learned to overcome his own stigmatizing attitudes by learning about HIV: *"(Initially) the husband took another room in the same house, so the man was sleeping in his own room while the wife slept in her own room with the baby. It was as if they were separated (CHW)."* However, after the husband met with the CHW, he came to see that he should not *"judge his wife"* and instead should *"get education on how to live in love even more than before."*

Opportunities to Mitigate Stigmatizing Attitudes

Participants were asked to share their ideas about strategies for addressing HIV stigma in ANC. The most common suggestions included normalizing HIV, improving counselling after delivering HIV test results, providing community-wide education on HIV transmission, and sharing examples of community role models who portrayed resilience to HIV stigma.

HIV Normalization

Across all interviews, healthcare workers mentioned the value of normalizing HIV, emphasizing that HIV is like other chronic diseases – such as diabetes and hypertension – that require lifestyle modification and daily medication. Healthcare workers believed this concept was important as it would help detach the associations of death and stigma from HIV. One healthcare worker described what she would tell any patient about HIV:

"I would tell you it's like any other normal illness, and that HIV doesn't kill, it's the opportunistic infections which kill. I will give you an example of the diabetic patients who take

pills every day – HIV patients think that they are the only patients who take pills every day, but there are diabetic and hypertensive patients who take their medications every day (Registered RCH nurse)."

Furthermore, an HIV-negative woman suggested to emphasize that people who test negative for HIV are *"not different from those who are infected."* More participants stated that interventions to address HIV stigma should speak to human empathy: *"Above all, we should have that feeling of being human, and care for those who are found to be HIV-positive so even if they meet the infected person, they should be able to consider their situation as a normal one (WLHIV, postpartum, 29 years old)."*

A woman living with HIV also stated that it is important for people to recognize that anyone can contract HIV, and people who do not have HIV should recognize their own vulnerability: *"They should just understand it is a normal infection like any other, and it might happen to anyone, even their relatives (WLHIV, postpartum, 37 years old)."*

Health Education

WLHIV consistently suggested health education as a method to mitigate HIV stigma, particularly combating misinformed fears relating to the transmission of HIV: *"They should know that HIV transmission occurs through using sharps things, and through unprotected sex, so they should not fear that they will be infected by an HIV-positive person just by sitting with them (WLHIV, postpartum, 25 years old)."* Some HIV-negative women also gave testaments to how receiving health education and information about HIV helped them not stigmatize others.

Healthcare providers recognised the role of counselling to address HIV stigma, particularly in the context of HIV testing; however, interviews documented inconsistency in the content of counselling during HIV testing in the study clinics. Some clients received information on how to prevent future transmission of HIV, but most HIV-negative women responded that they did not receive any counselling or information after they received their test result. One CHW suggested that education should be provided regardless of whether someone tests positive or negative, *"so that everybody will understand well what causes the infection."* This CHW also emphasized that efforts were needed to reach those who cannot access education via media or newspaper:

"If we were empowered and able to reach all the people and be giving out the education... at least what we know, it would help. But how do we reach all these people to tell them what they need to know? That is a little difficult (CHW)."

A CHW suggested that CHWs could bring education to households, going door-to-door, disseminating information about how HIV is transmitted, encouraging people to get tested for HIV, and explaining that people should not stigmatize others living with HIV. The CHWs said that one household can often have 6-7 rooms and many people, making it possible to share information with large numbers of people in just one visit.

Finally, across all populations, participants suggested that as part of HIV education, people should be presented with examples of behaviours of others who do not stigmatize people with HIV. For example, one HIV-negative women suggested that people *"should see a picture of someone eating food with another one who is infected (HIV-negative woman, pregnant, 28 years old)."*

DISCUSSION

Stigma has a clear impact on HIV care and engagement and takes an emotional toll on PLWH.[25,26] The various forms of stigma experienced by PLWH emanate from community-level stigmatizing attitudes, making these attitudes important to study. In this study, perceived drivers of stigma most commonly included a fear of HIV infection through casual contact, and damaging associations of HIV with sexual promiscuity, death, and poor personal choices or moral weakness. These drivers suggest that stigma is not only connected to judgments of the disease as dangerous, but also negative judgments about the behaviours of PLWH. Manifestations of stigma most commonly included gossip, social isolation, and changes in relationships with male partners. These forms of enacted stigma clearly link to barriers to care engagement for PLWH, particularly for pregnant women who need both HIV care and attentive antenatal and postpartum care.

Our study found that stigma was cited as a strong reason that WLHIV felt they could not disclose their HIV status to family members or male partners. It is well documented that non-disclosure impacts care engagement: PLWH who have not disclosed their status to someone are at risk of missing clinic visits (if they are unable to explain the visit to family or an employer) and missing medication doses (if they are unable to discreetly take pills and get to the clinic for refills).[14,27] However, pregnant WLHIV face additional barriers to care. Because of inequities in socioeconomic power in relationships with male partners, women may struggle to find transportation fare to reach a clinic, even if they have an independent source of income. For pregnant women with other children at home, they may experience challenges in securing childcare while they go to the clinic, and those who have not disclosed their status may struggle to explain their absence from the home.[27–29]

Many participants noted that male partners often perpetrated stigma against HIV-positive female partners, mainly by withholding financial support. This may be particularly true in contexts where gender inequity is high and traditional gender roles of the "male as provider" can be detrimental to women's wellbeing.[30] As discussed by healthcare workers, women whose partners exile them are often lost to care, as they move to a different place to live with family, and often are not able to continue receiving care at their original clinic, if at all. Providers should therefore be more attuned to the vulnerabilities of pregnant WLHIV and help these women plan for transfer of care, in case an interruption may happen due to enacted stigma.

At the same time, examples of resilience to stigma emerged in the form of some supportive male partners and family members, which confirms that stigma from partners is not inevitable. Looking to future interventions, reducing stigma among male partners is crucial to building support for care engagement and emotional wellbeing.[9,21,26] There is a critical need to develop efficacious interventions to address HIV stigmatizing attitudes in the general population, in order to create a supportive

social environment for people seeking HIV care.[5] A systematic review and meta-analysis of the effectiveness of HIV stigma reduction interventions found that most interventions (which were education-based or included peer-led approaches) led to only small improvements in HIV-related knowledge and small reductions in negative attitudes towards PLWH.[15] None of the studies were specific to the impact of stigma or anticipation of stigma during the pregnancy period. Furthermore, because the manifestations of stigma we found are consistent with previous documentations of stigma, interventions addressing HIV stigmatizing attitudes should go beyond educational content. Interventions can utilize stigma-resilient individuals as peer facilitators and role models, particularly to encourage male partners to test for HIV and support their pregnant partners to initiate ANC and if they test positive, to initiate PMTCT.

Given universal HIV testing during first ANC, there is an opportunity to address HIV stigmatizing attitudes in the ANC infrastructure. Participants reported inconsistencies in HIV pre-test and post-test counselling and health education, with some saying that they received minimal pre-test information on HIV prevention or the implications of a positive test. Similar inconsistences have been noted in post-test counselling among those who test positive, with missed opportunities for education about pregnancy and HIV.[31,32] A discussion of HIV stigma and HIV normalisation could be incorporated into pre-test and post-test counselling to address both personal and community-level stigma. This gap in ANC standard of care represents an opportune place to disseminate information relating to HIV transmission and HIV stigma. ANC also provides an opportunity to provide counselling to serodiscordant couples, in order to help them understand and accept each other's HIV status and to develop strategies to support one another.

To address drivers of stigmatising attitudes, education that dispels myths about HIV transmission should continue to be improved upon and disseminated. Individuals in our sample suggested that HIV stigma could be addressed through health education and added that such education should normalize HIV as a treatable chronic illness like diabetes or hypertension. This educational programming could also include information about HIV transmission that rectifies myths about promiscuity and poor lifestyle choices, as a large driver of stigmatizing attitudes was the association of HIV with moral weakness.

These recommendations were mentioned consistently across all participant groups, suggesting that this messaging could be effective in addressing stigmatising attitudes in the community and also help relieve internalized stigma for PLWH. Educational campaigns and public messaging around HIV that go beyond providing information about HIV transmission are needed to address the drivers of stigma related to the damaging associations of HIV with sexual promiscuity, immorality, physical weakness, and death. Interventions and public messaging that foreground the humanity of PLWH and normalise HIV can help people build empathy and advocacy for PLWH, in turn creating supportive environments for PLWH in the community and in healthcare settings.[21]

Some participants suggested that people might benefit from seeing examples of stigma-resilient individuals in the community, such as an HIV-negative person eating with a person living with HIV. Such role models could help reduce community stigmatising attitudes through peer groups at ANC or through public campaigns and could help show that PLWH are not less human than HIV-negative people. Emergent themes of resiliency, in the form of supportive male partners and family members, showed that the most impactful way to address someone's stigmatizing attitudes could be by addressing attitudes in their innermost circle. This would include incorporating HIV stigma reduction information into couples' HIV testing and counselling, addressing the prevalent changes in relationships that women documented throughout this study, and helping seronegative partners build empathy for seropositive partners. Further, group counselling that includes both PLWH and HIV-negative individuals could be effective in challenging stigmatising attitudes and potentially reducing stigma while improving social support and care engagement for PLWH.[29,33,34]

Limitations

Although this study used a comprehensive interview guide and interviewed a variety of stakeholders in ANC (WLHIV, HIV-negative women, and healthcare workers) to capture nuances of HIV stigma at the community level, the following limitations should be considered. We did not interview male partners, so we were not able to capture men's perspectives on HIV stigma, which might have proven useful for understanding HIV stigma, especially at the level of the family unit. Participants may have altered their responses due to social desirability bias, such as hiding their own stigmatizing attitudes related to PLWH. Data were collected at two clinic sites in a single region of Tanzania and should be generalized with caution.

CONCLUSION

HIV stigmatizing attitudes create barriers to a woman's ability to fully engage in PMTCT care. Manifestations of stigma such as gossip and loss of support from family and partners can leave pregnant WLHIV particularly vulnerable to challenges in care engagement. Ongoing work to increase community-wide HIV education that normalizes HIV as a chronic disease and challenges drivers of HIV stigma rooted in myths regarding HIV transmission and immorality should continue in order to reduce community-wide stigmatizing attitudes. HIV stigma should continue to be prioritized in a comprehensive response to HIV prevention and treatment, and the ANC environment, which is a site of routine HIV testing, should be seen for its potential to address HIV stigma. Pre-test counselling in ANC clinics should include specific content that addresses HIV stigma, taking advantage of the heightened emotions of an HIV test to build empathy for PLWH. Post-test counselling should reinforce stigma reduction messages for individuals who test negative and should explicitly address both internalized and anticipated stigma for individuals who test positive for HIV, especially those in discordant relationships. Providers should be keenly attuned to the social support resources that pregnant WLHIV have at their disposal. Providers should be trained to identify women with low social support networks and make referrals to other care facilities to prevent disruption of PMTCT care as needed.In addition to such policy, interve-

ntions and infrastructure should be built to incorporate peer-led stigma-specific programming into ANC, as examples of healthcare workers, family, and intimate partners who demonstrate and propagate resilience to stigmatizing attitudes in the community exist and could serve as role models to reduce stigmatizing attitudes.

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ORIGINAL ARTICLE

What motivates or demotivates injecting drug users to participate in hypothetical HIV vaccine efficacy trials? A qualitative study from urban Tanzania

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ABSTRACT

Background: HIV vaccine efficacy trials require the active participation of volunteers who are committed and adherent to the study protocol. However, information about the influence of Injecting Drug Users (IDUs) to participate in HIV vaccine efficacy trials in low-income countries is inadequate. The present study explored the factors that motivate or hinder IDUs from participating in HIV vaccine efficacy trials in Dar es Salaam, Tanzania.

Methods: A qualitative descriptive study design was employed among IDUs at Muhimbili National Hospital (MNH). A purposeful sampling technique was used to recruit the participants. Three (3) focus group discussions (FGDs) and 10 In-Depth Interviews (IDIs) were used to collect the data. The data from participants were audio-recorded, transcribed, and analysed using the content analysis approach.

Findings: The participants reported that altruism and the desire to reduce risks of HIV infection were the motivators to participate in hypothetical HIV vaccine trials. In addition, participants reported to consult close relatives towards motivation to participate in the vaccine trial. In contrast, the perceived fear of vaccine side effects, lack of information about HIV vaccine studies, and HIV-related stigma towards participants were described as barriers to participate in the HIV vaccine trials.

Conclusion: Participation in a hypothetical HIV vaccine trial among IDUs is influenced by positive and negative factors. Actual recruitment plans could be made through a better explanation of HIV vaccine trials, the expected individual and collective benefits associated with the trials. Community involvement and sensitisation is likely to enhance participation in future HIV vaccine trials in Tanzania.

BACKGROUND

Since the beginning of the epidemic, injecting drug behaviours are the key facilitators of HIV transmission[1]. In 2017, 15.6 million Injecting Drug Users (IDUs) aged 15to 64 years were identified worldwide, of whom 17.8% were living with HIV[2]. A substantial geographic variation in the prevalence of HIV infection across all countries has been noted. The number of IDUs in South-East Asia and East Asia has increased[3]. Evidence shows an increase in injection drug use and associated HIV infections in Sub-Saharan Africa, the region with the highest global HIV prevalence[4,5].

Although the overall HIV prevalence in Tanzania has decreased from 5.1% in 2012 to 4.7% in 2016[6], the prevalence of HIV among IDUs is still high at 42%.[7] Factors associated with an increase in HIV infection among IDUs include age, sharing of syringe and needles, low level of education, and history of drug overdose.[8–10] Various harm reduction programs such as methadone assisted treatments have been developed as one of the strategies for combating HIV infection among IDUs.[11,12] Additionally, the development/ deployment of an Integrated Methadone and Antiretroviral Therapy (IMAT) have shown to be effective in decreasing HIV prevalence among IDUs in Tanzania.[13] However, a multi-lateral approach including behavioural interventions, Treatment as p-

revention (TasP), pre-exposure prophylaxis, and vaccines is more likely to lead to effective infection control than deployment of a single approach.[14–16]

The efforts dedicated to discovering an HIV vaccine have a long history since HIV was first described in the early 1980s. The potential to slow the HIV epidemic and save lives fuels the development of an effective vaccine.[17] Clinical trials require the active participation of volunteers who are committed and adhere to the study protocols. Vaccine efficacy trials take years to monitor the effectiveness and side effects of any new vaccine. The process is more challenging for HIV vaccine efficacy trials because it involves socio-behavioural issues that affect the volunteers' participation.[18,19]

The successful development and implementation of a safe and efficacious vaccine greatly depend on the extent to which the at-risk populations are motivated to participate in HIV vaccine research.

Studies in high-income countries report financial reimbursement, reduction of risk behaviours, and support from researchers as the motivating factors among men who have sex with men (MSM) and female sex workers (FSW).[20–22] However, the social pressure of significant others, perceived lack of vaccine safety, and logistical concerns have also been identified as barriers to actual participation in the trials.[23] Also, misconceptions about HIV vaccine trials, personal and social risks, and costs are reported to hinder participation in hypothetical HIV vaccine trials in many high-income countries.[24] However, there is a paucity of information about motivations and barriers for participating in HIV vaccine trials among injecting drug users in low-income countries.

A recent study in Kenya reported a desire to receive healthcare and information about HIV were the motivating factors to participate in an HIV vaccine trial among MSM and FSW[25]. Furthermore, a review of the literature reported that retention and sexual disinhibition were the main socio-behavioural challenges for HIV vaccine efficacy trials in Sub-Saharan Africa.[26] However, none of these studies reported motivations and barriers to participating in HIV vaccine trials among IDUs in low-income countries. Thus, this study describes the reasons behind the willingness of IDUs to participate in the HIV vaccine trials and provides recommendations for future studies.

MATERIALS AND METHODS

Design

A qualitative descriptive study design was employed. We applied this approach to better understand the fundamental motives influencing participation in HIV vaccine trials among IDUs. This design was also used to raise awareness and increase insight into the best ways of conducting HIV vaccine trials in the study population.[27] In addition, the approach allowed interaction between the authors and the participants which increased trust among each other.

Setting

The study was conducted at the Methadone Clinic in Muhimbili National Hospital (MNH), Dar es Salaam. The site is 1 of the 3 Medication-Assisted Treatment clinics (MAT) for IDUs who are trying to stop the use of heroin in the region. The MAT clinic at MNH was the second to be opened in Sub-Saharan Africa after Mauritius[28].

The clinic is well staffed throughout the year to accommodate IDUs to come to the clinic daily to receive a Directly Observed Dose (DOT) of liquid methadone. The maximum duration of treatment to recovery for most IDUs was 5 years, although some finished treatment in 3 years, depending on medication adherence and effective use of counselling services. The authors were not part of the MAT clinic staff and had no affiliation with the hospital where the participants were receiving treatment services.

Population and Participants

This study was based on a high-risk population attending the MAT clinic. We selected the IDUs for their relatively high risk of HIV infection compared to other key populations in Tanzania.[29] The risk of IDUs was largely due to a history of needle and syringe sharing practices and that was suitable for the HIV vaccine efficacy trial.

Inclusion and Exclusion Criteria

The study included participants who were injecting drugs, physically and mentally stable, aged 18 and above, and HIV negative. Both males and females were included. IDUs who were physically and mentally unstable and those that could not communicate appropriately were excluded.

Sampling Procedure

We used purposive sampling to recruit the participants as proposed by Palinkas et al.[30] The decision to use this sampling technique was based on information-rich participants who could be willing to share their concepts and views about HIV vaccine studies. This sampling technique allowed the authors to obtain adequate information related to the phenomena of interest. A trained research assistant selected the participants from the MAT clinic.

Sample Size

The sample size was determined using the principles of saturation. That is, we terminated sampling when no new information was obtained as proposed by Hennink et al.[31]

Data Collection

Briefing Sessions

Before the commencement of data collection, we provided a brief overview of HIV vaccine efficacy trials to the participants, including the nature of vaccine material, how it would be administered, what to expect if the participant is enrolled in the study, and the issues related to vaccine-induced seropositivity and how it could be handled. This information promoted awareness of HIV vaccine efficacy trials, since some participants had never heard about these trials before.

Focus Group Discussions (FGDs)

FGDs were used as the main data collection method. We first conducted FGDs to identify the main recurrent ideas. This method provided an opportunity to interact with the participants and explore their understanding of HIV vacc-

ine trials. The group discussions were conducted immediately after the participants had taken their daily methadone doses to ensure maximum cooperation. The group size ranged between 6 and 8 participants.

We used homogeneous FGDs in the sense that male and female groups were conducted separately (2 groups and 1 group of males and females respectively). This approach allowed the free expression of ideas and views among the participants. A discussion guide was used to collect the data. The questions in the guide comprised of core questions from previous studies.[32–34] which were improved further through pilot testing.[35] The questions elicited the general views about the risk of HIV infection, the level of motivation to adhere to treatment protocols, and any perceived barriers toward HIV vaccine trials.

The following questions were asked during the group discussion:

1. What are your views on the risk of HIV infection due to injecting drugs?
2. What are your views if you are asked to participate in HIV vaccine efficacy trials?
3. What would motivate you to participate in an HIV vaccine efficacy trial?
4. How would the people you live with influence your decision to participate in HIV vaccine efficacy trials?
5. What would hinder you from participating in HIV vaccine trials?

These were followed by specific probing questions to obtain additional information or clarification. The first and second authors reviewed the discussion guide after the first FGD to include more emerging themes. The FGDs lasted between 45 and 60 minutes. During the group discussion, the first author moderated the discussion while a research assistant took notes and controlled the external environment. Data saturation was reached when no new information was obtained after a new group was added as guided by Hennink et al[31] resulting in 3 focus group discussions.

In-Depth Interviews (IDIs)

To complement the data from FGDs, we conducted IDIs with IDUs who participated and who did not participate in the FGDs. The individual interviews were conducted in a quiet, well-lit room in the hospital premises away from the MAT Clinic. This was important to ensure safety and maximum cooperation from the participant as well as to making the environment natural.[36]

The IDIs elicited more descriptive information on HIV vaccine trial participation. The first author conducted all interviews. The IDIs used the same questions that were applied in the FGDs. However, some specific probing questions were geared towards individual participants such as: How would your schedule fit in with a proposed HIV vaccine trial? What are your views on the availability of an effective preventive HIV vaccine? After the 10th IDI, we reached information saturation. Of these 10 interviews, 4 participants (3 males and 1 female) had participated in FGDs. These participants were invited to take part in the IDIs because during FGDs, the first author observed that they were hesitant to share their views; however, they appeared to have some ideas. The interviews lasted between 30 to 40 minutes. Both FGDs and IDIs were conducted in Kiswahili, the language spoken by most people in Tanzania, and was well understood by the participants. Data were audio-recorded.

Data Analysis

Focus Group Discussions

Data analysis started as soon as the first FGD was completed. This guided the subsequent levels of questions and probes in the discussion guide. The research assistant (a nurse) transcribed verbatim of all the audio-recorded data in the Kiswahili language and typed it into the Microsoft Word computer program. The first and second authors checked the transcripts against the audio-recorded data to ensure the correctness of the transcribed data. The unit of analysis was a whole transcript. All files of transcripts were transferred to NVivo 11.0 software (QSR International, Melbourne, Australia) for coding and organisation. The texts were analysed in the native language of the participants. The first 2 authors read the transcripts iteratively and thoroughly to immerse themselves in the data. Interesting content areas were coded, as guided by content analysis principles.[37] We used inductive coding whereby codes were developed from the data using phrases or terms utilised by the participants themselves. In this way, we were able to stay close to the data, mirroring what is actually in them. The coding of the contents continued throughout the rest of the documents. Reflecting on the objective of the present study, code classifications were created containing defined attributes related to the topic of interest. After we had coded all information and organised it into a manageable format, all codes were shared between the first 2 authors for discussion, and the consensus was reached on the coded information. The process of sharing the codes helped to improve the credibility of the coding system and organisation[38]. We then continued reading and abstracting the contents into more specific ideas that were mutually exclusive of each other. In other words, the text was divided into meaning units that were condensed, abstracted, and eventually labelled with codes. Coding continued for all transcripts to form categories and themes. (Table 1).

In-Depth Interviews

The same analysis process was carried out on the IDIs data. Following the analysis, we checked the FGDs' themes and categories to ascertain the new information obtained from the individual interviews. This contributed to an enhanced understanding of the participants' perspectives on HIV vaccine trial participation. Representative ideas and quotes from all IDIs were identified for each FGD theme and category. A new category emerged from IDIs and was reported in addition to the FGDs' themes. The whole text was translated into English. The translation of the text was conducted according to Brislin[39].

Ethical Consideration

Ethical clearance was obtained from the Institutional Review Board at Muhimbili University of Health and Allied Sciences (MUHAS) with Ref. No. 2017-06-028/AEC/Vol.XII/85. A permission letter was obtained from the Executive Director of Muhimbili National Hospital (MNH). The first author reviewed the informed consent

form and explained to the potential participants the principles of voluntary participation, anonymity, and the right to withdraw from the study at any time without losing any benefit from the health services at the clinic. Written consent was obtained from all participants before data collection. All potential participants consented to the audio-recording during the discussions and interviews. We ensured the anonymity of the information provided by using codes instead of their names in all documents. Participants were reimbursed Tshs 4,000 (equivalent to 1.76 USD) for transportation and their time.

FINDINGS

Characteristics of Participants

28 participants participated in the study as follows: 18 participated in FGDs only, 6 participated in IDIs only and 4 participated in both FGDs and IDIs. The following section reports the socio-demographic characteristics of the FGDs and IDIs' participants separately.

Focus group discussion

The ages of the 22 participants ranged from 19 to 50 years, with a mean age of 37.2 (SD=7.8). Of these 22 participants, 16 were males. Most of the participants had primary education levels. 10 of the participants were self-employed, performing activities that enabled them to obtain an income. 18 of the participants were single (Table 2a).

In-depth interview:

The ages of the 10 participants ranged from 25 to 44 years, with a mean age of 32.6 (SD=5.8). Of these 10 participants, 6 were males. Most of the participants had primary education and half were self-employed. 8 participants were single (Table 2b).

Themes and Categories

Motivations and barriers to participating in HIV vaccine trials were the 2 themes identified in this study. Both themes were derived from the FGDs. 3 categories are reported as motivators and 3 categories as barriers. Among the 6 categories from the themes, 5 categories were derived from FGDs and IDIs while 1 category emanated from IDIs only. The findings are presented together for both FGDs and IDIs (Table 3).

Motivation to Participate in HIV Vaccine Trials

Participants reported different factors that would drive them to participate in the trials. Altruism, the desire to reduce the risk of HIV infection, and social support were the main motivators for IDUs to participate in HIV vaccine trials as described in the following;

Altruism

Participants expressed a desire to participate in HIV vaccine trials with the hope that a successful vaccine would benefit many people in Tanzania and other countries. Also, they hoped that their participation would not only result in an effective HIV vaccine but might also encourage others to be vaccinated against HIV infection as expressed below:

> *"When I decide to participate in a vaccine trial against HIV infection, I will be helping my country. Also, if this vaccine becomes effective, it will be helpful to me, as well as other people and other countries."* (FGD2, participant 14, male, age 40)

TABLE 2a Socio-demographic characteristics of the participants in FGDs

Characteristic	Numbers
Age (Years)	
18-27	4
28-37	10
38-47	5
48 and above	3
Total	**22**
Gender	
Male	16
Female	6
Total	**22**
Level of education	
Primary	15
Secondary	5
College	2
Total	**22**
Occupation	
Employed	3
Unemployed	9
Self-employed	10
Total	**22**
Marital status	
Single	18
Married	4
Total	**22**

Some participants specifically expressed an eagerness to see an effective vaccine developed. They were interested to find out if the vaccine might be discovered because of their efforts. They stated that it would be difficult to get positive results from the vaccine unless they volunteer. The participants in this study also expressed that their participation in the trials was a motivating factor because it might lead to the development of an effective HIV vaccine that could be widely used in the country:

> *"No one knows if the vaccine works. How can we know? So, we need to volunteer for the study to get an effective HIV vaccine that will be useful for other people in our country."* (FGD2, participant 10, male, age 46)

Participants also expressed personal interests in receiving an alternative treatment and a possible cure for HIV infection. They reported that Antiretroviral drugs (ARVs) do not cure the disease; rather alleviate the severity of HIV infections. This awareness prompted them to understand the importance of participating in HIV vaccine trials as stated below:

> *"I have heard about it, and until now there is no cure. I am motivated to participate to develop a treatment that will help other people."* (FGD1 participant 2, male, age 48)

Other participants expressed the fact that they would be delighted to tell community members about the benefits of participation in HIV vaccine trials. They believed that

if their community could see the results of their participation, it might influence others to participate in future vaccine trials study as expressed below:

"If we reach the community, we will inform them that we were involved in the vaccine trials and that the trials have provided the best answers; the trial has been achieved, and its advantages are the same as you see us. These trials are both positive and harmless, and we volunteered as pioneers." (FGD2 participant 12, male, age 38)

TABLE 2b: In Depth Interviews

Characteristic	Numbers (also in FDG)
Age (Years)	
18-27	2(1)
28-37	3(2)
38-47	5(1)
48 and above	0(0)
Total	**10**
Gender	
Male	6(3)
Female	4(1)
Total	**10**
Level of education	
Primary	7(3)
Secondary	3(1)
College	0(0)
Total	**10**
Occupation	
Employed	2(1)
Unemployed	3(2)
Self-employed	5(1)
Total	**10**
Marital status	
Single	8(4)
Married	2(0)
Total	**10**

Participants expressed interest in being in a vaccine trial to obtain the positive results of a potential vaccine, knowing that they contributed to its development. Their main satisfaction was to know that other people might also be motivated to join the study. This factor was one of the strategies they thought they could use to attract their colleagues as described below:

"If the vaccine brings meaningful results, it will be a good example for other people who will see that we have contributed to the vaccine until the vaccine becomes available." (FGD2, participant 9, male, age 50)

Participants in the IDI had similar views on motivation to participate in an HIV vaccine trial through altruism. The information provided by individual interviews corroborates with that from FGDs. Participants stated that the experience of living with their relative infected with HIV drove them to participate in the trial. They expressed a desire to fight HIV/AIDS through the development of a preventive HIV vaccine. One participant remarked:

"... I have been hurt to see that some of my family have been affected by HIV disease, so when I hear that there is vaccine trial, I am glad that at least it can save the family and other people who have survived" (IDI, participant 1, Female, age 27).

Desire to Reduce the Risk of HIV Infection

Participants expressed that they would participate in HIV vaccine efficacy trials to reduce their risk of HIV infection. They described that education that will be provided during the HIV vaccine trial would help them to recognise their risk behaviours and health status. Health screening would help to know their status thus protecting themselves from HIV infection as described below:

"I am ready to be enrolled in a study because this activity involves participant education of risk-related behaviour, including screening for different infectious diseases. Participating in HIV vaccine trials will give information that helps to protect me from infection" (FGD2, participant 15, male, age 35).

Participants verbalised that they were motivated to participate in HIV vaccine trials to prevent infection among the at-risk population. They stated that it was a common practice to share needles and syringes, especially because of drug shortages and subsequent cravings. Some participants expressed how painful it was to remember some of the risky practices they had previously engaged in. This painful memory motivated them to participate in HIV vaccine trials. One participant stated:

"What happens is that we share the drug using the same syringe and needle for all of us so that everyone will have the drug to treat the addiction. You will be forced to trust this person even if you do not know his HIV status. This pains me a lot when it comes to my mind. To me, I will be willing to participate in HIV vaccine trials to facilitate the availability of prevention of HIV infection" (FGD 1, participant 1, male, age 50)

For IDIs, the desire to reduce the risk of HIV infection as a motivator to participate in the vaccine trial was expressed in the aspects of individual sexual behaviour and experience from harm reduction programs, which were not revealed in FGDs. In this case, participants verbalised that HIV/ AIDS is a pandemic disease that is prevalent throughout the country. They expressed the hope that participation in an HIV vaccine trial is an important way to make a vaccine available and thereby preventing HIV infection. The availability of an HIV vaccine might reduce the possibility of at-risk groups contracting HIV, One of the participants explained:

"HIV infection is a national catastrophe because you can protect yourself from infection, but you can get infected from others. Young people sometimes stay longer [without sex], when they get it [sex], they become confused and therefore forget to use a condom, which may lead to HIV infection. To me, I think, participating in the trials will facilitate the development of the vaccine and thus reduce HIV infection in the community." (IDI, participant 9, male, age 33)

Another IDIs' participant commented that exposure to different harm reduction programs such as the Syringe Exchange Program (NSEP) might have improved their awareness of other health-promoting activities. Effective education provided by Non-Government Organisation (NGOs) before joining the methadone clinic increased

the participants' motivation to participate in HIV vaccine trials as exemplified by the following statement:

> *"I was involved in the MDF program [one of the NGOs dealing with SEP]; they were educating us on how we can reduce our risk of HIV infection. To me, participation in an HIV vaccine trial is not a problem because I already know how the MDF works."* (IDI, participant 4, male, age 37)

Social Support

Participants in this study reported that social support was an essential motivating factor to participate in HIV vaccine trials. This was based on opinions from close people such as family members, friends, or sexual partners. They verbalised that informing the people they trusted was important because they could provide support and guidance throughout the trial period. They remarked that psychosocial support provided by family members could be a crucial aspect for them to participate in HIV vaccine trials. One of the participants said:

> *"...Family members are important people to be involved in decision making toward participation in an HIV vaccine trial. In case the trials bring adverse effects, they will be in the forefront line for guiding and advising on how to handle the problem."* (FGD3, participant 6, female, age 19)

Another participant expressed the following:

> *"Involving someone is important to me so that he can assist with counselling because when you discuss with the person, he will help in advising about whether the thing you want to do is good or not."* (FGD2, participant 11, male, age 40)

Some participants expressed that they would only follow the family/friends/loved one's opinions, which are congruent with the participants' own intention to participate. They also added that if the close relative disagrees with their opinions of participating in the HIV vaccine trial, then they would provide more information. This was said to help the family member to understand the participant's needs as stated below:

> *"For me to participate in an HIV vaccine trial, I will need to involve my close relatives. I know they* [family members] *cannot refuse. If they refuse, then I will not force them. Instead, I will inform them about the HIV vaccine efficacy trials until they understand"* (FGD3 participant 5, female, age 37)

For the social support as the motivating factors, participants in IDIs expressed similar findings. This validates the information provided in the FGDs. Participants verbalised different reasons for involving family members, including avoiding blame when something bad happens, and that family members were not informed.

> *"I would like to involve the family because if something bad happens, the family may ask you, why didn't you tell us? So, it's good to involve your closest people."* (IDI participant 4, male, age 37)

Barriers to participation in HIV vaccine efficacy trials

Participants expressed several factors that would hinder them from participating in an HIV vaccine trial. Perceived fear of vaccine side effects, lack of information about HIV vaccine studies, and HIV related stigma towards participants were the main factors that would demotivate participation in HIV vaccine trials.

Perceived fears of the vaccine side effects

Participants were worried about the effect of the vaccine on their bodies. They mentioned different perceptions related to the effectiveness of the vaccine. They asserted that the side effects of the vaccine might be difficult to handle. Lack of evidence from people in their community who had participated in previous HIV vaccine trials increased the fear of participation as stated below.

> *"To me, participation in a vaccine trial is very difficult. It would seem as if I am endangering my life for being vaccinated with an experimental vaccine"* (FGD2, participant 13, male, age 45).

Participants mentioned that people who believe that HIV vaccine contents are harmful could discourage one from HIV vaccine participation. They were worried that those who would volunteer to receive the vaccine might die because of the vaccine materials injected into their body as stated below:

"If you try to involve other people such as relatives, they can tell you a completely different story. People may say, 'you are going to be the first person to be harmed by the vaccine. the drug is going to be tested on you, you can die.' You do not know what effects the vaccines have on your body" (FGD1, Participant 8, male, age 29).

In the case of perceived fears of the vaccine side effects, the findings from IDIs are similar to those reported in FGDs. This validates the overall perception of the experimental vaccine among the participants. Additionally, the IDI participants were concerned about the safety of the vaccine. They were not sure of the ingredients in the vaccine and thus feared the effects that might occur as a result of an experimental vaccine:

"I would like my safety to be protected because anything done in the experimental vaccine means that it hasn't been proven 100 percent safe. So, when I volunteer in the HIV vaccine trial, how will my safety be guaranteed? What if it fails? So, I have to doubt anything that is in the test because it is not directly said to provide immunity" (IDI, Participant 4, male, age 37).

Lack of information about HIV vaccine studies

Participants expressed concern about the lack of knowledge about HIV vaccine trials. Lack of information was a hindrance to participants to volunteer in a vaccine trial if one was available. Some participants stated that they had heard about an HIV vaccine trial before this study, but did not understand what it was all about. This lack of knowledge discouraged them from participating in the trial. They asserted that they would allow to be recruited if they understood more about the nature of the vaccine and how it works. They expressed:

> *"I had heard in the media about HIV vaccines, but I did not fully understand where these vaccines come from. If I get enough information on this, it will be easy for me to be involved in an HIV vaccine study"* (FGD1Participant 2, male, age 48):

Another participant added:

> *"I cannot get involved in an activity if I don't understand what the activity is about. Education should be the priority because when a person is knowledgeable, he/she may help to convince and motivate others to join the study"* (FGD 2 participant 12, age 38).

TABLE 1: Example of Meaning Units, Condensed Meaning, and Codes, Category, and Theme

Meaning unit	Condensed meaning	Codes	Category	Theme
"When I decide to participate in a vaccine trial against HIV infection, I will be helping my country. Also, if this vaccine becomes effective, it will be helpful to me, as well as other people and other countries."	Participating in the vaccine to help the country	Helping the country	Altruism	Motivation
	An effective vaccine will help other people	Helping other propel		
"I am ready to be enrolled in a involves participant education of risk-related behaviour, study because this activity including screening for different infectious diseases. Participating in HIV vaccine trials is will give information that helps to protect me from infection"	Being enrolled to get behaviour and health check-ups	Getting education Health screening	Desire to reduce the risk for HIV infections	
	Participation helps protect from infection	Protecting from infection		

TABLE 3: Summary of Themes and Categories

Themes		Motivations to participate in HIV vaccine trials		Barriers to participation in HIV vaccine trials		
Categories	Altruism	Desire to reduce the risk of HIV infection	Social support	Fear of the vaccines' side effects	lack of information about HIV vaccine	HIV related stigma among vaccine trial participants

Other participants argued that drug users had difficulty understanding information about HIV vaccine trials. They referred to the hardship experienced during the recruitment of participants for the methadone clinic. They reported that drug users could not understand the importance of methadone and continued to inject illicit drugs even after educating them. One peer educator who used to recruit drug users from the street and educate them about the importance of attending the clinic and using the methadone treatment remarked:

> *"We followed and educated them about the importance of using methadone at the clinic. We told them that the drug is free but they were so difficult to understand. ...I'm not sure if they can understand and be motivated to engage in the HIV vaccine trial."* (FGD3, participant 7, female, age 24)

Another participant opposed the ideas and added:

> *"...we drug users are not a problem but when awareness is given, then people will understand. What is needed is just information and education. The only thing we ask for is education. People will be motivated to participate if given appropriate education"* (FGD3 Participant 6, Female, age 19).

Stigma towards HIV vaccine trial participants

Stigma towards HIV vaccine trial participation was prominent during IDIs. This concept did not emerge during the FGDs. In IDIs, many participants reported fears of being labelled and criticised by community members and people around them, including relatives. They stated that people might point fingers at them if they participate in the HIV vaccine efficacy trial because they believed that the participants are infected with HIV, as verbalised by one of the participants below.

> *"...so, everyone will be pointing his/her finger at you because you participated in the HIV vaccine trials. The community can discriminate against you because they think you already have HIV, which has no treatment"* (IDI, participant 1, female, age 27)

Other participants were worried about social isolation in the community when participating in the HIV vaccine trial. They asserted that the community members would

shun and even isolate them if the vaccine would not be effective:

> *"I would like to volunteer to participate and be given the vaccine material to see if it works. However, if I get the vaccine material and it does not work, this will hurt me. ...and the community will look at me negatively and even isolate me."* (IDI, participant 1, female, age 36)

Overall, the participants reported HIV related stigma towards HIV vaccine trial participants as an obstacle that needed to be eliminated through community involvement and education. They expressed that community sensitisation using various education materials such as fliers could help to promote community awareness and thus decreasing stigma towards HIV vaccine trial participants.

Comparison of findings from FGDs and IDIs

The findings from FGDs and IDIs correspond to each other in the following aspects: Participants from both FGDs and IDIs expressed altruism, desire to reduce HIV infection, and social support as motivations to take part in HIV vaccine studies. In addition, the 2 methods revealed that the perceived fear of vaccine side effects would hinder participation in HIV vaccine studies. While the lack of information about HIV vaccine studies became prominent in FGDs, during IDIs, stigma towards HIV vaccine trial participants emerged as an additional hindrance towards participation in HIV vaccine studies. Also, the participants who were reluctant to share their views in FGDs provided useful information during the individual interviews. Thus, the findings from IDIs complement those from FGDs in a meaningful way.

DISCUSSION

This study highlights the important factors that may motivate IDUs to participate in HIV vaccine trials. Various factors that may prevent them from participating in HIV vaccine trials are reported as barriers. In the current study, participants are motivated to participate in HIV vaccine trials through altruism, a desire to reduce the risk of HIV infection, and social support. In contrast, perceived fear of vaccine side effects, lack of information about HIV vaccine trials, and HIV related stigma towards participants are the barriers to participation in the hypothetical HIV vaccine trial.

Motivation to participate in HIV vaccine trials

Based on our findings, altruism is an important motivating factor for participation in HIV vaccine efficacy trials. Participants in this study had experienced people affected by HIV /AIDS. This experience may be a driving force to participate in an HIV vaccine trial. In other studies in the same setting, altruism was reported to be the primary motivator for participants to participate in the HIV vaccine trial.[19,40] This indicates that altruistic reasoning plays an essential role in motivating participants to join HIV vaccine trials in Tanzania. Similar reasoning is also reported in Kenya whereby the willingness to participate in HIV vaccine efficacy trials was driven by various forms of altruism.[41] Further evidence to support altruism as the motivating factor has been reported in the USA, the Netherland, and Canada[42,43]. Given the participants' responses in this study, our findings suggest that the participants' lives might have meaning and purpose because of participation in an HIV vaccine trial, particularly if it yields a positive outcome.

The desire to reduce the risk of HIV infection as a motivator for participation in HIV vaccine trials can be attributed to the high-risk behaviours that participants had experienced before joining the study. The participants are greatly affected by their memories of sharing contaminated needles/syringes and unsafe sexual behaviours as described in the Health Belief Model.[44,45]

This may have motivated them to participate in HIV vaccine trials to reduce HIV infection among themselves and the community at large. A multi-site study in the US, Canada, and the Netherlands revealed similar findings that volunteers were motivated to participate in the HIV vaccine trial to reduce risk behaviour.[22] Such findings were also reported in Philadelphia where protection from HIV infection was the motivator to participate in the HIV vaccine trial.[46] The desire to reduce the risk of HIV infection may also be accounted for by the knowledge of harm reduction program that participants were involved in before the current study.[12,28] Thus, participants perceived HIV vaccine trials as one of such programs for HIV risk behaviours reduction. Therefore, intensive training is needed to differentiate between HIV vaccine trials and other risk behaviour reduction programs during the implementation of actual vaccine trials. Likewise, the motivation to participate in an HIV vaccine trial for reducing HIV infection was reported in a phase I/II HIV vaccine trials study among police officers.[40] Given the experience of participants in our study, motivation to participate in vaccine trials to reduce high-risk behaviours is an important factor to consider when planning for future HIV vaccine trials among IDUs.

In the context of social support, IDUs demonstrate the key abilities needed to make meaningful decisions about HIV vaccine trial participation. Similarly, previous HIV vaccine studies in Tanzania show that social support plays an essential role in HIV vaccine trials.[18,47] In Tanzania, the reported importance of involving close people when making decisions may be described by the socio-cultural experience of household decisions among couples[48] and the type of family patterns.[49] This is similar to the study conducted in the United States which reported consultation with other people was one of the factors in the decision-making process among adolescents.[50] This reinforces our understanding that information sharing is important for informed decision-making. It also implies that participants have a meaningful relationship with other people and value their input when making difficult decisions. The findings in our study also correlate with findings from South Africa, whereby the ultimate decision to engage children in HIV vaccine trial participation rested on their mothers after they had shared information with their significant others.[51] However, further research is needed in this area to explore the social and behavioural characteristics of IDUs who can be motivated to participate in HIV vaccine trials based on consensus from significant others.

Barriers to participating in HIV vaccine trials

The reported fears of vaccine side effects as a barrier to participation in HIV vaccine trials may be contributed

by the lack of proper information about the nature of vaccine materials. Similarly, the phase I/II HIV vaccine trials among police officers in Dar es Salaam, Tanzania, reported fears of vaccine side effects as one of the reasons to decline from participating in an HIV vaccine trial.[52] Likewise, a study in India showed that participants feared vaccine-induced HIV infection.[53] Thorough and accurate information related to the vaccine is needed for potential HIV vaccine trial participants. Expanding education about HIV vaccine trials may help to decrease misperception and misinformation. Promoting awareness and comprehensive education for participants about what to expect during the trial is crucial for effective HIV vaccine trial participation.

Lack of information about HIV vaccine trials can be described by the fact that research findings have not been adequately disseminated among the population of interest. Dissemination of HIV vaccine-related information is important for raising awareness in the participating community.[54] A previous study in Uganda reported improved communication between participants and research staff that created a sense of community ownership among participants.[55] Nevertheless, a study among transwomen in 4 cities of the USA revealed that having either no exposure or limited exposure towards HIV vaccine trials which was translated as receiving inaccurate information from the laypeople[56]is a barrier to participation. The findings in our study indicate that the recruitment of prospective participants in an HIV vaccine efficacy trial requires sufficient education to address misperceptions. Such education may potentially decrease barriers towards participation in the vaccine trials. In other words, for effective HIV vaccine efficacy trial participation among IDUs, participants must have a broader understanding of the nature and procedures of the HIV vaccine trials.

As revealed in the present study, HIV-related stigma may prevent participants from volunteering for HIV vaccine efficacy trials. The negative reactions from their communities have greater impacts on the decision to participate. Such negative reactions and their impacts on participation in HIV vaccine studies have also been reported in Kenya.[57] Participants in our study believed that their participation in an HIV vaccine trial would expose them to prejudicial and discriminatory practices similar to those directed at HIV positive people. Several studies have reported similar findings in other countries.[58–61] These barriers may be reduced by providing the correct information about the HIV vaccine program. In HIV vaccine efficacy trials, high-risk populations are required for participation. Based on the findings of our study, IDUs represent a good vaccine trial population, as they have been involved in many health promotion programs. Researchers must provide educational materials and ensure that all behavioural and social needs are met before, during, and after the vaccine trials.

Limitation

This study is not without limitations. First, the study sample was recruited from the methadone clinic which might be different from IDUs in the general population. However, the risk and behavioural characteristics of the participants validate the information. The findings of 0ur study are valuable for planning future HIV vaccine efficacy trials. Second, although the findings of this study should not be generalised beyond the studied sample, the information obtained is important when formulating an HIV research study in a similar setting.

The use of the qualitative method allowed the authors to examine a study sample that had not been previously investigated in Tanzania. Finally, the integration of FGDs and IDIs data as a form of triangulation has been challenged in establishing rigour[62,63] and therefore might have affected the integrity of findings. However, the current study used data from both methods to complement each other. For example, the 4 participants who were reluctant to express their ideas during FGDs appeared more interactive during the IDIs.

Complementing is important to the qualitative inquiry as it allows for the recognition of multiple realities. In this case, the IDIs added additional information that was not recognised in the FGDs. The combination of 2 sources of data increased the richness of the information obtained, thus making the findings more valuable.

CONCLUSIONS

Participation in a hypothetical HIV vaccine trial among IDUs is influenced by positive and negative factors. Actual recruitment plans could be made through a better explanation of HIV vaccine trials, the expected individual and collective benefits associated with the trials. Correct information about the HIV vaccine studies and community sensitisation is likely to enhance participation in future HIV vaccine trials.

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ORIGINAL ARTICLE

Feasibility of SMS to remind pregnant and breastfeeding women living with HIV to take antiretroviral treatment in Kilimanjaro region, Tanzania: a pilot study

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ABSTRACT

Background: Pregnant and breastfeeding Women Living with HIV (WLHIV) often have difficulties in reaching adequate levels of adherence (>95%) to Antiretroviral treatment. "Forgetting" is the most commonly mentioned reason. Sending reminders via SMS is expected to improve adherence. We conducted a pilot study to investigate acceptability, user experience and technical feasibility of sending reminder-SMS to WLHIV.

Methods: This was a 6-months observational pilot-study among WLHIV attending antenatal and postnatal care at Kilimanjaro Christian Medical Centre in Moshi, Tanzania. Women received a reminder-SMS 30 minutes before usual time of intake. One hour later, they received an SMS asking whether they took medication to which they could reply with 'Yes' or 'No'. Messages were sent 3 times a week on randomly chosen days to prevent reliance on daily messages. We calculated the percentage of number of SMS delivered, failed to be delivered, and replied to. We analysed feedback from exit-interviews about experience with the SMS-reminders.

Results: 25 women were enrolled (age 18-45), 2 were lost to follow up. 5,054 messages were sent of which 53 failed to be delivered (1%). 1,880 SMS were sent with a question if medication was taken; 1,012 (54%) messages were replied to, of which 1,003 (99%) were replied with 'YES' and closely to 'YES', and a total of 9 (1%) with 'NO' and 'closely to NO'. 868 messages (46%) were not responded to due to either dropout, change of phone number, loss of phone or network failure. Results from 18 interviews showed that 16 (89%) women were satisfied with SMS reminders. 2 (11%) were concerned about unwanted disclosure because of the content 'don't forget to take medication' and one reported other privacy issues (6%). 3 (17%) women experienced stigma.

Conclusion: 99%of SMS being delivered indicates that SMS reminders in this resource-limited setting are technically feasible. However, concerns regarding privacy were noted, specifically the risk of unwanted disclosure and the experience of stigma. Participants indicated that being made aware of their adherence, motivated them to adhere better. However, personalised and more neutral content of the SMS might be a way to improving the intervention.

BACKGROUND

Infants are still being born with HIV in Sub Saharan Africa (SSA), despite significant increases in treatment coverage and implementation of programs to reduce vertical transmission of HIV.[1] In East African countries, the coverage of Prevention of Mother-To-Child Transmission (PMTCT) programmes varied between countries from for example 77% in Kenya to 95% in Uganda in 2016.[2,3] In Tanzania, there were 77,200 pregnant women living with HIV (WLHIV) in 2016.[4] Of them, only 84% received free effective Antiretroviral Treatment (ART), resulting in a high mother-to-child transmission rate of 11%. The transmission rates of HIV from mother to child during pre-

gnancy, delivery and breastfeeding vary from 15% to 45% in the absence of PMTCT programmes. According to the World Health Organization (WHO) guidelines, initiation of lifetime Antiretroviral Therapy (ART) by WLHIV under the recommended Option B+ programme has the potential to reduce the transmission of HIV to the newborn to below 5%.[6] In addition, their infants should receive nevirapine syrup till 6 weeks postpartum and exclusive breastfeeding up to month 6, preferably continuing breastfeeding up to 24 months in addition to solid foods.[7] In a prospective cohort study conducted in the Kilimanjaro region in 2016, out of 200 pregnant womenenrolled, 4.8% were found to be HIV positive while only 41% were in PMTC care.[5] Sustaining a high level of adherence to ART during pregnancy, postpartum and during breastfeeding are, however, a prerequisite to prevent HIV-transmission from mother to child.[8]
Achieving optimal levels of adherence (>95%) is still a major challenge due to several factors including drug shortages and forgetting to take medication.[9] Adherence to ART entails that medication is taken at the right time and exactly as prescribed without missing a dose. Poor adherence to ART may not only lead to virological failure and HIV-transmission from mother to child but also to creation of resistant HIV strains.

A meta-analysis among a large sample of People Living with HIV (PLHIV) outlined that worrying about disclosing the HIV status and forgetting to take medication on time were major barriers to adherence in Sub Saharan African countries.[10]Achieving and maintaining high levels of adherence to ART is particularly challenging for pregnant and breast-feeding women. It was shown that pregnant women using ARV tend to forget taking doses of ART more often than non-pregnant women. They also may have more difficulties in incorporating medication intake into their busy schedule than non-pregnant women.[11] Furthermore, it was shown that pregnant women may quit taking medication due to side-effects of ARV. Breastfeeding women may also feel more healthy after delivery leading to reduced motivation to continue taking medication.[1]

Nowadays, more than 80% of the population in Tanzania has access to mobile phones.[12] Out of those, 60% own a basic phone without internet access and 20% a smartphone. Short Message Service (SMS) has emerged as one of the leading mobile services.[12] This provides a potential platform to support HIV treatment adherence by sending reminder cues through texting.

Several studies conducted in resource-limited settings examined the potential of mobile phone use in enhancing adherence to HIV medication. In a study conducted in Kwazulu Natal, South Africa, participants received an SMS once a week to remind them to take their HIV medication.[13,14] A total of 98% of the participants reported that the SMS helped them to remember taking their medication. Two Randomised Clinical Trials (RCT) undertaken in Kenya indicated that weekly SMS reminders led to improved ART adherence.[15,16] In Botswana, the adoption of SMS reminders has improved adherence to ART and also the relationship between patients and health care providers. In addition, results from that study showed that 93% of participants responded to the SMS reminders indicating it had helped them to take medication on time.[17] WLHIV were satisfied about SMS reminders as indicated in both studies in South Africa and Kenya.[13,15] A 6 month pilot study conducted in South India, compared 2 to 3 times weekly SMS reminders with reminders via Interactive Voice Response (IVR). Adherence improved in both groups from 85% to 91%. However, all enrolled study participants would prefer automated IVR.[18]

Although previous studies showed that it is technically feasible to enhance adherence by sending SMS reminders and that this improved self-reported adherence, several challenges remain. In the studies in South Africa and Kenya, 10% of sent messages did not reach study participants due to loss of their phones and change of phone numbers during the study period. Also, they reported that participants who received daily SMS texts responded less often to these messages compared to participants who received weekly SMS texts.[15]Participants reported concerns about privacy in studies in Kenya, South Africa and Botswana.[14,15,17] Drop-out rates as high as 35% were reported in an RCT in Uganda.[19] In this RCT, the reminder and a question asking about adherence were included in a single SMS. This combined question was not found to motivate participants to take their medication. Language illiteracy was noted to be a challenge in studies in Cameroon[20] and Uganda[19] as participants preferred SMS text messages in their native language instead of English. A systematic review of 35 studies about SMS applications in Africa found that only 5 studies evaluated the level of acceptance through exit interviews, showing that 94% of participants were highly satisfied. This review also indicated that network failure was a concern for 14% of enrolled participants causing them to sometimes miss the reminder SMS. Battery power was a problem to participants as well.[21]

Whereas SMS reminders are a promising method to enhance adherence to ART, challenges remain with respect to technical feasibility, acceptability, timing and content of the messages. In the present pilot study, we aim to investigate the acceptability and technical feasibility of using short text messages for enhancing adherence to ART among pregnant and breastfeeding WLHIV in Kilimanjaro, Tanzania.

METHODS

Study Design

This was a prospective, single-arm, 6-months observational pilot-study among HIV-positive pregnant and breastfeeding women. The study was approved by the Kilimanjaro Christian Medical College Research Ethics and Review Committee (CRERC) No.829 and the National Health Research Ethics Sub-Committee (NathRec) of Tanzania NIMR/HQ/R.8a/Vol.1X/2432.

Study Participants

From May 2017 to July 2017, we recruited pregnant and breastfeeding women who were attending either antenatal or postnatal care at Kilimanjaro Christian Medical Center (KCMC) in Moshi, Tanzania. KCMC is a tertiary referral hospital in the Northern zone of Tanzania with 450 beds and provides service to approximately 250 to 300 pregnant and breastfeeding WLHIV annually. The centre includes a special Child Centred Family Care Clin-

ic (CCFCC), which provides care and treatment to children living with HIV/AIDS and their families. Women were eligible for the study if they (1) were HIV positive and pregnant or breastfeeding, (2) were aged between 18 and 50 years, (3) were attending Kilimanjaro Christian Medical Centre, (4) were on ART since at least 6 months, (5) had no foreseen changes in ART in the subsequent 3 months, (6) owned a mobile phone with operational SIM card, (7) lived in rural or urban areas of the Kilimanjaro Region, (8) were willing to receive SMS reminding them to take ART, (9) were able to read and reply to SMS, (10) were willing to come to the clinic at least once a month and (11) provided written informed consent to participate in the study. We excluded WLHIV who were either on co-medication for other (chronic) diseases such as tuberculosis (TB), diabetes and chronic hypertension; or who were admitted to a hospital or were participating in concurrent SMS reminder studies. As this was a pilot study investigating the feasibility of a newly developed intervention, a sample size of 25 WLHIV was considered sufficient to meet our aims.

Study Procedures

Recruitment and Monitoring of WLHIV

We used convenience sampling to recruit women. Potential participants were identified by a clinic nurse who informed the research doctor. The doctor determined whether a candidate fulfilled the eligibility criteria. The study nurses explained the study in detail to the eligible participant using a participant information leaflet. The participant was given time to read and understand the leaflet. Written informed consent was requested from participants before any study procedure. Following that, the nurse invited all women who agreed to participate. Subsequently, baseline information about the participants was collected through a short structured questionnaire asking about demographics, mobile phone number and usual time of medication intake according to the physician's prescription. We entered the participant's phone number into the SMS program and subscribed the participant's phone number to an unlimited monthly SMS bundle.

After enrolment, participants were followed for 6 months. The participants attended the clinic monthly for medication refill and antenatal follow-up. After 3 months, the study doctor asked a general question "*What is your general experience with the SMS messages?"* The answer was written down verbatim.

After 6 months, participants were interviewed about their experience with receiving SMS by using a semi-structured questionnaire. The interview was conducted in Swahili by the study doctor. Data from the enrolment questionnaire and the exit-interviews were entered in REDCap® (Research Electronic Data Capture) 9.3.5, Vanderbilt University, Tennessee USA, an open-source web-based system which has features for query generating, auditing and data validation.[22]

The Intervention

SMS Content

The SMS were grouped into 4 categories. We designed the SMS in Swahili and only those were sent to our participants. Figure 1 shows the SMS scheme translated into English for the purpose of general readability of this manuscript. First, an introduction SMS was sent once on the day of enrolment to welcome the participant. Second, a reminder message to alert the participant to not forget to take their medication was sent 30 minutes before usual time of medication intake. Thirdly, a question SMS was sent one hour after usual time of intake to ask the participants if they took the medication according to the doctor's instruction. The participant had to reply with any of the options 'N' (Ndiyo, meaning YES) - I took my medication, 'H' (Hapana, meaning NO) - I did not take my medication or 'B' (Bado, meaning NOT YET). If the reply was YES or NO, an acknowledgement SMS was sent saying "Thank you and have good day" and the SMS flow was terminated. If the reply was "NOT YET", one hour later, a question SMS was sent again to ask if medication was taken.

The timing of the SMS reminders was scheduled individually and processed automatically by the SMS system. The SMS system sent messages 3 times a week on randomly chosen days. The days were different for each participant. We used the permutations formula:

$$ {}_nP_r = \frac{n!}{(n-r)!} $$

for calculation of the number of possible combinations of 3 days in a week of 7 days. 35 combinations of days were possible (i.e. Mon-Tues-Wed, Mon-Tues-Thurs, Mon-Tues-Fri, Mon-Tues-Sat etc.).

The SMS Program

The SMS program was developed using open-source software Telerivet® (San Francisco, California, United States).[23] The software has a standard platform that integrates most of the existing mobile phone technologies. Telerivet allows routing of messages to and from any number of mobile devices with a basic internet connection. With a cloud-based management system, it supports the developer to adapt an external Application Platform Interface (API) using other platforms for monitoring and tracking activities. The system is only accessible through password authorisation.

Keywords

Keywords are pre-defined words that women could respond to by typing an SMS reply. Oncethe SMS from a participant is received, the SMS program scans the message content and matches it with our pre-defined keywords such as 'YES' and 'NO'. When keywords were recognised, the program automatically sent a reply to the participant based on the specified conditions and algorithm that we programmed in the system.

Outcome measures

Technical Feasibility of the SMS Program

Technical feasibility was based on the degree of performance and success of the system operation. Performance was determined by tracking the total number of SMS messages sent and delivered per participant; specifically, the number of SMS reminders and SMS questions.The success of the SMS system was based on scheduling of

SMS messages, which includes the time of intake and date of SMS sent, failed and delivered. The outcome of feasibility was measured through calculating percentages. The numerator was the total number of SMS delivered and the denominator was the total number of SMS sent.

Acceptability of Receiving SMS Reminders and Questions

Acceptability was evaluated in terms of satisfaction with receiving SMS reminders and questions by participants. This was evaluated using a questionnaire containing 18 questions. Each question had closed-ended response options to be answered by "yes" or "no" or "good" or not "good" followed by open-ended questions to solicit explanations. The open-ended questions provided more narrative explanations of the answers selected in the closed questions. The questionnaire was developed by the study team based on feedback given during consultations and on previous research.[16] The topics were on general experience with receiving the SMS reminders and questions, difficulties in receiving SMS, timing of SMS, contents of the SMS, problems with network connectivity, travelling, advantages of the SMS, potential stigma and loss of confidentiality by receiving SMS, ability to reply to SMS, impact on adherence, taking medication on days without SMS and ideas about adherence promoting interventions. Descriptive analyses (frequencies and percentages) of the outcomes were conducted to measure the acceptability. The numerator was the frequency calculated from closed-ended question. The denominator was the total number of participants that participated in the exit- interview.

Adherence to Medication

To obtain an indication about the extent to which SMS can be used for adherence monitoring, we calculated adherence based on SMS replies. 'Yes' answers were seen as an indication ("proxy") for medication intake. We calculated an adherence percentage for each participant based on the number of responses that contained the keyword 'YES' or similar to 'YES' and 'NO' or similar to 'NO' (numerator). This was divided by the total number of question SMS sent to the participants one hour after usual time of medication intake (denominator). SMS with responses similar to 'YES' were 'I TOOK MY PILLS', 'I REMEMBERED TO TAKE MY PILLS', 'THANKS FOR REMINDING ME'. These responses were considered "similar to Yes" and we assumed that these responses indicated that women took their medication. The responses determined to be similar to 'NO' where 'I DIDN'T TAKE IT', 'I FORGOT TO TAKE IT' and 'I COULD NOT TAKE IT'.

Data Analyses

We used IBM SPSS software® version 24 (New York, US) for statistical analyses to determine the frequencies of answers to the SMS messages. Responses to the questions of the exit-interview were presented as frequencies and percentages. Narratives from feedback during consultation and from the exit-interviews were used to illustrate the frequencies. We calculated adherence based on the SMS messages ('YES' meaning medication was taken) as stated in the previous paragraph for each woman who participated. From there we calculated median adherence for all included women.

TABLE 1: Characteristics of Pregnant and Breast-Feeding Women (N=25)

Characteristics	(%) or Median [IQR*]
Pregnant women	8 (32%)
Breastfeeding women	17(68%)
Age (Years)	10[range 30-40]
Duration on ART before the study(years)	2 [range: 6-8]
On first line ART (TLE) (DUOVIR-N)	22(88%)
On second line ART (LPV/r + TDF +FTC) OR (ATV/r + ABC + 3TC)	3(12%)

TLE: Tenofovir+Lamivudine+Efavirenz
ATV/r + ABC + 3TC: Atazanavir/Ritonavir (ATV/r) + Abacavir/Lamivudine (ABC/3TC)
LPV/r + TDF +FTC: Tenofovir +Emtricitabine (Truvada) + Lopinavir-ritonavir (LPV/r)
*IQR=Interquartile Range

TABLE 2: SMS Overview

Variables	Number of SMS (%)
Total SMS scheduled and sent for 25 participants	5054
• Delivered	5001(99%)
• Failed	53 (1%)
Reminder SMS that were delivered "Please don't forget to take your medication according to Doctor's instruction"	1845 (99.6%)
Question SMS that were delivered "Have you taken your medication according to Doctor's instructions?"	1880 (99.5%)*

TABLE 5: Adherence Based on SMS Replies

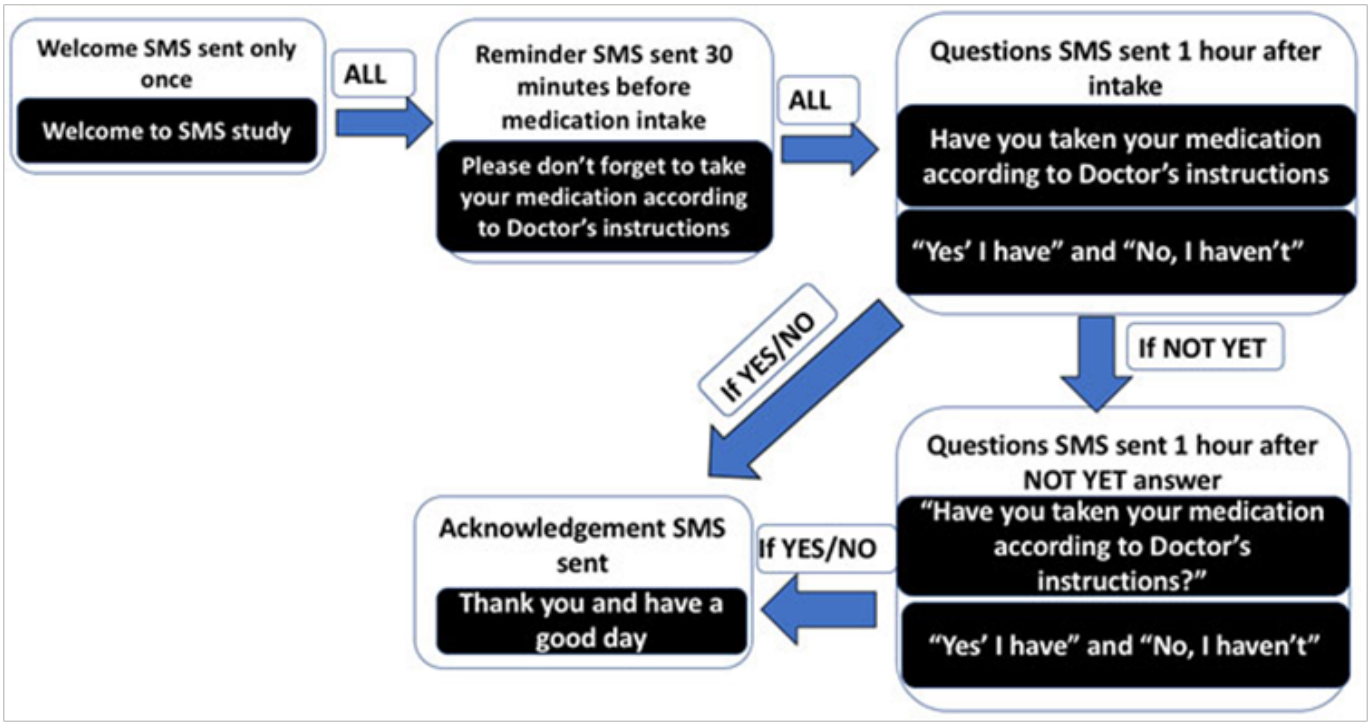
Variables	Number of SMS(%) or Median [IQR]
Total SMS sent with question "Have you taken your medication according to Doctor's instructions"	1880
Total Replied (YES, closely to YES, NO, closely to NO, NOT YET)	1012 (54%)
• Replied with YES	818 (81%)
• Total Replied YES and Closely to YES	1003 (99%)
• Replied with NO or closely to NO	9 (<1%)
Total not replied	864(46%)

TABLE 3: Overview of SMS Sent and Delivered Per Woman.

		Before cleaning Yes							After cleaning						
Number	Reminder	Question	Yes	No	TOTAL	%answered	Adherence YES/ Message SENT	Adherence based on answers	Question	Yes	No	TOTAL ANSWERS	%answered	Adherence YES/ Message SENT	Adherence
587	36	35	26	1	27	77%	74%	96%	35	26	1	27	77%	74%	96%
349	77	79	67	0	67	85%	85%	100%	79	67	0	67	85%	85%	100%
506	78	78	5	0	5	6%	6%	100%	78	67	0	67	86%	86%	100%
812	78	81	28	0	28	35%	35%	100%	81	28	0	28	35%	35%	100%
561	78	83	16	1 1	7	20%	19%	94%	83	17	1	18	22%	20%	94%
046	78	79	5	0	5	6%	6%	100%	79	5	0	5	6%	6%	100%
941	78	83	46	0	46	55%	55%	100%	83	48	0	48	58%	58%	100%
001	78	78	46	1	47	60%	59%	98%	78	46	1	47	60%	59%	98%
170	78	78	43	0	43	55%	55%	100%	78	44	0	44	56%	56%	100%
126	78	80	64	2	66	83%	80%	97%	80	64	2	66	83%	80%	97%
414	78	87	7	0	7	8%	8%	100%	87	60	0	60	69%	69%	100%
266	81	81	5	0	5	6%	6%	100%	81	17	0	17	21%	21%	100%
028	78	78	36	0	36	46%	46%	100%	78	66	0	66	85%	85%	100%
086	78	78	27	0	27	35%	35%	100%	78	27	0	27	35%	35%	100%
446	78	78	42	0	42	54%	54%	100%	78	43	0	43	55%	55%	100%
556	78	79	40	2	42	53%	51%	95%	79	41	2	43	54%	52%	95%
911	78	78	57	0	57	73%	73%	100%	78	57	0	57	73%	73%	100%
299	78	78	51	2	53	68%	65%	96%	78	51	2	53	68%	65%	96%
221	78	79	54	0	54	68%	68%	100%	79	54	0	54	68%	68%	100%
179	78	78	44	0	44	56%	56%	100%	78	52	0	52	67%	67%	100%
195	78	78	0	0	0	0%	0%		78	0	0	0	0%	0%	
977	78	82	12	0	12	15%	15%	100%	82	17	0	17	21%	21%	100%
455	13	13	0	0	0	0%	0%		13	0	0	0	0%	0%	
248	78	80	30	0	30	38%	38%	100%	80	37	0	37	46%	46%	100%
811	78	79	67	0	67	85%	85%	100%	79	69	0	69	87%	87%	100%
TOTAL	**1845**	**1880**	**818**	**9**	**827**	**44%**	**44%**	**99%**	**1880**	**1003**	**9**	**1012**	**54%**	**53%**	**99%**
MEDIAN							53%	51%	100%				58%	58%	100%
MEAN							44%	43%	99%				53%	52%	99%

*before cleaning: analysis included only the keyword "YES, NO"
*after cleaning" analysis included keyword "YES, NO, Similar with YES and Similar with NO "

FIGURE 1. Flow of SMS Messages Sent to Participants



RESULTS

25 women participated in our study. Their overall characteristics and variables related to HIV are shown inTable 1. 2 women dropped out before the end of the study and could not be traced for the exit interview. Data for all 25 participants are included in Table 1. 8 women (32%) were pregnant at the time of inclusion and 17(68%) were breastfeeding. The median duration on ART was 4 years (range: 0.5-12) and median age of participants was 36 (range 23-43)]. 22 (88%) women were on first-line ART and 3 (12%) were on second-line ART. (Table 1)

Technical Feasibility of Sending and Receiving Messages

In total, 5,054 SMS were scheduled and sent of which 5,001 (99%) were delivered. 53 (1%) were not delivered. (Table 2). 4 participants occasionally received SMS messages too late despite having been sent at the scheduled time, which appeared to be due to participants switching off their phone during the night or network failures. SMS messages were resent the next day. A total of 1,845 (99.6% of total sent) SMS reminders were delivered 30 minutes before medication intake and 1,880 (99.5% of total sent) SMS questions were delivered one hour after scheduled intake to ask the participants whether they took their medication or not. More question SMSs were sent than reminders, since the question was repeated after one hour if the reply was 'Not yet'. (Table 2)

Acceptability of SMS Reminders and Questions

18 (72%) participants were reached and willing to participate in the exit interviews whereas 5 participants could not be reached for follow-up (Table 4). 2 of 25 participants asked to be removed from the study before the end of the 6 months follow up due to the SMS content mentioning the word "medication". These participants proposed the SMS content to contain neutral or customised words. Other participants also mentioned the concern of limited confidentiality which might lead to disclosure of their HIV status. This was explained by one participant saying *"For instance the reminder question 'Did you take your medication' may lead to lack of confidentiality or disclosure of my status to my friends or partner"*. Another comment was *"The SMS as they come in, sometimes I am not with my phone, therefore I'm worried someone else could see that SMS"*. Most participants (75%) reported to be satisfied with receiving SMS reminders and questions. For example, one participant acknowledged that *"the reminder SMS was very supportive to me to remind me to take medication because several times I am busy with my usual activities"*. Others described the desire for continuing to receive reminder messages after the end of the study. 4 of the 18 participants (22%) expressed having difficulties in receiving the reminder SMS. The feedbacks from those participants were, *"The SMS were coming late, most of the times about 30 minutes later"*, *"Sometimes I find the SMS the next morning"*, *"Sometimes the SMS delays up to one day"*. (Table 4)

Adherence to Responding to SMS Questions

Out of 1,880 SMS sent with the question "Did you take medication?", a total of 1,012 (54%) were replied to. 818(44%) SMS were replied to with the keyword 'YES' and a total of 185 (10%) were replied to with similar to-

'YES' indicating that medication was taken. A total of 864 SMS (46%) were not replied to. 9 SMS (1%) replied with 'NO' and similar to 'NO' (see table 5). The median adherence based on YES-replies was 51% (range 0-85). The median adherence based on YES and similar-to-YES-replies was 58% (range 0-87). (Table 5)

TABLE 4: Feedback on Receiving SMS Reminders and Messages

Participants feedback	N 18(72%)
General experience with receiving SMS	
Not good at all	1 (5.6)
Not good	1 (5.6)
Good	2 (11.1)
Very good	14 (77.8)
Experience with SMS system not good at all (n=2)	
Lack of confidentiality – disclosure	
I don't like, it is not safe on my side	
SMS came on time	
Yes	15 (83.3)
No	3 (16.7)
SMS did not come on time (n=3)	
SMS delivered 30mins later	
SMS delivered on the following morning	
SMS delivered one day later	
Difficulties with receiving SMS	
Yes	4 (22.2)
No	14 (77.8)
Difficulties (n=4)	
Some days there were no SMS received	
Delay in receiving SMS	
Missing	
Opinion about content	
Not good at all	3 (16.7)
Not good	1 (5.6)
Good	2 (11.1)
Very good	12 (66.7)
Content is not good or not good at all (n=4)	
The words 'you are reminded to take medication' was not good to me	
It breaks the confidentiality	
The word 'kumeza dawa' (take medication) is not good. It breaches confidentiality	
The SMS which say 'kumeza dawa (take medication)' is a bit not good if someone else sees it	

DISCUSSION

In this pilot study, we investigated the acceptability and feasibility of sending SMS reminders to pregnant and breastfeeding WLHIV in Kilimanjaro (Tanzania) to take their antiretroviral medication. Almost all SMS that were sent, i.e. 99%, were actually delivered, supporting its technical feasibility. 54% of all monitoring SMS were replied to. The majority of participants found it acceptable to receive SMS that reminded them to take their medication and were satisfied with the content. However, there were also participants who expressed concerns about their privacy and were afraid that receiving the SMS could disclose their HIV status to others.

Only 1% of SMS was not delivered. Although we do not have data about each individual reason, they are most likely related to network failure, loss of phone and change of phone number. The finding that 46% of the question-SMS were not replied to was unexpected and disappointing. We were uncertain about the underlying reasons. Our primary thought was that participants did not understand or were annoyed by the messages. Also, there could have been changes of phone numbers, network failures, or participants could have been non-adherent. In the exit-interviews, the main reasons mentioned by participants were sharing of phones and network issue. Also, the adherence percentage of 58% is rather low, but as this was based on 'YES'-replies only this rather represents adherence to the SMS. In general, studies have shown that the mean adherence to ART among pregnant women in sub-Saharan Africa countries ranges from 35% to 93.5%.[24] For instance, a study in the Eastern Cape, South Africa showed an adherence level of 69% among pregnant women.[25] Some participants mentioned that they did not have an SMS bundle enabling them to reply, despite the fact that we sent them a monthly bundle. The fact that a few participants experienced stigma and had disclosure concerns, was expected. This finding is consistent with studies in South Africa, Kenya and Uganda that showed that some participants had concerns about the privacy of SMS[14,26,27] 2 participants withdrew consent during follow-up and 5 others could not be traced anymore at the end of the study. This is a common problem in resource-limited settings where there are challenges of retaining pregnant and breastfeeding women in care.[24,28,29]Many pregnant women discover their positive HIV status during pregnancy and are worried to disclose their status to their husbands or others.[27]

Our findings are in line with other studies showing that receiving SMS reminders might be intrusive. For example, Rashmi et al. in South India have recommended that weekly SMS should be sent at a time that is convenient for participants to reduce intrusion.[11] In this study, participants indicated that being aware that their adherence to medication was monitored, motivated them to adhere better. Similar to our study, participants mentioned that knowing someone caring for them by reminding them of the intakes, helped them to be adherent. The study of Mushamiri et al [30] found high response rates to reminder and question SMS in the first 3 months, but a clear decline in response rates thereafter. This suggests that participants may get used to SMS messages and ignore responding to the text despite being adherent.

This study has several limitations. First, the focus of the study was on technical feasibility and experience of users which both showed positive results. This means we cannot draw any formal conclusions regarding adherence to treatment. Also, the level of adherence was based on the reply-SMSs, which is indirect and self-reported. We are not sure if the percentages of 'Yes'-answers are a true rep-

resentation of adherence, as we did not measure accuracy through pill counts, questionnaires, direct measurements of drug concentrations, or with virological outcome. Despiteour study design not being optimal to relate "Yes responses" to true drug adherence, the study may provide some indication of self-reported adherence. As such SMS may, to a certain extent allow monitoring of adherence, although adaptations to the program is likely needed.Another limitation is that only women who own a mobile phone were enrolled. This means that WLHIV without a mobile phone were excluded. Therefore, the results cannot be generalised to WLHIV without a phone, who may have different characteristics such as living in rural areas, low socio-economic status and high illiteracy. In future studies, mobile phones may be supplied by adherence programmes.

One strength of our study is that it included so called interactive 2-way text messaging which encompasses receiving replies from participants and automated SMS sent back to participants. Another strength is that we were able to send the SMS content in local language that is understood and spoken by the vast majority of participants in contrast to several previous studies. Furthermore, the costs of the SMS program in terms of infrastructure investment were low. The sending of automated reminder SMS to 25 participants cost less than 2 US dollars per month. Also, being automated, we managed to decrease the burden on nurses by not having to involve them to send SMS to participants.

Based on our study, we recommend examining whether more neutral messages will trigger medication intake while not disclosing the HIV status. For instance, instead of the standard message 'Did you take your medication', we could ask 'did you do as recommended?' Furthermore, it is important to investigate whether the SMS program will really improve adherence in our setting. Therefore, clinical trials are needed to investigate the effect on adherence and implementation studies are needed to examine the effectiveness of the program in a real-world setting. WLHIV who will use the SMS program, whether it is in the context of a study or as part of regular care, should receive proper explanation about the SMS and its contents. Only in that way, they can make a well-informed decision whether to make use of the SMS reminders. WLHIV who are worried about unwanted disclosure can decline using it.

CONCLUSION

We found that it is technically feasible and acceptable to the majority of pregnant and breastfeeding women living with HIV to receive SMS to remind them to take their medication. There were a few women who expressed concerns about their privacy and were afraid that receiving the messages could lead to unwanted disclosure of their HIV status. Understanding and addressing such potential barriers and challenges will be crucial for researchers and policy makers to improve the design of future studies involving SMS and their successful implementation in practice. Moreover, further investigation of the impact of SMS on adherence to ART in other groups living with HIV is recommended.

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ORIGINAL ARTICLE

Task sharing and performance of Caesarean section by the Assistant Medical Officers in Tanzania: What have we learned?

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ABSTRACT

Background: Since the 1960s, Tanzania adopted the task shifting which was later termed task-sharing strategy in efforts to address the critical shortage of health workforce. However, poor maternal health indicators have remained a big challenge despite this strategy having introduced mid-level cadres (Assistant Medical Officers) capable of performing roles that otherwise were performed by doctors at the district level.

Objective: To analyse lessons from the performance of Caesarean section by Assistant Medical Officers (AMOs) in Tanzania as part of the task sharing strategy.

Methods: An exploratory qualitative case study was carried out where 10 key informant interviews with AMOs and 4 focused group discussions with AMO trainees were conducted in 4 selected districts and 2 AMO training schools in Tanzania. With the aid of Nvivo10 qualitative software, content analysis was performed to the gathered data.

Results: Performance of the Caesarean section by the AMOs is motivated by the support from various stakeholders towards improving the performance of Caesarean section. Frustrating work environment and poor incentive system are major demotivators to the performance of the Caesarean section by the AMOs.

Conclusions: More than 5 decades since the introduction of AMOs through task sharing, the performance of caesarean section by these cadres face more demotivators than the motivators. Efforts should be focused on improving the work environment and provision of appropriate incentives to the AMOs. Also, more stakeholders should be engaged to support the performance of caesarean section by the AMOs for realisation of the objectives of task sharing strategy.

BACKGROUND

Task sharing formerly known as task shifting is the name given to the process whereby less specialised health workers takes on some of the responsibilities of more specialised workers in a cost-effective manner without sacrificing the quality of care [1]. Task sharing may also involve the delegation of some delineated tasks to newly created cadres of health workers who receive specific competency-based training[1]. ask sharing in Tanzania dates back to 1930s when the country established non-clinician physician cadres to work as physicians due to a critical shortage of properly trained physicians. It is from this evolution that the country introduced the Assistant Clinical Officers, Clinical Officers and Assistant Medical Officers training programs in the 1960s[2]. In Tanzania similar to many other countries, much focus on task sharing has been in maternal health and HIV/AIDS[3,4]. This is due to the high maternal mortality and HIV/AIDS burden in many countries that are suffering from the critical shortage of Human Resources for Health (HRH) since the 1960s[1,5,6]. However, despite the global efforts geared towards task sharing in even after the Alma Ata declaration which emphasised the need for urgent action by all governments, all health and development workers, and the world community to protect and promote the health of all people[7]; maternal deaths have remained unacceptably high. Estimates show that by 2015, the global annual maternal deaths stood at 302,000[8] with 99% of these deaths occurring in low and middle-income countries. Sub-Saharan Africa (SSA) contributed to 66% of the-

se deaths with the highest maternal mortality ratio of 546 per 100,000 live births[8].

Tanzania is among the countries with high maternal mortality in the world[9]. Despite Tanzania making progress in addressing the Millennium Development Goal number five (MDG-5), to improve maternal health; witnessed by increasing antenatal clinic visits from 96% to 98%; and from 43% to 51% for women making at least 1 of the 4 recommended visits respectively[10]; and the reduction of maternal deaths from 578 to 432 per 100,000 live births between the 1990s and 2015[11]. However, there has been a sudden increase in maternal deaths to 556 per 100,000 deaths in 2016[10]. The latter is contrary to the increased number of women who delivered under the supervision of a skilled attendant that rose from 51% in 2011 to 64% in 2015[10]. The high maternal mortality ratio does not only questions the functioning of task sharing but also threaten the progress of Tanzania in attaining the Sustainable Development Goal Number Three (SDG-3). The SDG-3 is about improving the health and wellbeing of the people. One of its targets is to reduce the global maternal mortality ratio to less than 70 per 100,000 live births by 2030.

High maternal deaths in Tanzania is attributed to; weak health infrastructure, limited access to quality health services including Caesarean section deliveries, shortage of skilled health providers, weak referral systems and weak health management at all levels[12].

One of the backbones for the reduction of maternal mortality is the existence of a skilled and motivated workforce that is capable to diagnose and perform Caesarean section when needed. To ensure improved access to Caesarean section services, Assistant Medical Officers (AMOs), a cadre that was introduced in 1963 as part of task shifting strategy are equipped to perform Caesarean section deliveries and perform other similar roles as those performed by the medical doctors at the district level[2]. Furthermore, on-job training by different stakeholders have been provided to the AMOs on Comprehensive Emergency Obstetric and Newborn Care (CEmONC). The CEmONC interventions include safe blood transfusion, providing oxytocin and antibiotics, performing Caesarean sections, manual removal of the placenta, assisted vaginal delivery, abortion and resuscitation of the newborn[13].

However, despite having about 1,700 AMOs in the country as of 2010, access to Caesarean section deliveries has remained low. The average Caesarean section deliveries rate stands at 4.5% with a disparity of 3.2% in rural and 9.3% in urban areas[14]. While many studies have focused on assessing the unmet obstetric needs and the causes of high MMR[15–18], little is documented on the lessons learnt in the implementation of task sharing policy for reduction of maternal mortality in Tanzania. This study analysed lessons from the performance of Caesarean section by Assistant Medical Officers (AMOs) in Tanzania as part of the task sharing strategy.

METHODS

An exploratory qualitative case study was conducted in 4 districts of Tanzania mainland from 4 regions that are located in 4 of the seven geographical zones of the country (table 1). These Districts are; Handeni from Tanga region in the Northern zone, Kilombero district from Morogoro in the Eastern zone, Masasi from Mtwara region in the Southern zone, and Kasulu from Kigoma region in the Western zone (fig 1). These regions were selected because of their variations in women's access to Caesarean Sections and their performance of Caesarean sections[10]. Specifically, data collection was conducted in 4 Districts hospitals and 2 upgraded health centres that were supported by the Word-Lung Foundation and 2 AMO schools between September 2015 to February 2016. Selection of health facilities considered the type of the health facility, type of ownership (Government or Faith-Based Organization ownership) and rural-urban dichotomy.

FIGURE 1. Study sites and AMO training schools in Tanzania

Source: Adapted and inked of a map from http://ontheworldmap.com/tanzania/tanzania-regions-map.html

Study Participants

This study involved AMOs practising at the 4 study districts, a retired AMO and AMO trainees from 2 purposefully selected AMO training schools. The practising AMOs were purposefully selected to include those in the management position at the health facility, those performing surgery and those who have served for more than 10 years. For those in the management position, we aimed at capturing their experiences on the availability of equipment and supplies, experience on the referral system and incentives to the AMOs for the performance of Caesarean section. For the practising AMOs, we aimed at capturing their experiences on the

performance of the Caesarean section. For the retired AMO, we aimed at capturing the experience of the AMOs training as it has evolved with time. For the AMO trainees, we aimed at capturing their experience on the training of AMOs regarding the performance of the Caesarean section. The AMO trainees involved randomly selected participants to participate in a Focus Group Discussion (FGD) among those who were available during the days of this study. All the participants for the FGD were in the second year of training.

Data Collection

Ten (10) Key Informant Interviews (KIIs) were conducted with 9 practising AMOs and one retired AMO in the 4 zones. Each KII was carried out in the office of the key informant. The interview lasted between 50 and 100 minutes. Further, 4 FGDs with AMO trainees were conducted, 2 with females and 2 with males. 2 of the FGDs were conducted at Bombo AMO School and the other 2 at St. Francis Ifakara AMO School. The number of participants in each FGD ranged between 7 and 12. A total of 35 AMOs trainees participated in the FGDs. The FGDs lasted between 55 and 120 minutes. A researcher and a research assistant who assisted with note taking and recording of discussions moderated each FGD. Both the KIIs and FGDs were audio-recorded with permission of the participants.

The KIIs and FGDs were conducted by researchers with varying experience in conducting qualitative studies in maternal health ranging from 5 to 15 years. The research team included a nurse-midwife, a medical doctor with training in health systems and a sociologist. The researchers were assisted by trained experienced research assistants with a background in nursing and social sciences.

Semi-structured interview and FGD guides that were developed in collaboration with members from Averting Maternal Deaths and Disabilities from Columbia University, Traction, Eastern, Central and Southern Africa Health Community and the 4 country teams (Kenya, Tanzania, Uganda and Zambia) were used for data collection. These tools were guided by 8 thematic areas of; policy and regulations, human resources management, training, skill mix, referrals, stakeholders and professional associations and infrastructure, medical equipment and supplies. The tools were interpreted into Kiswahili language before being used.

Data Analysis

Interviews and FGDs transcripts were transcribed verbatim. The Kiswahili transcripts were then translated into English to ensure that data is accessible to non-Kiswahili speaking colleagues from TRAction. A codebook containing the domains under study that was developed before the data collection process was used to guide the initial coding process. From the study findings, the codebook was enriched and updated to include sub-domains and updated domain definitions. The final codebook was structured into 24 domains that originated from the major 8 domains of this study. In the beginning, the research team read and re-read the transcripts to familiarise with the data before the coding process. The team met together where each one coded at least 2 transcripts and met together to discuss the codes and coding process for harmonisation or clarification and finally agreed on the final codes. 2 separate researchers coded at least one transcript. After agreeing on the codes and coding process, the team distributed the transcripts among each other for the coding process. All the coded transcripts were then organised by using NVIVO10 qualitative analysis software by QSR international.

From the reproduced reports from the NVIVO, the research team subdivided the domains to one another for analysis. Qualitative content analysis was used to guide the analysis. Codes were extracted from the reduced meaningful unit and wrote across the margins. Through comparison, checking, and rechecking of similarities and differences between the sub-categories, the sub-categories were sorted to form categories to reflect the manifest content of the text. The final codes and categories were agreed upon among the team and the findings were presented with the support of succinct quotes.

Ethical Considerations

Ethical approval was obtained from the Senate Research and Ethics Committee of the Muhimbili University of Health and Allied Health Sciences (Ref. No. 2015-06-09/AEC/Vol. IX/103). Permission to conduct the study in the 4 study settings was granted by the Ministry of Health, Community Development, Gender, Elderly and Children. Written informed consent was obtained from each participant after receiving explanations about the study aims and they were informed that their participation was purely voluntary and they were free to decline or withdraw at any time in the course of the study. Participants' privacy was assured by not using their names during the data collection process and any of their identity in reports or publications. Special permission was requested for on the use of an audio recorder during interviews and discussions.

RESULTS

From the analysis of the KIIs and FGDs 3 categories emerged; unfavourable working environment at the health facilities, poor incentive system and support towards improving the performance of Caesarean section by AMOs. The 3 categories (Table 2) were further grouped into 2 major themes; motivations for the performance of Caesarean section by AMOs and the de-motivations for Caesarean section performance.

TABLE 1: Socio-demographic characteristics

Zone	Regions
Central zone	Dodoma and Singida
Eastern zone	Coast, Dar es Salaam and Morogoro
Lake zone	Kagera, Mara, Mwanza, Shinyanga, Simiyu and Geita
Northern zone	Arusha, Kilimanjaro, Manyara and Tanga
Southern zone	Lindi and Mtwara
Southern highlands	Iringa, Mbeya, Ruvuma, and Njombe
Western zone	Katavi, Kigoma, Rukwa and Tabora

Motivations for the Performance of Caesarean Section by AMOs

Informants revealed the existence of some motivations for the performance of the Caesarean section by the AMOs. These included; recognition of the work done by AMOs by higher authorities and other stakeholders, contextualised incentives to AMOs in some places and the stakeholders support to AMOs training, mentoring and improving the working environment for the performance of Caesarean section.

Recognition of the work done by the AMOs by Higher Authorities and Other Stakeholders

Recognition of the work done by AMOs by the ministry of Health and other higher government authorities was stated by the AMOs to motivate them to perform better. They added that the acceptability and continued engagement of their association that had been established in 2012 in matters pertaining delivery of health care services by the government and other stakeholders was a sign that they are recognised and supported.

"…We work hand in hand with the ministry of health, we are invited in many meetings and conferences, and this was not there before…we are happy when we see that there are people out there in power who recognise our work…this makes us work more and more…" [KI-Kigoma]

Contextualisation of incentives to the AMOs

In some places, informants stated that regardless of the financial crisis communicated by their immediate bosses, yet the councils had devised some top-up allowances in addition to the documented allowances. They mentioned some of the documented allowances to be on-call allowances and extra-duty allowances. They further added that the top-ups included; provision of soft loans for building houses to the AMOs and transport allowances. They stated that these financial incentives were motivating them to stay and to work hard as they felt that they were valued.

"…I feel good to be here, although not every time I receive the top-up allowances, I can say most of the time I receive transport allowance. …. I am aware that in some neighbour districts, they receive also housing loan, it is a good thing. I heard some of our leaders here discussing the possibility of introducing housing loan as an incentive in our district as well… …this makes us feel valued and thus perform more…." [KI-Morogoro]

Stakeholders' support to AMOs training, mentoring and improving the working environment

From 2 regions out of the 4 regions under this study, we were informed that they were receiving the support from an NGO that was carrying out training on (CEmONC) to AMOs and nurses and facilitating post-training supportive supervision, the World Lung Foundation (WLF). They added that WLF carried supportive supervision to AMOs and other cadres involved in skill mix for emergency obstetrics care. In that system, WLF did; training, coaching, mentoring and provided equipment that were necessary for carrying out Caesarean section.

"…One NGO [mention the name] come with their gynaecologists, anaesthetist and nurses, we work with them and they help us with the difficult cases that we had prepared because they always inform us before their arrival…" [KI-Kigoma]

In some places the NGO supported the performance of Caesarean section through; provision of equipment and other medical supplies and improving the infrastructure like operating theatres. This support not only helped to improve the performance of the Caesarean section but also made the AMOs to be motivated in their work. Respondents expressed their satisfaction and gratitude to partners' support in this activity.

"…As I mentioned earlier, we are so grateful to [mention an NGO] for their support, they help us with medication, equipment every 3 months, and they do service for theatre equipment after every 3 months, thanks to their support we do not have a shortage of theatre equipment anymore except the drugs that are used and run out of stock…" [KI-Morogoro].

De-motivations for Caesarean section performance by AMOs

From the interviews, informants stated the existence of demotivation that jeopardise Caesarean section performance. 2 categories emerged from participants' narratives regarding de-motivations for Caesarean section performance; these were; frustrating work environment and poor incentive system.

Frustrating work environment

Participants reported frustrating work environment for the performance of Caesarean section. The frustrating work was attributed to; underequipped health facilities, limited capacity for effecting the referral of patients from lower-level to higher-level facilities, supervision limited to managerial instead of technical support and a critical shortage of staff for skill mix.

Under-equipped health facilities

Informants stated that most of the health facilities at the districts were grossly under-equipped to an extent that the effective performance of the Caesarean section was jeopardised. The health facilities suffered from; shortage of medical supplies, shortage of theatre equipment like cardiac monitors, dilapidated building, shortage of water supply and necessary drugs for carrying the Caesarean section. Absence of these necessities not only hijacked the performance of Caesarean section but also acted as a de-motivator to the AMOs in Caesarean section performance.

"… There are shortages of equipment, instruments, and medicines are not enough. …. Some days we have anaesthesia drugs, and other days we do not. Especially these spinals (anaesthesia) are not enough, it causes problems. We don't have Anaesthesia machine, what we use is a small machine for blood pressure …" [KI-Kigoma]

Limited capacity for effecting the referral of patients from the lower level to higher-level health facilities

Participants reported lack of ambulances at the health centres for effecting smooth referral of the patients. The

TABLE 2: Summary of Findings

De-motivations for Caesarean section performance by AMOs	Motivations for the performance of Caesarean section by AMOs
Frustrating work environment	**Support towards improving the performance of Caesar ean section by AMOs**
• Underequipped health facilities • Limited capacity for effecting the referral of patients from the lower level to higher-level facilities • Supervision limited to managerial instead of technical support • The critical shortage of staff for skill mix	• Recognition of the work done by AMOs by higher authorities and other stakeholders • Contextualised incentives to AMOs in some places • Stakeholders support to AMOs training, mentoring and improving the working environment
Poor incentive system • Lack of clear career path for AMOs • Variation in support for AMO training • Overburdened AMOs in a situation of less compensation and often delayed	

reason of lack of ambulances varied across the 4 councils, in 2 councils, the vehicles were old and when taken for repair they were never sent back to the health centres but instead they were assigned to other activities at the council level. In the 3rd council, the ambulance was there at the health centre, however, there was money to fuel it, while in the 4th council, the vehicle was broken after an accident and there was yet not enough money to fix it. Participants added that lack of ambulances was a barrier for successful referral of women with complicated labour to the referral health facilities for comprehensive obstetric care.

"...Previously every health centre had a vehicle and it was easy for patients around that area but it was taken by the district because there are other activities in the district and there is no vehicle there, so they decided to take those cars from health centres and assigned them to other activities... In this district council, there are 3 health centres. I do not think there is any car in any of these health centres ..." [KI-Mtwara].

In another place, participants reported lack of fuel as hindrance to ambulance operation and therefore women had to incur the cost of fuel for them to be transferred to the referral health facility for adequate obstetric management:

"*... Sometimes the ambulance has no fuel so we have to ask the women/relatives to pay for the fuel for them to be taken to the referred hospital..."* [KI-Tanga]

Supervision limited to managerial instead of technical support

Participants reported that during supportive supervision, they expected to also receive technical support that was lacking. The current routine supportive supervision by the council's health management teams was primarily focusing on managerial issues. For the AMOs the technical competencies were important for them to effectively perform the Caesarean section rather than the managerial competencies.

"*…they come to observe our performance and identify our problems but they don't work with us unlike the (mention an NGO) people who come with their gynaecologists, anaesthetist and nurses, we work with them and they help us with the difficult cases ...."* [KI-Morogoro]

Critical shortage of other health workers needed for caesarean section delivery

From all the 4 study districts, informants stated the existence of a critical shortage of personnel who work hand in hand with AMOs in Caesarean section delivery. In 3 out of the districts, anaesthetists were not available and their roles were delegated to medical attendants or clinical officers who received a 4 months' short course on anaesthesia. In some places, there was a critical shortage to an extent that laboratory technicians were opted as assistant surgeons during caesarean section delivery.

"... You need at least 4 people for a Caesarean section. However, here we have a serious shortage; sometimes we even use people from the laboratory as assistant surgeons or circulating nurse. I am the only surgeon and have only one anaesthetist and she is my assistant surgeon..." [KI-Kigoma]

Poor Incentive System

Participants reported the existence of varying incentives from some incentives to lack any form of incentive across the 4 districts. The informants revealed; absence of clear career path for AMO cadre; varied financial support to the AMO trainees, lack of scholarships and limited financial incentives for AMOs.

Lack of clear career path for the AMOs

Informants of this study stated that becoming an AMO was like going to the end of one's career. Although some universities admitted AMOs for the Doctor of Medicine degree, participants stated that it was very hard for the AMOs to survive the competition with fresh graduates from high schools. They further added that Medical schools provided very few slots for the AMOs and other equally qualified clinical officers to compete for admission to the doctor of medicine programme.

"... Imagine, you trained for 3 years to become a clinical officer, you worked for at least 3 years before joining AMO program which is 2 years... You need 5 years to become a medical doctor. That is like saying you need 13 years to acquire a degree. That not being enough, to be admitted, you are subjected to stiff competition with fresh graduates. ... Indeed, becoming an AMO is like a dead end in your career..." [KI-Tanga]

Variation in support for AMO Training

Focused group discussion with AMOs trainees revealed that there was a big variation in financial support to the training of AMO students across the districts. While some districts fully supported their Clinical Officers to join the training, some did not support at all. Some FGD members reported having received partial support (covering full tuition fees and stationeries, or half tuition fees and full stationeries or tuition fees without stationeries or stationeries without tuition fees). Another group reported having received full support (full tuition fees and stationeries) and the last group reported to have not received any kind of support from their districts.

"...When we were about to go for studies, our employer told us that it was upon ourselves to pay for our studies or not to join the studies. That has been the situation to now. I and colleague from the same district we pay for our studies...." [FGD Member no.10 Male group]

Another FGD member lamented that regardless of the promise of support, that support was never provided.

"... I am getting just words of support from my bosses that I will be given stationeries, but since when I came here now is my final year, I have not seen that support for stationeries..." [FGD Member no. 2 Male group]

For some AMO trainees who were not receiving any form of financial support from their districts, they complained that even moral support was not there. They added that it was difficult for them to leave their workplace for AMO training.

"... I am giving an example from my own experience because I was harassed very much. There was a lot of disturbance when I applied for studies, I was told that I do not qualify and after all, the cadre is not needed. This happened while I had already got my admission letter...it took much effort until I was released to come here to study without a single penny of support..." [FGD Member number 1, Female Group]

Overburdened AMOs in a situation of less and often delayed compensation

From interviews, the AMOs explained that there was reported limited financial capacity at the districts. They added that the latter resulted into; failure of some districts to provide financial incentives or delayed payment of the financial incentives. Furthermore, the AMOs reported that with the severe shortage of health workers, they had to work for extended hours to ensure that services are not interrupted. However, they complained that regardless of this labouring, they were not compensated accordingly, and even the little compensation sometimes was seriously delayed.

" *.... there has also been a problem with motivation to work for example; there are few workers and sometimes they are required to work extra hours but the extra hours' allowances are not given accordingly...for instance now, the last allowances were paid 3 months ago..."* [KI-Kigoma]

DISCUSSION

We aimed to analyse lessons from the performance of Caesarean section by Assistant Medical Officers (AMOs) in Tanzania as part of the task sharing strategy. From the findings of this case study, we have found that the performance of the Caesarean section by the AMOs is motivated by the support from various stakeholders towards improving the performance of Caesarean section by the AMOs. Frustrating work environment and poor incentive system were found to be the demotivators for the performance of caesarean section by the AMOs.

The motivations revealed by this study are similar to what is documented by other studies with regards to the motivation of health workers in Tanzania[19,20]. Recognition of the performance of the AMOs as found in this study is in line with prominent human resources motivation theories[21–23]. The latter reveals that when an effort is recognised, it leads to more efforts that result into increased performance. The AMO cadre since its introduction has been the backbone of health care service provision at the district level where there is a critical shortage of medical doctors[24]. Recognising their efforts by higher authorities as revealed by this study is in line with the Vroom's expectancy theory of motivation[21]. According to Vroom, recognising the efforts of the workers tend to increase their performance. The authors feel that by recognising not only the contribution by AMOs but of all the workers in the health sector may have positive outcomes in reducing the maternal mortality in this country that are still unacceptably high[10].

Provision of housing or housing allowances and or in this case loans for building houses is retention strategy used in many parts of the world for retaining health workers in rural and remote areas[25–27]. Although the latter strategy was not found to be universally implemented in all the study districts, our findings have revealed that in the places where it was implemented, AMOs were motivated. Motivation is closely linked to the retention of health workers[28]. The reduction of maternal mortality among other things requires the retention of AMOs and other cadres required for skill mix in the district health system. Performance of Caesarean section delivery is a product of teamwork that requires the availability of a surgeon (in this case, the AMO), a nurse, a midwife, an anaesthetist, an assistant surgeon and a lab technician. Existence of the stakeholders on improving the performance of Caesarean

section conform to what was documented by the global health initiative as a shared responsibility in ensuring the availability of adequate health workforce[29]. Stakeholders working together in improving the performance of the health workforce is a good sign towards the sustainability of the task sharing strategy in Tanzania. However, our findings point out that the donor-driven support through the NGOs as found in this study contradicts the aim of the government of reducing donor dependency syndrome in the health sector[30].

Frustrating work environment as revealed in this study is not unique to the AMOs in Tanzania. It is a crosscutting problem in the health sector in Tanzania as pointed out by other studies on health workforce retention in rural districts of Tanzania[31,32]. The latter stated that the working environment at the district health system was poor to an extent that health workers and health managers felt as if the government forgot them and were looking for opportunities to leave the districts.

Under-equipped facilities as found in this study is not facing AMOs in solitary. The latter situation equally challenges all other cadres at the district level and below. The situation revealed is similar to what Mbaruku et al [33] documented in a countrywide survey on health workers' dissatisfaction on working environment. In the latter study, Mbaruku reported that shortage of drugs and supplies was the most dissatisfying aspect of the work environment and it contributed to demotivation of the health workers.

Critical shortage of health workers for skills mix in Caesarean section delivery as revealed in our study, is not a new phenomenon and is not unique to the Caesarean section delivery, rather it is a chronic problem in the health care services provision arena in the health sector in Tanzania[34]. As for other parts of the world[27] the rural areas are the most affected places[35–37]. Shortage of health workers is recognised at global level as among the main challenges rendering under-performance of many health systems[38]. In sub-Saharan Africa where 66% of maternal deaths occur annually, at least one million new health workers are needed to rescue the current situation[39]. In Tanzania where the health system operates with less than 50% of the required health workforce, raising performance of the available overstretched health workforce is perhaps the immediate solution at hand as training and deploying new cadres is time consuming and costly.

The poor supervision system as revealed by our study is contrary to what the government advocates for on reduction of maternal mortality in Tanzania[11,12]. The government recognises that without adequate supervision the current MMR will not go down. Our findings are also in line with findings by study carried out in Ghana which indicated that good supervision was associated with improved maternal health outcomes[40].

Our study revealed limited career path, limited scholarships for AMOs training and limited financial incentives in overwhelmed burden of work as among the demotivators to the AMOs. The findings are similar to what other studies found in Tanzania with regards to the incentives in health workers performance[34,41–45].

Although offering career opportunity is well recognised by the ministry of health of Tanzania as an important non-financial incentive for motivating health workers especially in rural areas to stay and perform well, its implementation is challenged by scarcity of resources[34]. Experiences from South Africa revealed that offering career opportunities not only motivate health workers but also retain them in working places[46,47]. The scarcity of resources for offering financial incentives as documented in our findings is similar to what other studies documented in Tanzania[20,45,48]. The latter is similar to what Dambisya documented in a study in the Eastern, Central and Southern Africa. In the latter study, Dambisya stated that many countries of Eastern, Central and Southern Africa have many written good financial incentives but its implementation is jeopardised by their limited financial resources[49].

Methodological Consideration

We discussed the methodological considerations by first discussing the trustworthiness of the findings and then the study limitations. Trustworthiness is attained in a qualitative study when the findings of such a study are worth believing[50]. Four (4) criteria are used to assess the trustworthiness of a qualitative study; credibility, dependability, transferability, and confirmability[51]. The credibility of the findings of this study was enhanced through the triangulation of informants with experiences and rich information on the study questions. In order to enhance the credibility and dependability of this study, we used triangulation of data collection techniques, study settings, and researchers. Data were collected using interview guides and a focus group discussion guide in 4 different zones with different cultural and socio-economic activities. In order to confirm that the findings reflected informants' perspectives rather than the researchers' understanding of the question under study, categories were inductively generated using content analysis and presented with the support of sub-categories and quotes. The transferability of the findings of this study is enhanced through the description of the study setting, context, data collection process, and analysis.

The findings of this study are subject to the following limitations. First, the fact that health workers (medical doctor, midwife) were involved in conducting the interviews, might have introduced social desirability from the participants. However, the triangulation of informants, setting and having research assistants with social sciences background offset this limitation. Second, only 4 districts were involved and in a few selected facilities, this may have left out other variations of experience from the remaining part of the country uncovered. However, the involvement of the different categories of informants add richness to this study and enhance the applicability and the truth value of these findings. Third and last, this was a qualitative study and thus only a few selected informants were interviewed. The latter has the magnitude of motivations and de-motivations uncovered. However, this study provides insights into the situation at the districts and may set for a bigger study to address the health workforce performance challenges at the districts. Involvement of the terrain from the district hospital to a dispensary offset the latter limitation. It should be noted that the findings of this study reflect the situation during

the period when data collection for this study was done.

CONCLUSION

Our findings underscore that improving the performance of Caesarean section delivery by the AMOs as a task sharing strategy is surrounded by motivators and de-motivators which are linked to their training and workplace. Improving work environment and appropriate incentives, both financial and non-financial are necessary for addressing the demotivators for the performance of Caesarean section delivery by the AMOs. Joint stakeholders' efforts are key in the realisation of the latter as massive investments are needed. For smooth implementation of task sharing and thus help in reducing the maternal mortality, measures must be instituted to ensure availability of all necessities.

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ORIGINAL ARTICLE

Factors and Causes of Puerperal Sepsis in Kilimanjaro, Tanzania: A Descriptive Study among Postnatal Women who Attended Kilimanjaro Christian Medical Centre

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ABSTRACT

Background: Puerperal sepsis is the major cause of maternal morbidity and mortality worldwide. About 94% of maternal mortality occur in low and middle-income countries including Tanzania.

Objective: To estimate the prevalence, document factors and causes of puerperal sepsis among postnatal women who attended postnatal care in Kilimanjaro Christian Medical Centre Hospital in the year 2015.

Methodology: A descriptive cross-sectional study was carried out at Kilimanjaro Christian Medical Centre, Tanzania. A total of 183 medical records of attendance in 2015 were used for the study. Information about the isolated organism in culture was retrieved from the Laboratory Information System.

Results: The prevalence of puerperal sepsis was 11.5% (21/183). The most common factors and causes of puerperal sepsis included caesarean section 66.7% (14/21), postpartum haemorrhage 57.1% (12/21), moderate to severe anaemia 61.9% (13/21), prolonged labour 76.2% (16/21) and bacterial infection 90.5% (19/21). The difference was significant at p<.05. The most bacteria species isolated among women with puerperal sepsis was Staphylococcus spp 50.0% (7/14), Escherichia 28.6% (4/14) and Streptococcus spp 21.4% (3/14).

Conclusion: Puerperal sepsis is prevalent (11.5%) at Kilimanjaro Christian Medical Centre. *Staphylococcus spp* was found to be a predominant isolate which causes puerperal sepsis followed by *E. coli* and *Streptococcus spp*.

BACKGROUND

Puerperal sepsis is the major cause of maternal morbidity and mortality worldwide while about 94% of maternal mortality occur in low and middle-income countries.[1] Puerperal sepsis is among the preventable conditions in all settings.[2] World health organization (WHO) defines puerperal sepsis as infection of the genital tract occurring at any time between the onset of rupture of membranes or labour and the 42 days (6 weeks) after delivery in which 2 or more of the following are present: pelvic pain, fever, abnormal vaginal discharge, abnormal smell/ foul odour discharge or delay in uterine involution.[3] Puerperal sepsis causes 10.7% of maternal deaths and it is one of the 5 common causes of maternal mortality worldwide.[4] Despite major advances in postnatal care, puerperal sepsis remains a common and potentially preventable cause of direct maternal death.[5–8] Risk factors for puerperal sepsis include retained products of conception, chorioamnionitis, pelvic abscess, and wound infection are the common causes for severe puerperal sepsis and septic shock in pregnancy and puerperium.[5]

It is reported that major consequences of puerperal sepsis are chronic or acute pelvic inflammatory disease, bilateral tubal occlusion and infertility.[9,10] After delivery there is susceptibility to invasion of the birth canal by microorganisms for several days which may lead to occurrence of puerperal sepsis when there are births in unhygienic conditions, prolonged rupture of membranes, prolonged labour, postpartum haemorrhage and when vagina examination is done frequently during labour i.e when examinations are done more than 5 times.[11]

Puerperal sepsis is evidenced with clinical signs such as fever above 38°C, pelvic pain, delayed reduction of the uterine size and smelling vaginal discharge.[9,12] Most puerperal sepsis is due to infection of the genital tract by pathogens that colonise the cervix and vagina,

gain access to amniotic fluid and invade the devitalised uterine tissues.[13]. Bacteria that cause puerperal sepsis includes, *Streptococci* spp, *Staphylococcus* spp, *Escherichia coli*, *Clostridium tetani, Clostridium welchii, Chlamydia* spp and *Gonococcus* spp.[13] Moreover, several studies reported the common aetiologies for puerperal sepsis, including *Klebsiella* spp, *E .coli*, *S. aureus*, *Pseudomonas* and *Enterococci*.[14–18]

In Tanzania, few studies have been conducted on puerperal sepsis. The findings have registered a varied puerperal sepsis prevalence ranging from 20% to 30%.[19,20] These two studies have been done in Dar Es Salaam. A previous study done in Mwanza reported a prevalence of 38.9%.[21]. In the year 2015, the average national puerperal sepsis prevalence in Tanzania was 29.7%[22] which is twice as much as the global puerperal sepsis prevalence which is estimated to be 11%.[23]. To this end, it is therefore important to estimate the prevalence, document factors and causes of puerperal sepsis among postnatal women at Kilimanjaro Christian Medical Centre (KCMC) hospital. The information will help to establish baseline information and identify the gap that can be used during intervention and control of puerperal sepsis. Scarcity of information regarding puerperal sepsis has led to negligence of puerperal sepsis whilst increasing incidences of maternal mortality. The research questions is "what are the factors and causes of puerperal sepsis among postnatal women?".

METHODOLOGY

Study Design and Area

This was a descriptive cross-sectional study conducted at KCMC hospital. KCMC is referral hospital located in Kilimanjaro region, Tanzania. Kilimanjaro region is found at the foothills of Mount Kilimanjaro, (www.kcmc.ac.tz). The region has a population of 1,640,087, with average annual population growth rate of 1.8 %, Fertility Rate (TFR) for Kilimanjaro Region is 4.3 (Adjusted) persons per woman in 2013 and Child-woman ratio of 0.46, maternal mortality rate in Kilimanjaro is 492.1/100,000 live births.[24,25]

The Department of Obstetrics at KCMC serves as a zonal referral centre for complicated obstetric patients. The hospital has an average annual delivery of 3,300, of which 33% are caesarean deliveries. The labour ward has 4 beds partitioned along the sterile room, with the sterile corridor serving for the extras. There are two operating theatres along the labour ward used for caesarean section services and other obstetric surgical emergencies.[25]

Sample Size Estimation

The sample size for this study was calculated using the following formula $n=z^2pq/d^2$. In this equation, n is the sample size, z is the value of the Standard Normal Distribution at 5% level (1.96), p is the prevalence, $q=1–p$, and d is the precision level (0.05). The prevalence of puerperal sepsis is 12%.[26]. Sample size=$1.96^2*0.12*(1-0.12)/(0.05)^2$. The sample size was 178+10%=183.

Sampling Techniques and Inclusion/Exclusion Criteria

A systematic sampling technique was used to select the files. The hospital has annual delivery of 3,300, a list of all deliveries in 2015 was requested from the KCMC medical records department. The sampling interval was after every 18th delivery. The study included patient files from January 2015 to December 2015, patients who visited KCMC hospital for obstetrics and gynaecology services. All files with incomplete information were excluded from the study.

Data Collection Method

Data was collected from the Medical Record Department. Information about isolated causative organism was retrieved from the Laboratory Information System. All required data relevant for the study was recorded using a constructed data extraction sheet. Demographic information such as age, marital status and residence were recorded. Other information such as Haemoglobin level, postpartum haemorrhage, prolonged labour, diabetes, HIV status, mode of delivery and type of bacteria isolated were collected.

Data Analysis

Data was collected and entered in an excel sheet. Quantitative data was analysed using Statistical Package for Social Science (SPSS) version 22 software (SPSS Inc., Chicago, IL, USA). Descriptive statistical analysis was done to test the effect of each factor on the outcome. Chi-square ($\chi 2$) was used to compare categorical data while Fisher's exact test was used in cases when expected counts were less than 5. A P-value $<.05$ was considered statistically significant.

Definitions

Mild anaemia was defined as haemoglobin concentration <11.0-11.9 g/dl. Moderate to severe anaemia was defined as haemoglobin concentration ≤ 10.9 g/dL.[27]

Ethical Consideration

Ethical approval was obtained from the Kilimanjaro Christian Medical University College Research and Ethics Review Committee (CRERC) with certificate number 2072. Privacy and confidentiality were ensured since the information from patients' file records is kept confidential. Patient names and their corresponding file numbers were not used but instead, individual files identification numbers were generated and used in the data extraction sheet.

RESULTS

Demographic Characteristics and Prevalence of Puerperal Sepsis

A total of 183 files were reviewed. Most of the participants 73 (39.9%) were aged between 26 and 35 years, with a mean (±SD) age of 30.63 (±8.08). The majority of participants were married 143 (78.1%) and 93 (50.8%) were residing in rural areas. Furthermore, 86(47%) were multigravid. The prevalence of puerperal sepsis was 11.5% (21/183) Table 1.

Bacteria Isolated as Causative Agent of Puerperal Sepsis

Among 21 patient files with puerperal sepsis, 14 had results of the isolated causative organism, 2 files had only report of gram stain (gram-negative rods) and 4 files had no record of any isolated organism. The most bacteria species (*spp*) isolated among women with puerperal sepsis was *Staphylococcus spp* 50% (7/21), *Escherichia* 28.6%

(4/21) and *Streptococcus spp* 21.4% (3/21). Figure 1

FIGURE 1. Common Isolated Bacteria as Causative Agent of Puerperal Sepsis

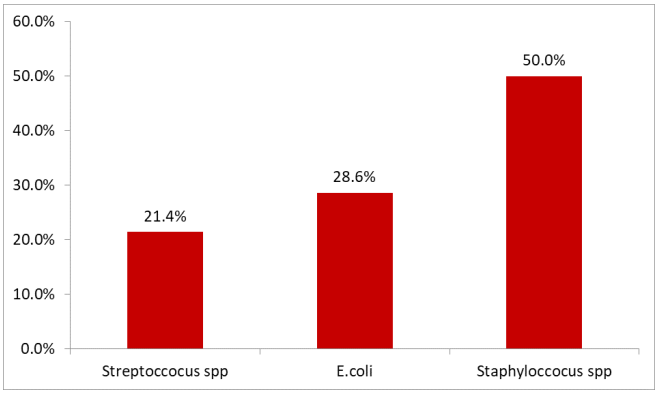

TABLE 1: Demographic Characteristics of the Participants (N=183)

Variable	Frequency(n)	Percent (%)
Age category		
17 – 25 years	55	30.1
26 – 35 years	73	39.9
36 – 48 years	55	30.1
Marital status		
Single	36	19.7
Married	143	78.1
Widow	4	2.2
Residence		
Rural	93	50.8
Urban	90	49.2
Parity		
Primigravid	66	36.1
Multigravid	86	47.0
Grand multigravid	31	16.9

Factors and Causes of Puerperal Sepsis

In this study, the most common factors associated with puerperal sepsis included mode of delivery (caesarean section), postpartum haemorrhage, moderate to severe anaemia, prolonged labour and bacterial infection. There was significant difference in puerperal sepsis proportions among women who had Spontaneous Vaginal Delivery (SVD) 33.3% (7/21) as compared to those with caesarean section 66.7% (14/21), χ^2 =18.49, $p=\leq.01$. Women who did not experiences Postpartum Haemorrhage 57.1% (12/21) were more frequent as compared to those who did not have 42.9% (9/21), χ^2=25.85, $p<.001$. The study found that more women with moderate to severe anaemia 61.9% (13/21) were having puerperal sepsis as compared to others, Fischer exact=8.40, $p=.01$. The study shows that puerperal sepsis were more prevalent among women who experienced prolonged labour 76.2% (16/21) as compared to those who did not experience 23.8% (5/21), χ^2=64.77, $p<.001$. Women with puerperal sepsis were more infected with bacteria 90.5% (19/21) as compared to other cause of infection 9.5% (2/21) such as *Candida spp*, χ^2=162, $p<.001$. Other factor such as age, residence, parity, pelvic infection during pregnancy, HIV status and Diabetes were not associated with puerperal sepsis, Table 2.

DISCUSSION

The study aimed to estimate the prevalence, document factors and causes of puerperal sepsis among postnatal women who attended postnatal care in Kilimanjaro Christian Medical Centre Hospital in the year 2015. The prevalence of puerperal sepsis was 11.5%. The findings are relatively comparable with two studies conducted at Muhimbili, Tanzania where the prevalence was 9.2% in 2011[28] and 11.2% in 2019.[14] As well as compared to a recent countrywide study which reported a higher prevalence of 16.7%.[29]

In the present study, 50% of commonly isolated bacteria were *Staphylococcus spp*. The results are higher than other reported findings at Muhimbili, Tanzania (22.7%)[14] and Sudan (39.5%).[16] The high prevalence of *Staphylococcus spp* as the cause of puerperal sepsis might be exogenous where pathogens from nearby skin flora or contact with contaminated non-sterilised instruments or frequent vaginal examination with unwashed hands.[30] Additionally, the current study did not go further to characterise the Staphylococcus at specie level, although *Staphylococcus aureus* is more expected than other species. However, in other settings, *Staphylococcus epidermidis* were isolated among women with puerperal sepsis in other settings.[30] Although, *S. epidermidis* is rarely reported but it is a significant nosocomial pathogen, patients may acquire infection when they have compromised immunity.[30]

The present study reports that *E.coli* (28.6%) as the second common cause of puerperal sepsis. This is similar to a study conducted in Harare, which reported *E.coli* as the commonest cause of puerperal sepsis.[15] A study conducted at Muhimbili also reported *E. coli* as one of the causes of puerperal sepsis, accounting for 27.3% of all isolates.[14] Variations in the proportion of the commonest bacteria as the cause of puerperal sepsis may be due to differences in the immune status of an individual or population of commensal bacteria.[31] Furthermore, the differences could be due to study design used, settings as well as variations in bacteriological culture techniques used.[2,32] It is recommended that in order to have proper infection control measures, it is required that there must be proper education, improvements of guidelines and various technologies and introduction of new clinical guidelines[33], and continuous improvement of all aspects of maternal health.[34]

In this study, various factor were associated with puerperal sepsis including mode of Delivery (caesarean section), Postpartum Haemorrhage, moderate to severe anaemia and prolonged Labour were statistically associated with puerperal sepsis. Mode of delivery was significantly associated with puerperal sepsis. Data shows that mothers who delivered by SVD were associated with

TABLE 2: Malaria Prevalence by Age Category

Variable	With Puerperal Sepsis (N=21) %(n)	Without Puerperal Sepsis (N=162) %(n)	Chi-square	P-value
Age category				
17 – 25 years	23.8 (5)	30.9 (50)	0.8	.6
26 – 35 years	38.1 (8)	40.1 (65)		
36 – 48 years	38.1 (8)	29.0 (47)		
Residence				
Urban	57.1 (12)	48.1 (78)	0.6	.4
Rural	42.9 (9)	51.9 (84)		
Parity				
Primigravid	28.6 (6)	37.0 (60)	1.03	.5
Multigravid	47.6 (10)	46.9 (76)		
Grand multigravida	23.8 (5)	16.0 (26)		
Mode of delivery				
SVD	33.3 (7)	77.8 (126)	18.49	≤.001
Caesarean section	66.7 (14)	22.2 (36)		
Postpartum Haemorrhage				
Yes	57.1 (12)	12.3 (20)	30.89	≤.001
No	42.9 (9)	87.7 (142)		
Anaemia				
Normal	33.3 (7)	57.4 (93)		.01*
Mild anaemia	4.8 (1)	12.3 (20)		
Moderate to severe anaemia	61.9 (13)	30.2 (49)		
Pelvic infections during pregnancy				
Yes	38.1 (8)	32.1 (52)	0.3	.5
No	61.9 (13)	67.9 (110)		
HIV Status				
Positive	9.5 (2)	3.6 (6)) -		.2*
Negative	90.5 (19)	96.3 (155)		
Prolonged labour				
Yes	76.2 (16)	8.0 (13)	64.77	<.001
No	23.8 (5)	92.0 (149)		
Diabetes				
Yes	4.8 (1)	1.2 (2)	-	.3*
No	95.2 (20)	98.8 (160)		
Bacterial Infection				
Yes	90.5 (19)	0.0 (0)	162	<.001
No	9.5 (2)	100 (161)		

*Fischer exact test, SVD: Spontaneous Vaginal Delivery

puerperal sepsis when compared to those delivered by caesarean section. The findings are different from a study conducted in Ethiopia[2] and Nigeria.[18] Moreover, this is different from a study conducted in Uganda, which reported that Caesarean delivery was independently associated with puerperal sepsis.[32] This is inconsistent with the study conducted in Ethiopia which reported that participants associated with caesarean section were more less likely to develop puerperal sepsis when compared to those who gave birth through SDV.[4] In this study, prolonged labour was associated to puerperal sepsis. This is in line with a study by Demisse *et al.*, which reported that participants who experienced labour for 12 to 24 hours and more than 25 hours were 3.1 and 4.7 times respectively more likely to develop puerperal sepsis as compared to those who experienced labour for less than 12 hours.[2]

The present study also revealed that moderate to severe anaemia is among factors that are associated with puerperal sepsis. In Kenya, a study was conducted and reported that anaemia is indirectly associated with puerperal sepsis as well as maternal mortality.[35] Further research is required to explore the role of anaemia to puerperal sepsis. The study provides valuable information

that is needed for planning meaningful Reproductive Health Control Programs that aim at reducing the prevalence and associated morbidity of puerperal sepsis among postnatal women attending care at the Hospital.

There is a need for educating the community on hygiene practices especially for postnatal women to reduce cases of puerperal sepsis. Health care providers should be emphasised on working under aseptic conditions to prevent nosocomial infections. During the attendance of antenatal care clinics, hygiene and proper nutrition during and after pregnancy should be taught and emphasised, women should also be enlightened about puerperal sepsis risks and preventive measures.

Strength and Limitation of the Study

These data signify unique and vigorous information from Kilimanjaro and contribute to the available knowledge on puerperal sepsis among postnatal women in Kilimanjaro region. However, the study is limited with the following; first, the results are limited to Hospital settings, the prevalence and risks of the disease in the community might be different. Secondly, the study was conducted on a small sample size. This may have provided bias on the prevalence and risk of puerperal sepsis, a study with a larger sample size is required.

CONCLUSION

Puerperal sepsis is prevalent at KCMC hospital. The common risk factors for puerperal infection includes mode of delivery, Postpartum Haemorrhage, prolonged labour, and anaemia. *Staphylococcus spp* was found to be a predominant isolate which causes puerperal sepsis followed by *E. coli* and *Streptococcus spp*.

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EAHRC
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ORIGINAL ARTICLE

Magnitude of Overweight, Obesity and Insufficient Physical Sports Activities Among Secondary School Students in Kinondoni Municipal, Dar es Salaam

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ABSTRACT

Introduction: There is an overwhelming increase of Non-Communicable Disease worldwide such as diabetes and cardiovascular diseases. Overweight and obesity are highly associated with development of these diseases. Unhealthy lifestyle such as excessive sugar, alcohol intake and lack of adequate physical activities has been associated with development of obesity. However, these risk factors are not well elucidated among adolescents in Tanzania. We conducted this survey to determine obesity, overweight, self-reported physical activities, and preferred foods among secondary school students in Kinondoni Municipal in Dar es salaam, Tanzania.
Methods: A cross sectional descriptive survey was conducted among secondary school students at Kambangwa and Makumbusho secondary schools in Kinondoni municipal in Dar es Salaam city. A simple random sampling technique was used to select participating schools with systemic random selection procedure was used to select participants. A pre structured, self-administered questionnaire was used to collect demographic information from the participants. Anthropometric measurement for Body Mass Index (BMI) was done using standard tools. Interpretation of the findings was done using World Health Organization (WHO) standard charts for age and sex. Data were analysed using Statistical Package for Social Sciences (SPSS version 20; SPSS Inc., Chicago, US).
Results: A total of 234 participants were enrolled in the study. A total of 204 (87.2%) of study participants reported to regularly participate in physical sports activities. Furthermore, Males reported to participate more in physical sports activities compared to females (X^2 (1) =8.13., p = 0.004). During sex-wise comparison, 30 (46.2%) of males reported to participate in sports once per week compared to 71 (51.5%) of females. Reported frequency was influenced by participants' sex (X^2 (3) =16.4., p= 0.001). A total of 28 (12%) participants reported fruits as their favourite food. Food preference was influenced by the participants' sex (X 2 (5) =13.1., p < 0.02). 32(47.7%) of males reported fresh fruits juice as their favourite drink compared to 106(63.5%) of females) while 6(9%) of males reported to prefer commercial industrial juice compared to 4 (2.4%) of females
Conclusion: Obesity and overweight are prevalent among secondary school adolescents in Kinondoni Municipal, Dar es salaam. In addition, the magnitude of physical activities was below the recommended amount. Therefore, awareness campaigns and advocacy programs aiming at preventive measures against NCDs such as healthy eating behaviour and promotion of physical activities among adolescents should be given high priority.

BACKGROUND

The global burden of Non-Communicable Disease (NCD) has been increasing dramatically in recent years. From 1980 to 2014, the prevalence of hypertension and diabetes had doubled[1]. In 2014, The World Health Organization (WHO) estimated that the global prevalence of hypertension was 22%, 9% of these were diabetic while the global prevalence of obesity was estimated at 13%, showing to have tripled since 1975 [1]. Furthermore, the same analysis showed that, around 42 million children below 5 years of age were obese. Low and middle income countries are experiencing double burden of diseases since communicable diseases such as Tuberculosis and HIV have not been well controlled, NCDs are increasing tremendously[2,3]. In 2010, the prevalence of obesity, diabetes and hypertension in Tanzania was estimated to be 5%, 7.2% and 20% respectively[4]. With the current trend, it is estimated that by 2025, the prevalence of obesity will be 8%, diabetes 9%, and 25% for Hypertension[5]. Sixty-eight percent (68%) deaths occurring worldwide are due to NCDs mainly cardiovascular diseases, diabetes and chronic lung diseases. Eighty percent (80%) of these deaths are from middle and low income countries[6,7]. Furthermore, around one-million children below 20 years of age died in 2002 as a result of NCDs[7]. In Tanzania, NCDs contribute 33% of all causes of mor-

tality[5].

Overall prevalence of obesity and overweight is profoundly high in developed countries compared to low and middle income countries, with Northern American countries leading with around 30% of adolescents' population being overweight or obese followed by Europe (22%-25%) while in African countries registering between 13%-20%[8–11]. The overall prevalence in Tanzania is estimated to be around 15%. However, in Tanzania, most of the studies included pre-adolescents[12,13]. Although prevalence of obesity and overweight is relatively low in low and middle income countries compared to high income countries, the incidence rate is high due to increasing urbanisation and changes in life style[14].

Given the current trend, it is projected that 57.3% of children will be obese at the age of 35 years[15] while round 25% of obese adolescents will have signs of diabetes by 15 years old[16].

Several study findings suggest that risk factors for development of NCDs start early in childhood which warrants preventive measures to be taken earlier[17,18]

Most of risk factors for NCDs are modifiable such as unhealthy diets, lack of physical activity, cigarette smoking, and excessive alcohol intake[19,20]. Usually, exposure to these risk behaviours start in early childhood and adolescence[18,21]. Over 90% of adults who smoke in United States of America started as children or youth[22]. Furthermore, heavy marketing of risky foods with high salt, fats and sugar target children and adolescents, and they are readily available especially in urban areas[23,24]. Change in children environment and technology has also led to change of lifestyle from being active to sedentary ways of living. Activities such as computer games and television watching consume children's time, attention, and prevent them from participating in physical activities[25–27]

Thus, prevention of obesity and other NCDs should start early in childhood through behaviour change strategies and promotion of healthy life style.

World Health Organization (WHO) Global Recommendations on Physical Activities for Health recommends at least 60 minutes of moderate to vigorous intensity activities daily for adolescents[28]. This includes games, sports, transportation, physical education or planned exercise context of school, family and community activities. Furthermore, it is recommended to include vegetables, fresh fruits and whole grain based carbohydrates while avoiding high fatty foods and high calorie beverages[29]. However, these healthy behaviours have been found to be low among adolescents[30–33]

Under NCD-Child support, we planned to conduct NCD advocacy program among secondary school students in Dar es salaam, but there was paucity of data on risk factors for NCDs among this age group. Therefore, we conducted this cross section survey to determine the magnitude of obesity, underweight, insufficient physical activity and food preference among secondary school children in Kinondoni Municipal in Dar es salaam. This information was collected for proper planning of the advocacy program and to provide appropriate recommendation to stakeholders after the program.

METHODS

Study Area

This cross sectional descriptive survey was conducted among secondary school students at Kambangwa and Makumbusho secondary schools in Kinondoni municipal in Dar es Salaam metropolitan city in June 2016. Kinondoni Municipal is one of the 5 administrative municipals located in North-West part of Dar es salaam city in Tanzania. It is occupying 321 square kilometres of land with 21 administrative wards[34]. In 2012 census, Kinondoni municipal had 929,681 inhabitants with steady population growth rate of 5% per annum and population density amounting 2,896 people per square metre. Adolescents were 186,950 which is equivalent to 22.1% of the entire population[35]

In 2018, Kinondoni had 83 secondary schools (26 public and 57 private owned) and a total of 39,295 students from form 1 to form 4[34].

Study Design

This cross sectional descriptive survey was conducted among adolescents in secondary schools in Kinondoni municipal with a total of 39,295 students. Kambangwa and Makumbusho secondary schools were selected by simple random sampling from a list of 65 schools obtained from the Department of Education of the municipal council in 2016 when the survey was conducted.

Sample Size Calculation

The minimum sample size of the study participants was Calculated using Kish and Lisle formula for determination of proportion in cross-sectional studies as below:

$$N=Z^2p(1-p)/d^2$$

Where N=estimated sample size, Z=z score at 95% confidence interval (1.96), d=marginal error (0.05) and p= overall prevalence of obesity and overweight among pre-adolescents done in Dar es salaam (15%) [13]

By using the above formula, the calculated minimum sample size was 196, but we increased the sample size by 30 in order to cover the drop out keeping in mind that it was not an invasive and risky to study participants. Therefore, 250 participants were selected. However, 234 only filled the questionnaire and presented themselves for anthropometric measurements. Those who did not turn out were not replaced.

Ethical Considerations

The ethical clearance for conducting the survey was provided by the Ethical Review Committee of the Hubert Kairuki Memorial University with clearance REF: HK/ERC/58/06. The permission to conduct this survey and Non-Communicable Disease advocacy activity was sought from the Director of Non-Communicable Disease in the Ministry of Health, Kinondoni Municipal Executive Director and headmasters of Kambangwa and Makumbusho primary schools. We discussed with the head teachers on the aim and significance of the survey and requested for permission to discuss the same topic with students.

Written consents were sought from parents before their children (students) were enrolled in the survey. Verbal assent was sought from the participating students. Furthermore, the aim of the survey and freedom to participate or to withdraw from the survey were clearly stated in the introductory part of the questionnaire.

Sampling Procedure

After verbal communication with form 1 up to form 4 students in schools regarding the aim, significance and risk associated with the survey, we sought their verbal assent to participate in the survey. All students who accepted were given the written consent forms in Swahili language for their parents to allow them to participate and return the filled consent form on the agreed date. For those who did not assent, and whose parents did not give consent were excluded. Systematic random sampling was used to select 250 students from 446 who met the criteria to take part in the survey. No stratification was done based on schools, age, year of study or gender.

Data Collection

A pre-structured, self-administered questionnaire with Swahili translation was used to collect demographic information such as age, year of study and sex from the participants. Information on most favourable foods, drinks and time for physical activities were also enquired. We did not use other pretested tools for collection of physical exercise and eating habit, but we designed the questionnaire specific for our survey where self-reported information was collected. This tool was tested among few students at Makumbusho secondary school for clarity and consistency before it was used on all participants.

Standard measuring board (stadiometer) was used to measure the height of every participant and recorded in metres (m). Salter Mechanical stand on weighting scale (SECA Corporation, Humberg, Germany) was used to record the participant's weight in kilograms. The Body Mass Index (BMI) was calculated in kilograms (kg) / height (m) ²

World Health Organization (WHO) reference charts for adolescents were used for interpretation of BMI[36,37]. These reference charts have horizontal curved lines that show the range of percentiles in relation to the BMI on the vertical axis. Those below 5th percentile on the charts are considered underweight, 5th to 85th percentile normal, 85th to 95th percentile overweight and those above 95th percentile are classified as obese.

Statistical Analysis

All statistical analyses were performed using Statistical Package for Social Sciences (SPSS version 20, SPSS Inc., Chicago, USA). Continuous variables were summarised by Mean and standard Deviation. Categorical variables were summarised by frequencies and percentages. Chi Square test was used to compare frequencies in categorical variables, and p value ≤ 0.05 was considered statistically significant. Data were presented using tables and bar charts.

RESULTS

A total 234 participants were enrolled in the survey. Females were 167 (71.4%). Participants below 15 years of age were 120 (51.3%) forming majority of participants (Table 1)

65 males (97%) reported to participate in physical sports activities compared to 139 (87.3%) of females. Furthermore, 28 (16.8%) of females reported not to participate in any physical sports compared to 2(3%) of males ($X^2(1) = 8.13.$, $p = 0.004$).

During sex-wise sex comparison, 30(46.2%) of males reported to be participating in physical sports once per weeks compared to 71 (51.5%) of females (Table 2). Reported frequency was also influenced by sex of participants (X^2 (3) =16.4., $p = 0.001$). 7 males (10.8%) reported to spend less than 10 minutes in each physical sports session compared to 35 (17.2%) of females while 38 (58.5%) males reported to spend more than 30 minutes per session compared to 64 (46.8%) of females (Table 2)

In reporting favourite sports, 49 (75.4%) males reported to participate more in football while 58 (41%) of female reported netball as their most favourite physical sport. The choice of type of sports was highly influenced by participants' sex (X^2 (4) =93., $p < 0.001$)

28 (41.8%) of males reported ugali (stiff porridge) as their favourite food compared to 47 (28.1%) females, while 36 (21.6%) of females reported to prefer French fries (chips) compared to 6(9%) males. 6 (9%) of males reported fruits among their favourite foods compared to 22(13.2%) of females forming a total of 28 (12%) participants who reported fruits as their favourite food (Table 3). The choice was influenced by the participants' sex (X^2 (5) =13.1., $p < 0.02$). Both males and females reported fresh vegetable juice as their favourite drinks while 6(9%) of males reported to prefer commercial industrial juice compared to 4(2.4%) of females (Table 3).

After taking anthropometric measurements, 23 (9.9%) of all participants were overweight while 5(2.1%) were obese (Figure 1), with 12% overall prevalence of obesity and overweight. On sex-wise comparison, 8(11.9%) of males were overweight compared to 15(9.1%) of females while all who were found to be obese were females (Table 4). However, the difference was not statistically significant (X^2 (3) =5.6., $p < 0.13$)

DISCUSSION

Overweight and obesity comprised 12% of the survey participants. This is consistent with studies conducted among pre-adolescents reported by Mosha and Fungo in Dodoma and Dar es salaam[12,13]. This is also consistent with other studies conducted in s7 African countries[11]. The magnitude is relatively low compared to other developed countries. A study conducted by WHO in European region reported the prevalence of overweight and obesity among adolescents to be between 11-33% with the main predictor of obesity being from low social economic status[8–10,38].

In our study, obesity and overweight was more prevalent in females. This is similar to other studies conducted in Tanzania[12,13]. However, in our study, the difference was not statistically significant. This difference among sexes has been attributed to hormonal changes which favour fat deposition in females and cultural restrictions of fema-

TABLE 2: Sex-Wise Comparison of BMI Interpretation of Study Participants

BMI interpretation	Sex of Study Participants Male N (%)	Female N (%)	Total N N(%)	X^2 (df)	P value
less than 5th percentile(underweight)	29 (43.3)	52 (31.3)	81 (34.8)		
5th-85th percentile(normal)	30 (44.8)	94 (56.6)	124 (53.2)	5.6 (3)	0.13
85-95th percentile(overweight)	8 (11.9)	15 (9.1)	23 (9.9)		
above 95th percentile(obese)	0 (0.0)	5(3.0)	5 (2.1)		
	67 (100)	116 (100)	233 (100)		

Abbreviations:
X^2 Chi-Square Test
Df=Degree of Freedom
BMI=Body Mass Index

TABLE 3: Sex-wise Comparison of Participants Involvement in Physical Sports Activities

Study Variable	Sex of study participants Male N (%)	Female N (%)	Total N (%)	X2 (df)	P value
Participants' involvement in sports activities (N=234)					
Yes	65 (97)	139 (83.2)	204 (87.2)	8.13 (1)	004
No	2 (3)	28 (16.8)	30 (12.8)		
Total	67 (100)	167 (100)	234 (100)		
Participants' Number of Physical Sports Activities Per Week (N=202)					
Once	30 (46.2)	71 (51.8)	101 (50.0)		
Twice	14 (21.5)	28 (20.4)	42 (20.8)	16.4 (3)	0.001
Thrice	10 (15.4)	2 (1.5)	12 (5.9)		
More than thrice	11 (16.9)	36 (26.3)	47 (23.3)		
Total	65 (100)	137 (100)	202 (100)		
Time Spent by Participants Per Sports Session in Minutes (N=204)					
< 10	7 (10.8)	28 (20.1)	35 (17.2)		
11-20	13 (20.0)	22 (15.8)	35 (17.2)		
21-30	7 (10.8)	24 (17.3)	31 (15.2)	5.15(3)	0.16
>30	38 (58.5)	65 (46.8)	103 (50.5)		
	65 (100)	139 (100)	204 (100)		
Participants' Favorite Sports (N=204)					
Football	49 (75.4)	13 (9.4)	62 (30.4)		
Basketball	4 (6.2)	27 (19.4)	31 (15.2)	93 (4)	<0.001
Netball	4 (6.2)	58 (41.7)	62 (30.4)		
Jogging'	8 (12.3)	38 (27.3)	46 (22.5)		
Others	0 (0)	3 (2.2)	3 (1.5)		
Total	65 (100)	139 (100)	204 (100)		

Df = Degree of freedom.
X^2 Chi-Square Test
BMI=Body Mass Index

TABLE 4: Sex-wise Comparison of Participants Favorite Foods and Drinks (N=234)

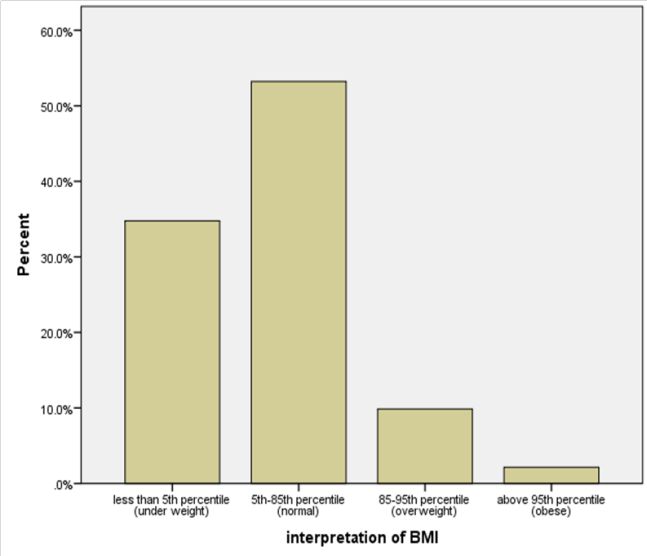
Study Variable	Sex of Study Participants Male N (%)	Female N(%)	Total N (%)	X^2 (df)	P value
Participants' Favorite Food					
Ugali	28(41.8)	47(28.1)	75(32.1)		
Rice	25(37.3)	61(36.5)	86(36.8)		
French fries	6(9.0)	36(21.6)	42(17.9)	13.1(5)	0.02
Fruits	6(9.0)	22(13.2)	28(12.0)		
Others	2(3.0)	1(0.6)	3(1)		
Total	67(100)	167(100)	234(100)		
Favorite drink					
Fresh fruit juice	32(47.8)	106(63.5)	138 (59.0)		
Soda	15(22.4)	28(16.8)	43(18.4)		
Water	12(17.9)	27(16.2)	39(16.7)	8.6(4)	0.07
Commercial industrial juice	6(9.0)	4(2.4)	10(4.3)		
Others	2(3.0)	2(1.2)	4(1.7)		
Total	67(100)	167(100.0)	234(100.0)		

Df = Degree of freedom.
X^2 Chi-Square Test

TABLE 1: Baseline Characteristics of Study Participants

Variable	Frequency	Percentage
Age		
<15	120	51.3
15-<17	88	37.6
17 -<19	21	9
≥19	5	2.1
Total	**234**	**100**
Sex		
Males	67	28.6
Females	167	71.4
Total	**234**	**100**
Year of study		
Form 1 or 2	164	70.1
Form 3 or 4	70	29.5
Total	**234**	**100**

FIGURE 1. Frequency Distribution of BMI Interpretation



les from participating in physical sports activities[39–42]

According to our survey, 204(87.2%) of participants reported to regularly participate in physical sports activities. However, frequency and time spent during sports sessions was low compared to WHO recommendation whereby adolescents should accumulate at least 60 minutes of moderate to vigorous intensity physical activity per day[28]. Most of the physical sports should be aerobic but also strength exercise should be incorporated at least 3 times a week[28].

Low physical activity observed in our study is consistent with other studies conducted elsewhere[43–46]. The 2012 Lancet series report estimated the global proportion of adolescents not achieving 60 minutes of Moderate To Vigorous Physical Activity (MVPA) to be to be 80.3% basing on self-reported leisure sports activities[47].

This trend has been attributed to rapid urbanisation with increased use of modern private and public transportation

such as cars, motor cycles, trains, school buses as well as other entertainments that encourage sedentary lifestyle such as computer games and television.[21,25–27,43,45]

Reported participation in physical sports was significantly lower in females (frequency per week and duration of sessions) compared to males (Table 2). This is similar to other studies conducted in both high, middle and lower income countries[48–53]. This could additionally explain the relatively higher frequency of obesity among females compared to males.

We could not quantitatively measure sedentary behaviour which is defined as time spent sitting per day in any waking activity characterised by low energy expenditure (≤ 1.5 metabolic equivalent) and a sitting or reclining posture due to time constrain. Sedentary behaviour includes sitting at work or school, motorized transport and screen time such as television viewing and video games[54].

Rice and ugali (stiff porridge) were the most preferred foods while French flies (chips) were preferred by females compared to males. Only 28(12%) participants reported fresh fruits among their favourite foods which suggests lower consumption of fruits and vegetables below the recommended amount of eating 5 or more servings or 400 grams of fruits and vegetables daily[29].

Other studies have indicated a slight increase in daily fruits and vegetable consumption, but still the amount is low compared to the recommended amount[30–32]

Fresh fruits juice and soda where the most preferred drinks. This indicates preference of sweetened and high calories foods compared to high fibre diet such as raw fresh fruits and vegetables. This trend is global due to rapid urbanisation and promotion of sweet and high sugary beverages[20,33,55–57]

CONCLUSION

Obesity and overweight are prevalent among secondary school adolescents in Kinondoni municipal with high level of inadequate physical activities and unhealthy food preferences. Adolescents should not be sidelined in National NCDs control programs. Therefore, there is a need to establish school based health education program to provide knowledge on risk factors and consequences of NCDs, as well as to encourage them to opt for healthy eating habits and participation in physical sports activities. Schools should create supportive environment for them such as sports fields, equipment, and time.

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ORIGINAL ARTICLE

Prevalence and Factors Associated with Stunting among Public Primary School Pupils in Kasulu District, Western Tanzania.

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ABSTRACT

Background: Underfeeding of a child in the first 2 years of life results in irreversible growth damage. Globally, stunting has declined from 39.7% in 1990 to 26.7% in 2010 while in Africa has remained at 40% since 1990. However, stunting is little known in primary pupils.
This study estimated the prevalence of stunting and contributing factors among public primary school pupils in Kasulu District.
Method: Cross-sectional study was conducted among public primary pupils. Systematic random sampling was used to select study participants and then stratified to 5-7 and 8-12 years. Socio-economic factors, dietary practices, water, sanitation, and hygiene behaviours; school performance/attendance data were collected using a pretested questionnaire. Measurements were standardised to the World Health Organization HAZ-Scores for both girls and boys. Descriptive statistics, bivariate, and multivariable logistic regression were used to generate results.
Results: A total of 400 pupils (100%RR) were recruited into the study, mean age of 7.51 (STD= 1.54) years and a half (50.3%) were boys. The prevalence of stunting was 127 (31.8%) (95% CI: 27.2%–36.6%), with no sex difference (63 (31.7%) – girls vs. 64 (31.8%) – boys; p = 0.969). Household wealth influenced stunting; lowest quintile (AOR= 28; 95% CI: 3.64 – 214.6; p<0.001) 2nd quintile (AOR = 17; 95%CI: 2.20 – 138.5; p<0.01), the 3rd quintile (AOR = 8.0; 95%CI: 0.99 – 64.67; p = 0.051) and 4th quintile (AOR = 4.2; 95%CI: 0.49 – 36.75; p = 0.191) when compared to 5th (highest) wealthquintile. Food insecurity (AOR = 10.6; 95%CI: 4.60 – 24.60; p< 0.001), less protein in meal were the risk for stunting (AOR = 14.6; 95%CI: 4.07 – 52.42; p<0.001).Inappropriate hand wash after toilets both at school, (AOR=3.5; 95%CI:1.62–7.58; p=0.001), and home (AOR = 13.0; 95%CI: 2.73 – 61.76; p = 0.001) were the risk for stunting. Stunted pupils had irregular school attendance (AOR = 9.4;95%CI: 4.42 – 19.93; p<0.001) and poor performance (AOR = 23.6; 95%CI: 10.24 –54.19; p<0.001). Food insecurity influenced poor performance (AOR = 3.9; 95%CI:1.67–8.92; p<0.01) and irregular school attendance (AOR=5.4, p=0.000).
Conclusion: Stunting among public primary school pupils is very high despite the prevention effort. Low wealth, food insecurity, poor hand hygiene, and lack of protein in a meal significantly influence stunting. Also, it affects the pupils' academic performance and attendance, availability of food in both quantity and quality, community nutrition

INTRODUCTION

Adequate nutrition during infancy and early childhood is a fundamental prerequisite of each child's full human developmental potential. Thus, the period from conception through birth to 2 years of age is a vital window for child optimal growth, health, and behavioural development.[2] Literature shows that, undernourishment during the first 1000 days, from pregnancy through the child's second birthday, results to long term and irreversible growth damage, with impacts observed at the individual, community, and nation as whole.[3] In the joint United Nations International Children's Emergency Fund (UNICEF), World Health Organization (WHO) and World Bank 2013 report, 162 million children under the age of five are affected by stunting globally either during pregnancy or after delivery; this being only a two-percentage-point lower than it was 5 years ago.[4,5] If the current trend is to continue, projections in East Africa show that 42.1% of children under five years of age will be stunted in 2025.[6] Studies have indicated that stunting can be inherited from one generation to the next.[7,8] This may occur when an undernourished woman bears low birth weight babies, who if are subjected to suboptimal feeding practices and high rate of infectious diseases, do not experience the catch-up growth in subsequent years leading to an intergenerational cycle of stunting.[7] United Nations International Children's Emergency Fund (UNICEF) describes four forms in which under nutrition can m-

anifest: underweight (<-1SD weight-for-age Z-score), wasting (<1SDweight-for-height), and stunting (<-1SD height-for-age). In 2010 UNICEF reported among these 3 forms of under nutrition, stunting was globally higher - for the year 2015 the global prevalence of stunting was 42% in comparison to wasting and underweight which were 5% and 16%, respectively.[2] A similar trend was observed in the Joint UNICEF, WHO and World Bank report of 2012 whereby 26% of the global under-fives population were stunted, 8% wasted and 11% underweight.[8] The stunting was reported to be caused by the chronic lack of adequate nutritious food, poor child care practices, lack of access to health, and other social services.[8]

Forty-two percent (42%) of children are affected by stunting either during pregnancy or after delivery globally. The prevalence of stunting in Tanzania is estimated to be 35%.[3] Kigoma region is one of the regions with a "very high" prevalence of stunting in children less than five years, estimated at 35 %.[2]

Bad feeding habits, number of household members, frequent infectious diseases attack, unhealthy environment, inadequate care practices, poverty, illiteracy, socio norms and Water, Sanitation, and Hygiene practices are determinants of stunting commonly described in most literature on stunting among under five years of age. We assumed that the distribution of these determinants may be different among school children as they were not under total parental care and can secure food on their own if available. They also may access food at school as well as other health interventions such as de-worming and schistosomiasis treatment. To ascertain whether these determinants affect primary school children in the same way as they do among under-five children, we conducted this study aiming at estimating the prevalence of stunting and its associated factors among primary school children in Kasulu District.

MATERIALS AND METHODS

Study Area and Design.

This was a cross-sectional study conducted in Kasulu District involving primary school pupils attending public schools by January 2018. Kasulu District Council was purposefully selected among the eight councils in Kigoma region, due to its high population density. Food adequacy in the district is determined by cross broader trade across the national border and/or inter-regional boundaries which have tended to shift large quantities of food across the border to neighbouring regions or countries. The most cultivated crops are maize, cassava, potatoes, and beans.[31] Kasulu district has been the recipient of the highest number of refugees and asylum seekers from the Republic of Burundi and the Democratic Republic of Congo. The total district population was 556,851; 273,904 (49.2%) being male,50.7% were children aged between 5-12 years as projected by the National Bureau of Statistics in the 2018 dashboard. The population growth was estimated at 2.4, primary school enrolment was about 59%, and an illiteracy rate of 23%.[32] Kasulu district is highly populated in the region contributing to 20% of the region population with an average household size of 7.6.[9] It also hosts more refugees than any other district in the region. The district has a total of 79 public primary schools with no private primary schools, 38 dispensaries, and 5 health centres.

Sample Size Calculation

The sample size was calculated using Leslie's formula. The estimation of the sample size based on the stunting prevalence of 38% taken from a study done by *Semali et al*[14] in Kongwa District Tanzania, a site with similar settings as ours, with a marginal error of 5% and 95% confidence level. A response rate of 90% was used to adjust the estimated sample size resulting in a minimum sample size of 400 study participants.

The sample size (n) was calculated using Leslie's formula

$$n = Z^2 \times P \frac{(100 - P)}{\varepsilon^2}$$

Where (n) = Sample size

Z = 1.96 (95% confidence interval) in two tailed t-test

P = Prevalence of stunting of 38%.[14]

ε= Marginal error 5%

$$n = 1.96^2 \times 38\% \times \frac{(100 - 38\%)}{52} = 362 \sim 360$$

Expected response rate (RR) = 90%

Adjusting for non-response, then,

n = 360/90%

= 400

Therefore, the minimum study sample size was 400 participants

Sampling Technique

We used a systematic sampling technique to select three wards and one village from the respective ward. Kitema village, Kibirizi village, and Bugaga village were randomly selected from Nyenge Ward, Buhoro Ward, and Bugaga Ward respectively, and one public primary school from each village was randomly selected. Proportion probability sampling was used to estimate the sample size for each public primary school selected. The study respondents were stratified into two age groups: 5 to 7 years whose parents/guardians were traced at home to complete responses of the household questionnaire as their responses to some questions were not reliable; and 8 to 12 years who self-administered the questionnaire. (Figure 1)

The k^{th} interval depended on the number of eligible study participants in each school and each age strata. The formula below was used to calculate the kth interval

$$k = N/n$$

Where;

k is a sampling interval (sometimes called a skip)

N is the number of eligible study population size

n is the required sample size

FIGURE 1. Study Participants' Selection Framework

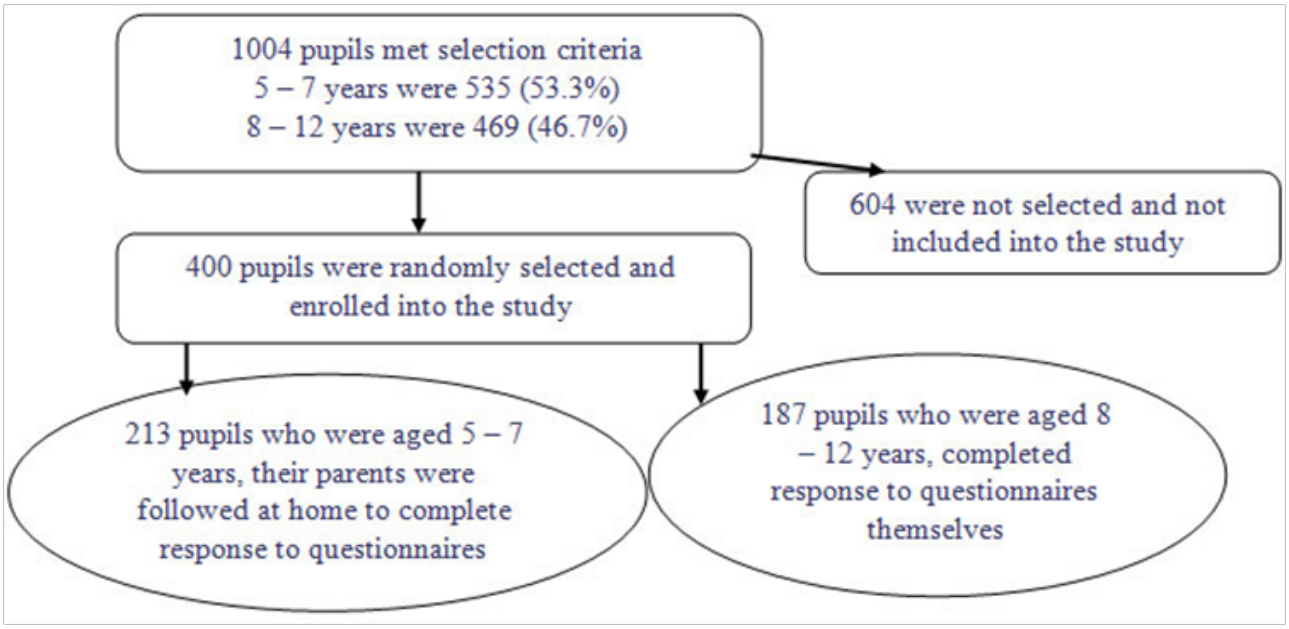
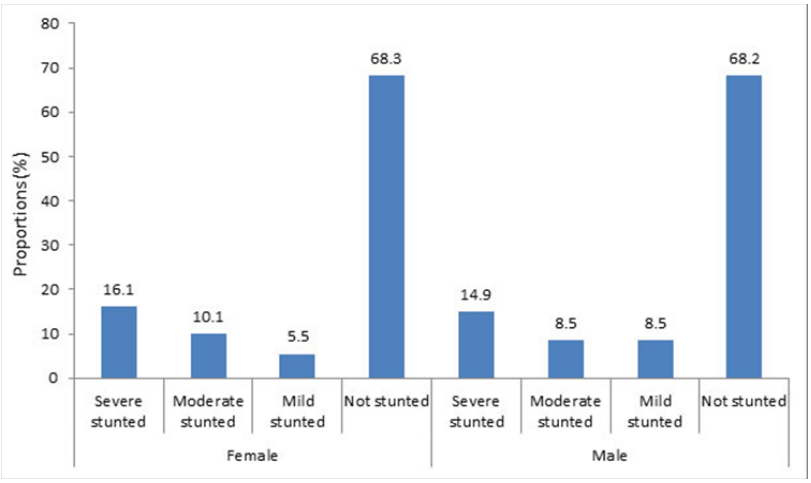


FIGURE 2. Prevalence of Stunting by Sex in Public Primary School Pupils in Kasulu District



Data Collection Instruments and Procedures

A questionnaire was developed in English then translated to Swahili and back-translated to English to ensure a correct translation of meaning. Pre-testing of questionnaires was done to test for clarity of questions, validity, reliability, feasibility, and study logistics. This also assisted the research assistants to exercise flexibility in the wording of questions contained in a questionnaire. The pre-testing results were used to modify the content and wording of the questionnaire. The questionnaire had both closed and open-ended questions. The close-ended questions provided more structured responses to aid precision of responses to standardize analysis. The open-ended questions provided additional information that may not have been captured in the close-ended questions. The type of data collected included: socio-demographic and economic data, dietary practices, sanitation practices, school performance, and school attendance. The questionnaires were administered by a

Principle researcher and two trained research assistants.

Anthropometric Measurements

We measured height in centimetres to the nearest 0.1cm. The respondent stood upright on a uniformly calibrated height board facing forward without shoes. Height-for-age Z scores were calculated for boys and girls separately. WHO 2006 references were used to define stunting – HAZ<-1SD was used to create the outcome variables.

Data Management and Analysis

The responses to open-end questions were grouped then coded to respective codes in a questionnaire. The complete filled and coded questionnaires were entered in the Epi Info™ make view; a trademark of the Centre for Diseases and Control, and then transferred to STATA software version 13 owned by StataCorp LP, 4905 Lake way Drive, College Station, Texas 77845, United States of America, for analysis. After data cleaning, frequencies, and percentages of independent variables were summarized in tables. Univariate, bivariate, and multivariable logistic regression models (inclusion criteria were any variable with p-value <0.2) were built to examine demographic characteristics and their association with stunting. We created population wealth quintiles by Principal Component Analysis. We reported Odd Ratios and their 95% Confidence Interval, and the significance level of alpha <5%.

Ethical Considerations

We obtained ethical clearance to conduct the study from the Muhimbili University of Health and Allied Sciences Institutional Review Board. We sought permission to conduct this study from the Kasulu district authority. The head teacher signed written informed consent and parent/guardian consented on behalf of children. We explained study objectives, methodology, and benefits to the head teachers of respective primary school and parent/guardian of each study participant. Study participants aged 8 years and older assented before recruitment into the study. All participants were free to withdraw from the study at any point in time. We assigned numbers to participants to assure confidentiality and only the researcher and research team accessed the respondent questionnaires

RESULTS

Demographic Characteristics of the Study Population

We enrolled a total of 400 pupils with a mean age of 7.51 (SD = 1.54) years with a 100% respondents response rate to the study. More than half 213(53.2%) were aged between 5 to 7 years, and about half 201(50.3%) were boys. More than half of the respondents 201 (50.3%) were in class two, while 123 (30.8%) were in class one and 76 (19.0%) were in class three. About forty percent of 159 (39.8%) of the pupils were from Kibirizi primary school. The mean age of the parents/guardians was 32.4 (SD =5.09) years, with a majority of 243 (60.8%) aged between 26 -35 years. More than half of the parents/guardians 211 (52.3%) had primary education, while only 50 (12.4%) had secondary education or above. The majority of 248 (62%) of the parents/guardians were either peasants or livestock keepers or about 1 in 5 were involved in petty business 86 (21.5%), 57 (14.3%) were skilled labourers and only 9 (2.2%) were employed.

Almost all parents/guardians were married or cohabiting 366 (91.5%) (Table 1)

Prevalence of Stunting Among Study Respondents

The overall prevalence of stunting was 127 (31.8 %) (95% CI: 27.2%–36.6%), where 63 (31.7%) girls and 64 (31.8%) boys were considered as stunted. The distribution of stunting among girl's pupils was 5.5% mild, 10.1% moderate, and 16.1% severely stunted; and boys were 8.5% mild, 8.5% moderate, and 14.9% stunted. (Figure 2).

Socio-Economic Determinants of Stunting

Older pupils 8-12years of age were significantly more likely to be stunted 70 (37.4%) as compared to younger pupils 5-7 years 57 (26.8%; p=0.022). Stunting was not differentially distributed by sex (boys 64 (31.8%) and girls 63 (31.7%; p = 0.969). Pupils in lower classes one 41 (33.3%) and two70 (34.8) were more stunted than pupils in class three 16 (21.1%; p = 0.081).

Older parents/guardians (>35 years) had a higher probability of 76 (60.3%) of having a child who was stunted than parents/guardians aged 26-35 years 44 (18.1%) or parents/guardians age<26 years 7 (22.6%; p<0.001). Having no formal education had a higher likelihood of 62 (44.6%) of having a stunted child than primary education 56 (26.5%) and secondary education or higher 9 (18.0%; p<0.001). Being either a peasant or livestock keeper was associated with a significantly higher probability of having a stunted child 91 (37.5%) compared to those who were employed 2 (22.2%), skilled labourers 9 (15.8%) or in petty business 25(28.4%; p = 0.014).

Parents/guardians who were categorised as not being in marriage (single, separated, divorced, or widow) had a significantly higher likelihood of having a stunted child than those who were married or cohabiting 24 (70.6%) vs. 103 (28.1%; p<0.001). A household, which had six or more children, were significantly more likely to have a stunted child 73 (59.8%) than households with five or less 54 (19.4%; p<0.001). Also, pupils not living with both of their parents (categorized as others) had a higher proportion of stunting compared to those who reported living with both parents 31 (68.9% vs. 96 (27.0%; p<0.001). Households ranked as having lower economic status were significantly associated with stunting than households ranked in the highest economic status where 3 (3.8%), 11 (14.1%), 18 (22.0%), 42 (53.2%), 53 (65.4%) percent of the children were categorised as stunted from lowest, low, middle, high and highest quintile, respectively (p trend < 0.001)

The Influence of Dietary Practices on Stunting

Pupils reporting coming from households with inadequate food were more likely to be stunted compared to pupils coming from households reported to have adequate food supply 97 (84.4%) vs. 30 (10.5%; p<0.001). Reporting eating less than 2 meals a day had a 108 (61.7%) probability of stunting compared to 19(8.4%) in pupils reporting eating 3 meals (p < 0.001). Stunting was not differentially distributed by food diversity (starch only 65 (32.3%), starch and protein 23 (26.1%), starch protein and fats 6 (33.3%) and starch, protein, fats and vegetables

TABLE 1: Demographic Characteristics of Pupils and their Parents/Guardians

Pupils characteristics			Parent/guardian characteristics		
Variable	**N**	**%**	**Variable**	**N**	**%**
Age, Years			**Age, Years**		
Mean (SD1)	7.5	1.54	Mean (SD)	32.4	5.09
5 - 7	213	53.3	<26	31	7.7
8 - 12	187	46.8	26 - 35	243	60.8
Sex			>35	126	31.5
Girls	199	49.8	**Marital status**		
Boys	201	50.3	Not married*	34	8.5
Class			Married/cohabiting	366	91.5
One	123	30.8	**Education**		
Two	201	50.3	No formal education	139	34.8
Three	76	19	Primary education	211	52.8
School			Secondary and above	50	12.4
Kitema	125	31.2	**Occupation**		
Kibirizi	159	39.8	Peasant/livestock keepers	248	62
Bugaga	116	29.0	Petty business	86	21.5
			Skilled labourers	57	14.3
			Employed	9	2.2

*Mean (Standard Deviation), **Single variable comprised 'divorced, separated and single

/fruits 33 (35.5%; *p=.587*). Pupils reported eating proteins' food less frequently had a higher chance of being stunted than children who reported eating proteins' food frequently (*p<.001*). There was no difference observed between sharing 103 (31.4%) and not sharing plate 24(33.3%) during eating (*p=.750*).

The Influence of Hand Hygiene Practices to Stunting

Not washing hands after visiting the toilet at school increased the chance of stunting by 103 (52.3%) in comparison with washing hands with running water only or with soap which was 24(11.8%; p<0.001). Similarly, not washing hands at home after visiting the toilet was associated with a 39(92.9%) increased probability of stunting compared to washing hands with running water only or with soap 88(24.6%; *p<.001*)

Multivariable Analysis of Stunting By Social-Economic, Dietary, Hygiene, and Sanitation Factors

Socio-demographic characteristics that were significantly associated with stunting in this population were household wealth quintiles, household food security, and frequency of eating proteinous food and hand wash practices at both school and home. Household wealth had a linear relationship with stunting where pupils from the lowest quintile had a 28 fold increase chance of being stunted (AOR = 28; 95% CI: 3.64 – 214.6; p<0.001) followed by the 2nd quintile (AOR = 17; 95%CI: 2.20– 138.5; p<0.01), the 3rd quintile(AOR = 8.0; 95%CI: 0.99 –64.67; *p=.051*) and 4th quintile (AOR=4.2; 95%CI: 0.49– 6.75; *p=.191*) when compared to 5th (highest) wealth quintile.

Pupils who reported inadequate food in the household had 11 times more likelihood of being stunted than pupils who reported adequate food in their households (AOR = 10.6; 95%CI: 4.60 – 24.60; p< 0.001).The probability of being stunted increased by a factor of 14 times if the eating of proteinous food occurred once a month or less compared to those who ate proteinous foods 3 times per week (AOR = 14.6; 95%CI: 4.07 – 52.42; *p<.001*).

Improper hands wash after toilet both at school and the home was significantly associated with stunting. Those who reported not to wash hands after toilets at school were at higher risk of being stunted (AOR = 3.5; 95%CI: 1.62 – 7.58; *p=.001*), compared to those who used either water only or with soap for washing hands after toilets. At home pupils who reported not to wash hands were at 13 folds increase at risk of being stunted (AOR =13.0; 95%CI: 2.73 – 61.76; *p=0.001*)

Relationship between Stunting and School Attendance and Academic Performance

Pupils who were stunted had a higher proportion of irregular school attendance 35 (27.6%) compared to pupils who were not stunted 10(3.7%; *p<.000)*. Being stunted 68(77.3%) was associated with a significantly higher chance of failing at the end of year examination compared to those who were not stunted 13(6.7%; *p<0.001*).

Multivariable Analysis of School Attendance and Academic Performance by Stunting

TABLE 2: Logistic Regression Analysis of Stunting by Social Economic, Dietary, Hygiene and Sanitation Factors

Variables	Crude OR (95%CI[a])	Adjusted OR (95%CI[b])
Age, in years		
5 – 7	Ref	
8 – 12	**1.6 (1.07 – 2.50)	NA
Sex		
Girls	Ref	
Boys	1.0 (0.66 – 1.54)	NA
Class of the pupils		
One	*1.9 (0.96 – 3.65)	NA
Two	**2 (1.07 – 3.74)	NA
Three	Ref	
Parent/guardian characteristics		
Age, years		
<26	1.3 (0.53 – 3.25)	NA
26 – 35	Ref	
>35	6.9 (4.24 – 11.15)***	NS
Parent/guardian education		
No formal education	3.7 (1.66 – 8.12)***	NS
Primary education	1.6 (0.75 – 3.60)	NS
Secondary & high education	Ref	
Parent/guardian Occupation		
Peasants/Livestock keepers	3.1 (1.47 - 6.68)**	NS
Petty business	2.1 (0.91 -4.95)	NS
Skilled labour	Ref	
Employment	1.5 (0.27 - 8.55)	NS
Marital status		
Not married	6.1 (2.83 – 13.26)***	NS
Married/cohabiting	Ref	
Number of children in household		
5 or less	Ref	
6 or more	***6.2 (3.87 - 9.87)	NS
A person living with a child		
Both parents	Ref	
Others	6.0 (3.05 – 11.711)***	NS
Household wealth quintiles		
Lowest	48.6 (14.05 - 168.05)***	28.0 (3.64 – 214.6)***
Low	29.1 (8.47 - 100.10)***	17.4 (2.20 – 138.5)**
Medium	7.2 (2.03 - 25.61)**	8.0(0.99 – 64.67)
High	4.2 (1.12 - 15.74)**	4.2 (0.49 – 36.75)
Highest	Ref	Ref
Household food security		
Adequate	Ref	Ref
Inadequate	45.8 (24.41 - 85.95)***	10.6 (4.60 – 24.60)***
Number of meals per 24 hours		
Two or less	17.5 (9.98 – 30.60)***	NS
Three	Ref	
Frequency of eating protenous food		
Three times per week	Ref	Ref
Once per week	1.4 (0.63 - 3.14)	1.1 (0.37 – 3.30)
More than once per month	21.3 (10.90 - 41.74)***	3.0 (1.14 - .17)**
Once or less than once per month	59.2 (22.60 - 155.0)***	14.6 (4.7 – 54.42)***
Hand wash practices after visiting toilet at school		
Do not wash hands	8.2 (4.91 – 13.60)***	3.5 (1.62 – 7.58)***
Wash with water only or with soap	Ref	Ref
Hand wash practices after visiting toilet at home		
Do not wash hands	39.9 (12.03 -132.0)***	13.0 (2.73 – 6176)***
Wash with water only or with soap	Ref	Ref

aOdds Ratio (95% Confidence Interval); b Adjusted Odds Ratio (95% Confidence Interval) for all variables in the table; * p value <0.05; ** p value < 0.01;***p value < 0.001; NA = Not applicable; NS = Not significant

TABLE 3: Logistic Regression Analysis Academic Performance and School Attendance by Stunting Status and Socio-Demographic Factors

	School attendance Crude OR (95% CI)	Adjusted OR (95%CI)	Academic performance Crude OR (95%CI)	Adjusted OR (95%CI)
Stunting status				
Not stunted	Ref	Ref	Ref	Ref
Stunted	10 (4.77 – 21.0)***	9.4 (4.42 - 19.93)***	47.3 (22.3 – 100)***	23.6 (10.24–54.19)***
Household food security				
Adequate	Ref		Ref	Ref
Inadequate	6.3 (3.26 – 12.37)***	NS	17.8 (9.37 – 33.7)***	3.9 (1.67–8.92)**
Pupils age group in years				
5 – 7	Ref			
8 – 12	4.1 (2.0 – 8.31)***	3.7 (1.73 - 7.73)***	NA	
Number of meals per 24 hours				
Two or less	5.4 (2.58 – 11.20)***	NS	8.5 (4.56 - 15.83)***	NS
Three	Ref		Ref	
Pupil's class				
One	Ref			
Two	4.5 (1.69 – 11.8)**	NS	NA	NA
Three	2.8 (0.87 – 8.83)	NS	NA	NA
Frequency of eating protenous food				
Three times per week	Ref		Ref	
Once a week	1.3 (0.48 – 3.52)	NS	1.3 (0.53 - 3.23)	NS
> Once per month	3.0 (1.32 -6.62)**	NS	9.1 (4.41 - 18.84)***	NS
Once or < once per month	***4.6 (1.98 – 10.8)	NS	24.2 (9.12 - 64.19)***	NS
A person living with a child				
Both parents			Ref	
Others	NA	NA	2.8 (1.35 - 6.02)*	NS
Household wealth quintiles				
Lowest	4.0 (1.25 - 12.65)*	NS	16.3 (4.61 - 57.84)***	NS
Low	4.5 (1.41 - 14.09)*	NS	14.4 (4.04 - 51.0)***	NS
Medium	2.6 (0.79 - 8.79)	NS	4.8 (1.29 - 18.06)***	NS
High	0.5 (0.89 - 2.81)	NS	1.5 (0.32 - 7.17)	NS
Highest	Ref		Ref	

a Odds Ratio (95% Confidence Interval); b Adjusted Odds Ratio (95% Confidence Interval) for all variables in the table; * p value < 0.05; ** p value < 0.01; *** p value <0.001,NS = Not significant, NA= Not applicable

Stunted pupils were likely to have irregular school attendance (AOR = 9.4; 95%CI: 4.42 – 19.93; *p<.001)*-examination (AOR = 3.9; 95%CI: 1.67 – 8.92; *p<.01)*.and failed in recent end of year examinations (AOR=23.6; 95%CI:10.24–54.19; *p<.001*). Older age pupils were likely to have irregular school attendance (AOR=3.7; 95%CI:1.73–7.73; *p<.001*) as compared to younger pupils. And pupils who belonged in a household with inadequate food were likely to fail at the end of year

DISCUSSION

This study aimed to determine the prevalence of stunting and its associated factors among public primary school pupils in Kasulu District. We observed that 31.8% of the study population was stunted, in which 49.6% were girls and 50.4% were boys, showing both girls and boys being equally affected by stunting. Also, inadequate household food supply; reduced frequency of eating proteinous food, and poor hand hygiene after toilet use significantly were associated with stunting. Importantly, stunting negatively affected school attendance and subsequent pupil's academics. It has shown that inadequate food at home reduce children learning capacity at school.

Prevalence of Stunting

This prevalence of stunting is high and according to WHO is of public health concern requiring interventions. We observed a 6% higher prevalence than the global prevalence of stunting among under-five children which is at 26%, [8] but, was about 6% lower than the African region stunting prevalence [9], and lower than that found by *Galgamuwa et al.*[16]

Other studies done in the African region among a similar population have reported varying prevalence of stunting. For instance, *Biadgilign et al.*[17] and *Derso T, et al* [11] found the prevalence of stunting to be 46.7% and 58.1%, respectively while *Bamba I, et al* reported a prevalence of 29.4% among primary school children.[12] Differences in prevalence were attributed to differences and similarities in study methodology, study age population, and the difference in study geographical areas.

Besides, this prevalence is 3% lower than the estimated stunting prevalence among under-fives in Tanzania and 2% lower than what was found in THDS-MIS 2015-2016.[33] suggesting that stunting affects primary school pupils at the same magnitude as it affects children under five years of age.

Similarly, *Masanyiwa et al* in Nzega Tanzania found a prevalence of 26.1%, and *Semali et al* found a prevalence of 47.9%,[13, 14] these studies were done among under-fives.

We observed that stunting affected public primary pupils as it was observed among under-five children. We found insignificant variation of stunting between Kasulu District public primary school and other parts of Tanzania. This prevalence is high and poses challenges to Kasulu District public health to achieving Sustainable Development Goal. It also has a negative implication for the nation, as stunting was associated with poor academic trajectory.

Socio-Economic Factors

In our study household wealth was found to be a significant factor associated with stunting. As the household wealth quintile increases, the risk for stunting decreases. This corroborates with findings in a study done by *Makoka et al, Semali et al and Masanyiwa et al.*[18, 14, 13].

It also concurs with findings in the studies done in African countries and other parts; *Herrador et al.*[34], and the study done in Sri-Lanka by *Galgamuwa et al.*[16]

Dietary Practices

We found that inadequate household food security was associated with stunting. A similar observation was observed by *Nyaruhucha et al,*[22] in Simanjiro district Tanzania reported that 87% of stunted children came from households with food insecurity of which food was described as poor in terms of both quantity and quality.[22] However, food diversity and plate sharing during eating on multivariable analysis were not associated with stunting as it was found in a study done by *Masanyiwa et al,*[13] *Semali et al,*[14] and *Chirande et al,*[19] the difference can be explained by the difference in the age group of study populations and study methodology

Water, Sanitation, and Hygiene

Additionally, we found that; stunting among primary pupils was associated with poor hand hygiene after visiting toilets. This habit may have predisposed them to water-borne diseases and to intestinal worm infestation and diarrhoea diseases, which if left untreated deprives nutrients and chronic deprivation lead to stunting. Similar results were found by *Masanyiwa et al,*[13] in Nzega, Tanzania, *Biadgilign et al,*[17] in Ethiopia, *Kofuor et al,*[25] in Ghana.

Academic Performance /Attendance

We observed that majority of stunted children had high odds of performing poorly in the recent overall end of year examinations. Similar observations were found among school children in Malaysia,[21] in North Tripura,[22] Ethiopia,[18] and Burkina Faso.[23] The impact of stunting on academic performance has negative onward academic trajectories and well-being. We further observed that; older and stunted pupils had irregular school attendance; however, pupil's age was not associated with stunting. These findings were like findings found by SR NAIK et al and Stuber et al.[24, 25]

Study Limitations

Some study participants did not understand Kiswahili which necessitated finding interpretation which may have resulted in misclassification biases. Data collection was done in the rainy season where vegetables and fruits were readily available which may have shifted the study results to either direction, and about 30% of study respondents were in class one who had not experienced school life hence not exposed to starvation for a long time during class hours which may have affected stunting prevalence.

Academic performance was examined for about 70% of respondents as class one pupils had no examination results, this may have affected the association

CONCLUSION

The study was able to determine the socio-economic factors which were associated with stunting. It was found

that household wealth predetermined a pupil's stunting status. Moreover, household food insecurity and not including protein-containing food in daily meals contributed significantly to pupils stunting. Also, poor hand wash after visiting the toilet was found to be associated with stunting. More stunting has a significant association with school academic performance and attendance.

Recommendations

Primary schools based programs to address stunting such as school feeding program should be implemented and strengthened, making use of locally available foods, coupled with creating community awareness on the inclusion of food diversity in a meal, strengthening water, sanitation, and hygiene in schools, and channel the community program such as Tanzania Social Action Funds (TASAF) to the household with food insecurity by emphasizing on micro-agro-business to supplement household with food insecurity.

Other researches with superior methods should be done in Kasulu District to establish causality, and to find out whether the stunted pupils received or missed nutrition interventions during under-fives and how to mitigate factors associated with stunting among public primary school pupils.

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EAHRC
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ORIGINAL ARTICLE

Trends in Malaria Cases and Deaths: Assessing National Prevention and Control Progress in Burundi

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ABSTRACT

Background: Malaria is associated with high morbidity and mortality especially in World's tropical regions. In 2016, an estimated 216 million and 445,000 cases of malaria and deaths associated with malaria respectively were reported globally. Malaria is the first leading cause of outpatient visits, hospitalization and death in Burundi. We therefore examined the trend in malaria cases and deaths in Burundi.

Methods: We extracted data from Burundi National Health Information System (BNHIS) and assessed trends in malaria cases and deaths from January 2015 to December 2017. A suspected case of malaria was defined as any person treated by anti-malarial drugs without testing while a confirmed case as any person with a positive microscopy or rapid diagnostic test for malaria parasite. We described malaria cases and deaths, and calculated malaria case incidence rate.

Results: A total of22,225,699 malaria cases with 8,660 deaths (CFR 0.04%) was documented during the study period. Out of 22,225,699 cases, 45,291 cases (0.2%) were suspected malaria cases. The observed peak season of malaria infection in any of the studied year was in the raining season (March-June). All provinces of the country were affected. Kirundo and Cankuzo provinces the incidence of malaria cases increased from 10.1 cases per 1,000 persons in 2015 to 13.2 cases per 1,000 persons in 2017. The case fatality rate decreased from 0.06% in 2015 to 0.01% in 2017.

Conclusions: An increasing trend in malaria prevalence was observed in Burundi but Kirundo and Cankuzo provinces were the most affected. However, the case fatality decreased within the studied period. Malaria intervention should be intensified/scaled up in the raining season and the most affected provinces.

BACKGROUND

Malaria remains a threat to public health, particularly in sub-Saharan Africa, which is home to 90% of the world's malaria cases.[1] In 2016, this African sub-region had about 64,000 malaria deaths and 38 million reported cases, of which 32 million were confirmed malaria cases. The Democratic Republic of the Congo accounted for 48% of these reported cases, followed by Burundi (26%) and Angola (12%). Nine countries had increased cases from 2015 to2016. Angola and Burundi alone reported 3.8 and 8.3 million confirmed cases in 2016, which represents a 60% and 37% increase from 2015, respectively.[2] Due to high mortality associated with malaria in Burundi and some countries in sub-Saharan Africa, one of the Sustainable Development Goals (SDGs) targets of reducing child mortality might be unrealizable if the trend continues.

Malaria is the main cause of mortality in pregnant women and children below five years of age[3] and continues to kill millions of Burundians, despite concerted efforts to reduce malaria mortality. This is often attributed to a number of factors, including poor immunological competence because of malnutrition, climate change responsible for rising temperatures and increased rainfall and poverty, limited access to basic health care and specialized health facilities.[4] Three species of Plasmodium are present and affect the population differently. Plasmodium falciparum is the most formidable species because it is responsible for serious fatal forms and according to existing data, it is the cause of more than 90% of the infections encountered in Burundi. The other two species (*Plasmodium falciparum and Plasmodium ovale*) represent only 8% and 2% respectively. Mixed infections with *P. falciparum* and *P. ovale* also exist.[5]

Burundi's Strategic Plan for the fight against malaria

covers interventions aimed at reducing malaria; including universal Insecticide Treated Bed Net (ITN). The plan also includes strategies to improve malaria case management, improve diagnostic testing capacity and quality, increase coverage of three doses of sulfadoxinepyrimethamine (SP) for intermittent preventive treatment in pregnancy (IPTp), establish a robust surveillance system, and establish a monitoring and evaluation framework.[3]

In Burundi, the results of the evaluation of routine distribution of long-lasting insecticidal nets (LLINs) show that coverage is higher in urban than in rural areas. Indeed, 75% of urban households versus 62% of rural households own at least one ITN or LLIN. The average number of ITNs or LLINs is estimated at 1.5 per household in urban areas compared to 1.1 in rural areas.[6] In Burundi, the results of the evaluation of routine distribution of LLINs show that coverage is higher in urban than in rural areas. Indeed, 75% of urban households versus 62% of rural households own at least one ITN or LLIN. The average number of ITNs or LLINs is estimated at 1.5 per household in urban areas compared to 1.1 in rural areas.[6]

Understanding malaria cases and deaths trends is critical for evaluation of progress made or assessing gaps in the malaria control efforts in Burundi. Reducing the incidence of malaria cases and deaths is a national priority that requires a focused, comprehensive, and consistent approach in order to achieve the vision of "a malaria-free by 2030", as stated in the 2016-2017 Burundi National health policy (PNS).[7] We described the national and provincial malaria cases and deaths from 2015 to 2017, highlighting vulnerable populations, and comparing proportions of laboratory-confirmed malaria cases reported from Burundi's eighteen provinces. Our objective was to assess the trends in malaria cases and deaths in Burundi from 2015 to 2017.

METHODS

Study Setting

Burundi is located in the eastern part of Africa and is divided administratively into 18 provinces. The 2017 projected population was estimated to be 9,978,423 with 50.8% women and an annual population growth of 2.4%. Children under 5 years of age represent 19.3% of the total population. Burundi covers an area of square kilometre 27,834.[8] Its climate is tropical with four seasons, a small rainy season (October to December), a small dry season (January to February), the great rainy season (March to May) and the great dry season (June to September).[7] The country's healthcare coordination is organized into three pyramidal and hierarchical levels: the central, intermediate and peripheral levels. The central level consists of the office of the minister, a general health inspectorate, two general directorates, 6 departments, 9 health programs and related services. The intermediate level comprises 18 provincial health bureaux[9]. The peripheral level has 46 health districts, 91 hospitals and 1,057 primary healthcare centres.[10]

Malaria is one of the nationally diseases under surveillance reported on a both weekly and monthly basis. However, during epidemics the reporting is changed to daily form. Public health facilities, private and No Governmental Organizations (NGO) health facilities are the reporting entities. Clinical staff records health data. This data is then sent weekly and monthly to the Districts data managers. District data managers then compile reports from health facilities and send them to provincial data managers, which in turn, submit this information to the central level. The collected malaria data is reported from health facilities through either a focal person's email or mobile texting.[11] The population under surveillance for malaria is the total population of the country.

Study Design and Data Source

This is a secondary data analysis of routinely collected countrywide malaria data from both hospitals and health facilities in the 18 provinces in Burundi. We obtained data from Burundi National Health Information System (BNHIS) for the period from 2015 to 2017.

Permission to analyze the data was obtained from Burundi Ministry of Health. We extracted provincial data on all malaria cases reported in the District Health Information Software 2 (*DHIS2*) from 2015 to 2017. Variables extracted from the surveillance system included total reported malaria cases and laboratory confirmed malaria cases. A suspected malaria case was defined as any person treated by anti-malarial drugs without testing. A confirmed case was a person who tested positive for malaria parasite. The extracted data was exported into an Excel 2016 workbook. All the characteristics at inclusion, as well as the variables of interest were described in terms of numbers and percentages from the cross-tabulations and frequency tables. The QGIS 2.18.13 software allowed us to produce the flat maps of our study area.

Data Analysis

Malaria prevalence and specific mortality rates were calculated using the mid-year population, which was estimated from the projected population based on the 2008 census and assuming a 2.4% annual population growth each year. The prevalence of malaria was estimated per year. The malaria mortality rate was defined as the number of deaths among confirmed malaria cases divided by the mid-year population of the district, while prevalence was defined as the number of reported malaria cases divided by the mid-year population. Charts and frequency were used to describe the trend.

Ethical Consideration

This is a secondary data analysis without personal identification information, not human subject research. Permission to use the malaria morbidity data was obtained from and grated by Burundi National Health Information System of the Ministry of Health. All data extracted were confidentially stored at the end of the study.

RESULTS

A total of 22,225,699 malaria cases were reported from January 2015 to December, 2017, and almost all cases (99.8%) were parasitological confirmed. The malaria contribution to the outpatient cases was 41.5% with less proportion of malaria cases being recorded in 2015 (Table 1). Malaria prevalence was highest in 2016 with 57.0/100 persons (Figure 1). The Case Fatality Rate (CFR) decreased from 0.06% in 2015 to 0.01% in 2017 (Figure 3). The decrease in CFR was not statistically significant ($p=.21$).

The highest number of malaria cases was recorded in 201-

FIGURE 1. Annual Prevalence Rates of Total Malaria Cases (All) Per 100 Populations 2015-2017

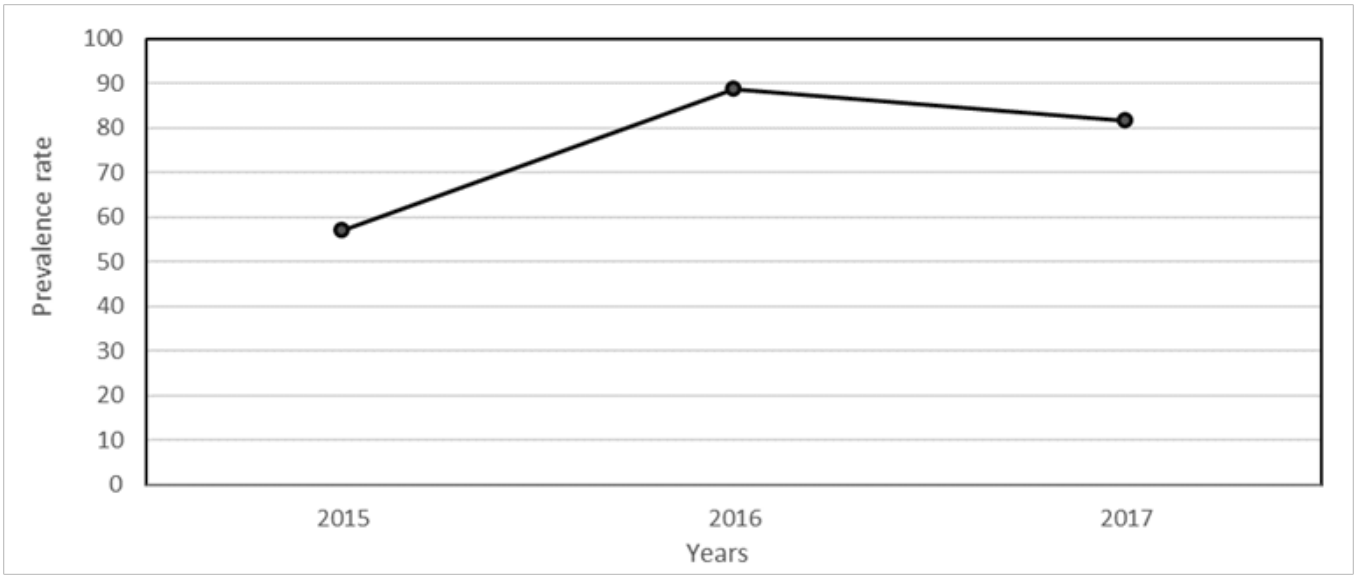


FIGURE 2. Seasonal Indexes of 3 Years Malaria Cases in Burundi, 2015-2017

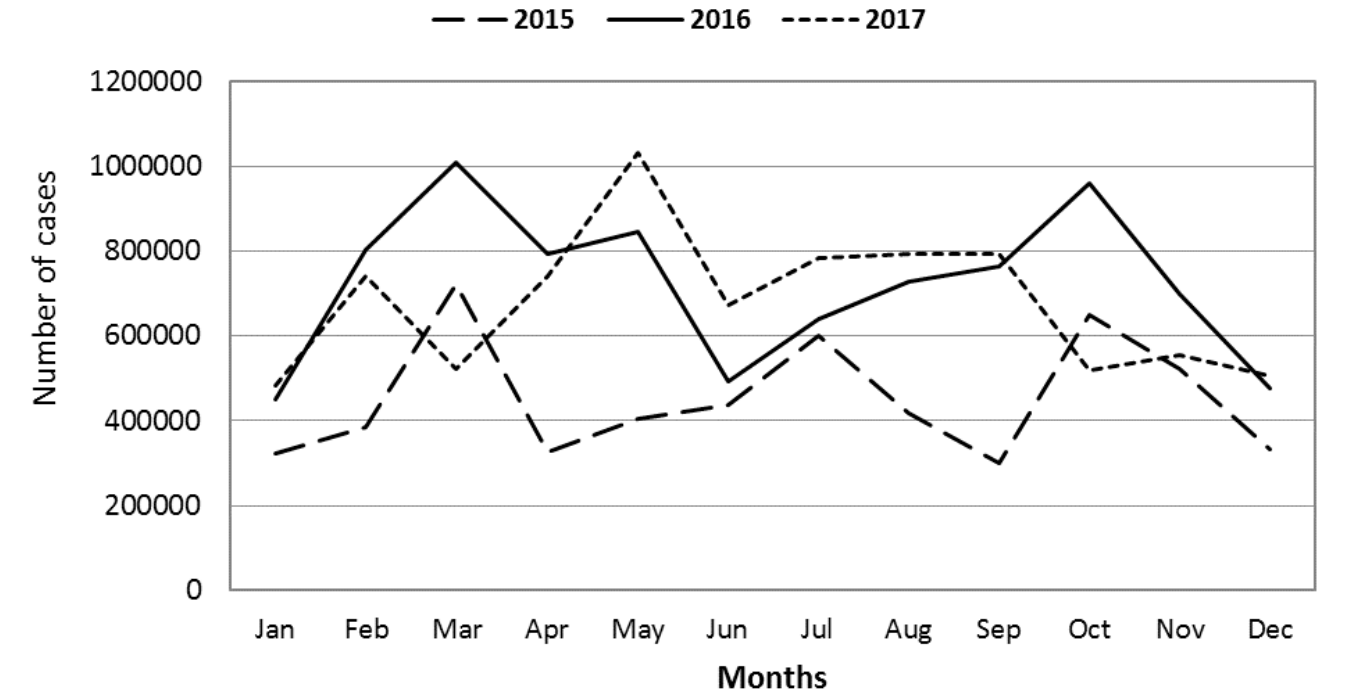


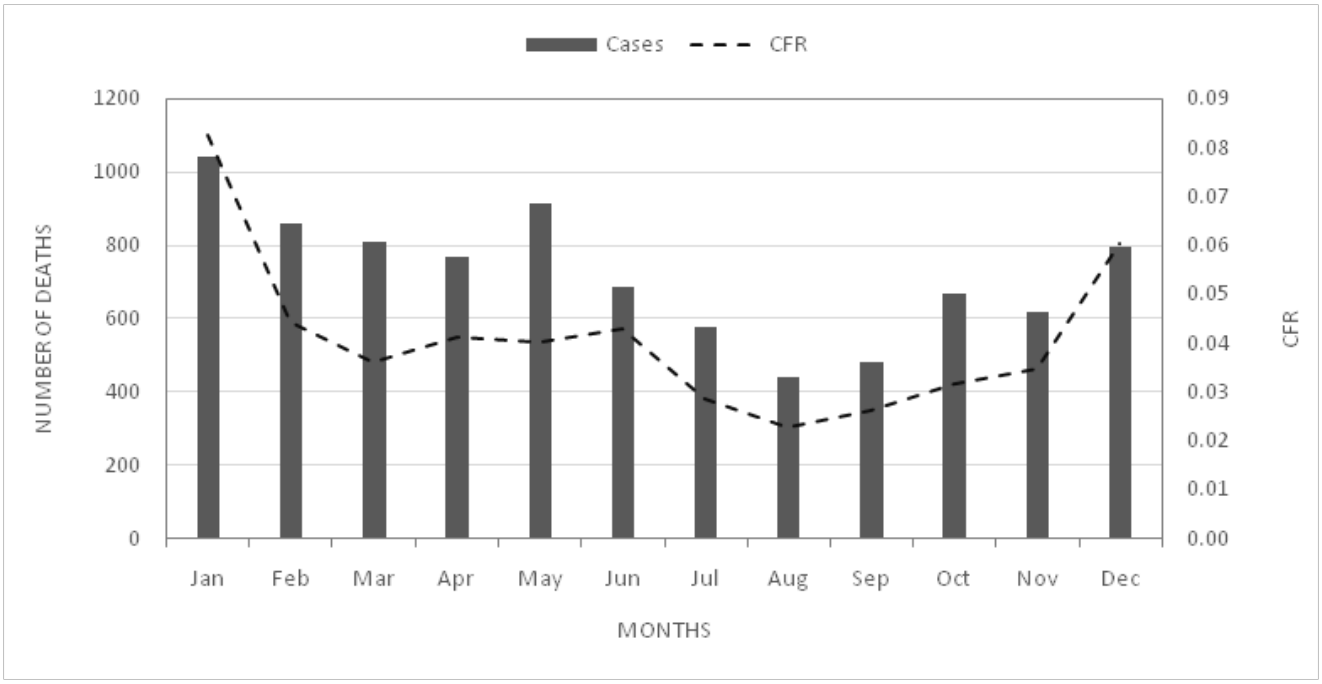
TABLE 1: Outpatient Malaria Cases Reported in Burundi from 2015 To 2017

Year	Outpatient all causes	TotalMalaria Cases	%	Confirmed cases	%
2015	16,138,956	5,426,400	33.6	5,408,809	99.7
2016	19,368,945	8,658,050	44.7	8,637,680	99.8
2017	18,099,575	8,141,249	45.0	8,133,919	99.9
Total	**53,607,476**	**22,225,699**	**41.5**	**22,180,408**	**99.8**

TABLE 2: Mean Number of Malaria Cases in Burundi, From 2015 To 2017

Year	Mean	Standard deviation	Minimum	Maximum	Total
2015	452,200	140,266.4	299,776	722,790	5,426,400
2016	721,504.2	181,442.1	450,988	1,010,098	8,658,050
2017	678,437.4	166,122.1	482,710	1,030,712	8,141,249

FIGURE 3. Compilated Malaria Deaths/ CFR per Month in Burundi 2015-2017



6 (8,658,050 cases), while the lowest was recorded in 2015 (5,426,400 cases). The highest standard deviation was observed in 2016, meaning that cases reported in that year had the highest monthly variation, while the lowest standard deviation was recorded in 2015, meaning that monthly reported cases did not vary significantly (Table 2).

Malaria occurred every month and the distribution of cases per month showed a monthly and yearly fluctuation in trend in the years under study. Cases peaked in March of 2015 and 2016 and in May of 2017 (Figure 3). In addition, the result of Chi-square analysis revealed statistically significant association of malaria cases and seasons ($x^2 = 713661.41$, df = 22, $p < .0001$).

FIGURE 4. Malaria Case Fatality Rate Trends in Burundi, 2015-2017

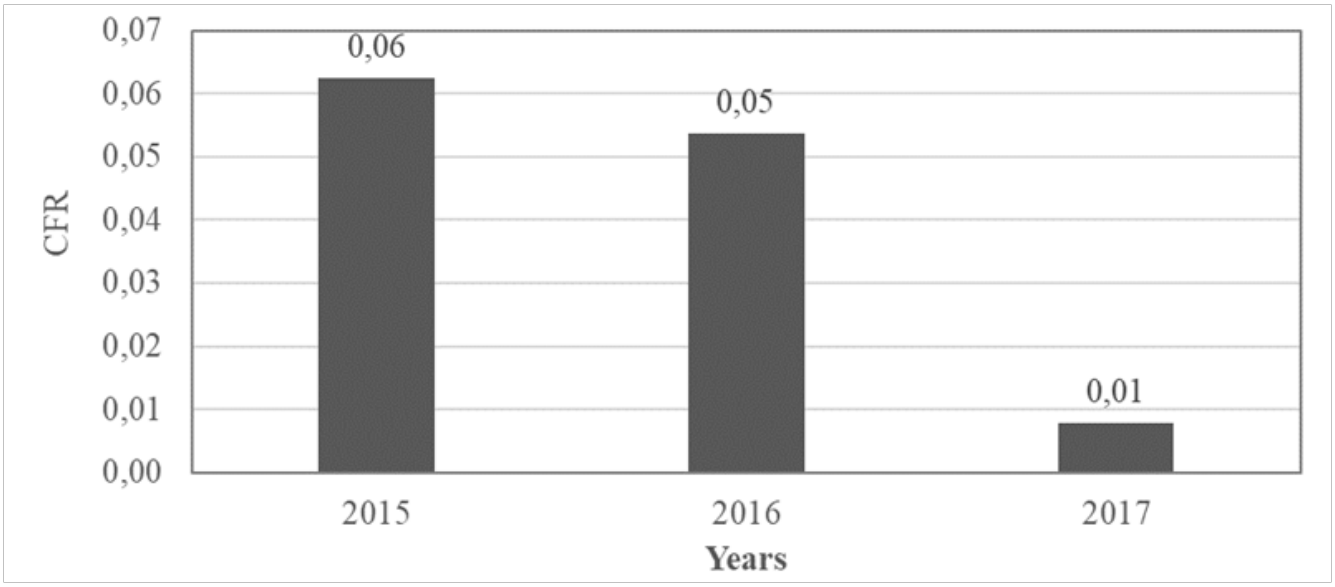
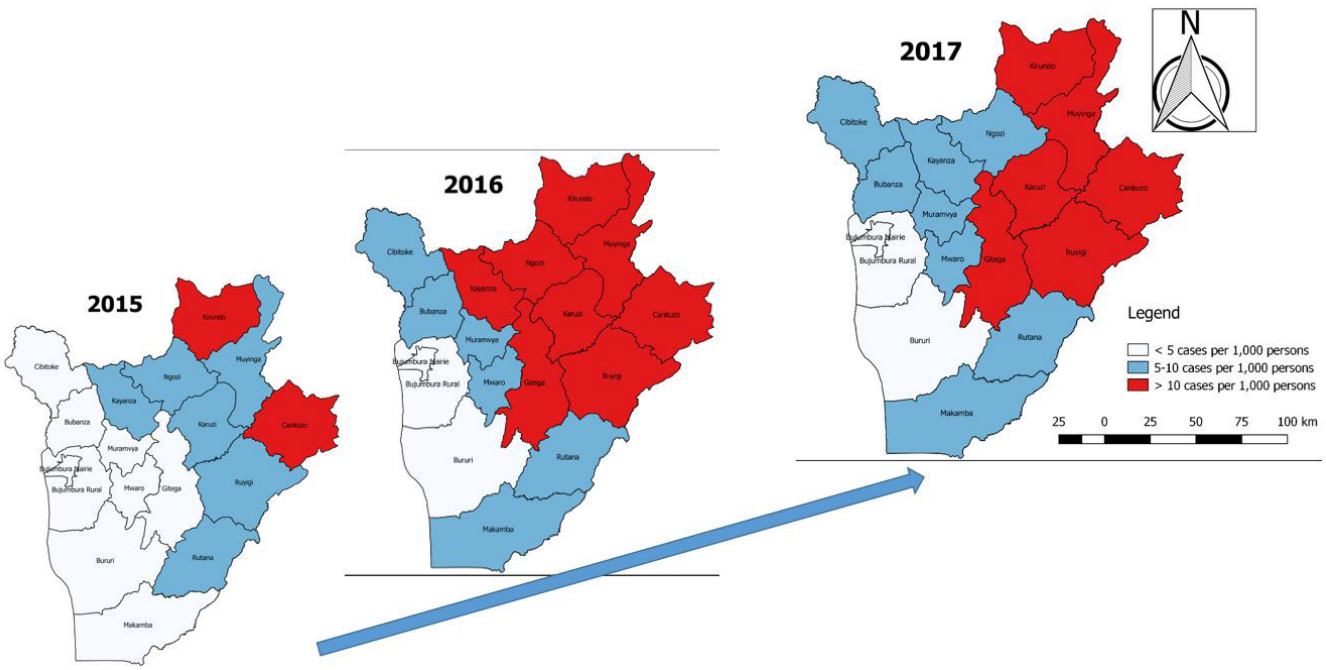


FIGURE 5. Malaria Prevalence Trends by Province in Burundi 2015-2017



Kirundo and Cankuzo provinces had the highest changes in incidence, increasing from 101 cases per 1,000 persons in 2015 to 137 cases per 1,000 persons in 2017 for Cankuzo province and 113 cases per 1,000 persons in 2015 to 135 cases per 1,000 persons in 2017 for Kirundo province. (Figure 4).

DISCUSSION

The present study demonstrated that malaria incidence fluctuated annually, with the minimum and maximum number of cases recorded in 2015 and 2016, respectively. The maximum number of malaria cases recorded in 2016 despite the mass distribution campaign of long-lasting insecticide treated mosquito nets in 2014 may be attributed to community misconception surrounding malaria prevention and control. Moreover, the ITNs alone is not enough to control malaria. Its combination with other strategies including vector control, pharmacovigilance of ant malarial drugs, etc.

The effectiveness of the national response strategy undertaken to control malaria in the year 2016 might be the reason for the decrease of the prevalence to 81.5 % in 2017. The strategy includes universal insecticide-treated bed net (ITN), malaria case management, improve diagnostic testing capacity and quality, increase coverage of three doses of *sulfadoxinepyrimethamine* (SP) for intermittent preventive treatment in pregnancy (IPTp), establish a robust surveillance system, and establish a monitoring and evaluation framework. However, this finding still higher than that of the Burundi Demographic and Health Survey (BDHS) which revealed a prevalence of 51%[12]. This may be due the fact that our study used the country wide data obtained from the surveillance system while the BDHS used a sample since there is the possibility of sampling bias in favour of those who did not have malaria two weeks before the survey as defined in BDHS protocol.

The percentage of confirmed cases among those who reported that they show symptoms of malaria ranged from 99.7 % in 2015 to 99.9 % in 2017. High rate of confirmed cases among the reported cases found in this study is an indication of good knowledge and correct diagnosis of malaria by the Burundians without the use laboratory confirmation. An increasing proportion of reported malaria cases with laboratory confirmation can signify improved adherence to diagnostic and treatment guidelines for malaria and stronger surveillance.

However, the finding from this present study with respect to high percentage of confirmed cases among reported cases is greater than the finding from the 2015 survey on the availability, accessibility and use of malaria control inputs as well as the quality of malaria care in selected health facilities, where the proportion of confirmed malaria cases in all fever cases (confirmation rate) was 72%.[13]

The difference could be attributed to the fact that 2015 survey on the availability, accessibility and use of malaria control inputs as well as the quality of malaria care in selected health facilities was conducted in some selected heath centres in Burundi and not population based as observed in the surveillance data which more enhanced and robust than the health facility survey.

In this study, malaria case fatality rate showed a decreasing trend from 2015 to 2017 (0.06% to 0.01%). This should be attributable to the scaling-up of RDT based rapid case detection contributing especially during the malaria outbreak of 2017. A study conducted in India where malarial mortality was showing gradual decrease in trend corroborate our finding.[14]

Malaria cases occur in all month and years in this study area. The highest peak malaria case was observed in March, May and October. This may be the consequence of the Burundian rainy seasons which runs from March to October of a particular year create a favourable conditions and environment for the breading of mosquitoes. Kirundo and Cankuzo provinces consistently had the highest incidence of malaria cases from 10.1 cases per 1,000 persons in 2015 to 13.2 cases per 1,000 persons in 2017. This pattern is similar to the findings from the Burundian malaria indicators survey of 2012.[15] Reducing the incidence of malaria is a national priority that requires a focused, comprehensive, and consistent approach in order to achieve the vision of "a malaria-free by 2030", as stated in the 2016-2017 Burundi National health policy (PNS).[7]

CONCLUSION

Malaria occurred in all months throughout the years under investigation and all provinces in Burundi were affected by malaria but substantial variation was expressed across the province. Laboratory confirmation of malaria in the 3-year period under review was on the increase. However, cases peaked in March, May and October. The case fatality rate gradually declined. Therefore, the existing malaria prevention and control programs should be scaled-up and strengthened in Burundi. Appropriate disease and vector control strategies must be implemented.

Limitations

Individual-level data were not available and consequently data on age or sex distribution were not provided. This limited our ability to determine malaria prevalence by sex as well as other potential risk factors. Lack of availability of station level climate data, more detailed role of climatic conditions on the spatial patterns of malaria prevalence could not be assessed.

Authors' Contributions

Adolphe Ndoreraho was responsible for data sorting, data analysis, manuscript drafting. Muhammed Shakir and Ayo Adebowale provided technical support in terms of data analyses and reporting. JumaNdereye, Olusola Aruna, Chukwuma Umeokonkwo and Celestine Ameh contributed to the writing of the introduction and discussion section of the paper. All the authors reviewed and approved the final version of the manuscript.

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ORIGINAL ARTICLE

Plasmodium falciparum and P. malariae: infection rates in the population of Northern Imbo Plain, Burundi

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ABSTRACT

Background: Burundi is cited among countries where malaria remains endemic. Notably, malaria is highly endemic in Imbo region, a lowland lying astride Lake Tanganyika. Among key malaria riposte interventions includes the promotion of Long-Lasting Insecticidal Nets (LLINs), but its incidence rate has not reduced. In this paper, we present the distribution of malaria species in 2 settings within Imbo region by accounting for the seasonal variations and the mostly infected populations.

Methods: The study was conducted from 2 Health Care Centres of Murambi and Rugombo in Cibitoke District, Northern Burundi. Blood samples were collected on blood slides and the samples were used to confirm the presence of malaria parasites by microscopy.

Results: The study observed an average malaria parasite prevalence of 32.5% across the selected site. Majority of patients 459(95.2%) were infected by P. falciparum while 8(1.7%) patients were infected by P. malariae. Patients from Murambi were more infected than those from Rugombo. P. falciparum was the most highly prevalent specie in the 2 localities. High prevalence was observed in children aged between 2 and 5 years. Among older participants P. falciparum still predominated and mixed infections were rather the least prevalent.

Conclusion: This study showed that P. falciparum and P. malariae are the most parasites involved in malaria morbidity in North Imbo region. The transmission of P. falciparum was observed year-round. Patients in Murambi are most exposed to malaria infections than those in Rugombo. Further research at large scale including entomological studies is required to better understand the relationship between Entomological Inoculation Rates (EIR) and malaria transmission levels in this setting.

BACKGROUND

In most Sub-Saharan African countries, malaria remains a public health threat. In 2018, the world malaria report estimated an incidence of 218 million cases which translated into nearly 405,000 deaths. The Sub-Saharan Africa (SSA) accounted for about 93% of malaria-related deaths. In this Subcontinent, malaria accounts for 10% of global deaths and up to 50% of hospital admissions.[1] Markedly, children below 5 years and pregnant women are the most vulnerable to malaria.[2] For instance, in 2018, children below 5 represented 67 % of annual malaria-related death toll.[1]

Until today, Burundi is cited among countries where malaria remains endemic.[3] The country undergoes seasonal malaria epidemics, causing thousands of deaths each year.[4,5] Notably, malaria is highly endemic in Imbo region, a lowland lying astride Lake Tanganyika.[6] In this region, rice growing has significantly contributed to malaria endemicity as this constitutes a favourable breeding site for mosquitoes.[7] Among key malaria riposte interventions include the promotion of Long-Lasting Insecticidal Nets (LLINs) use which the Government has noticeably invested in for more than a decade.[8] However, despite enormous efforts to control malaria by the Government and other players, its incidence rate has not reduced.[9] It is against this statement that we conducted a study to shed more light on the current malaria transmission and endemicity rates in Imbo region. In this paper, we present the distribution of malaria species in two settings within Imbo Region by accounting for the seasonal variations and the mostly infected populations.

METHODS

Study Area

The study was conducted in two sub-settings namely Murambi and Rugombo in Northern Imbo lowland. Murambi is located on 02° 08″ Latitude South and 29° 04″ Longitude East and Rugombo on 02° 54″ Latitude South and 29° 08″ Longitude East. These settings are a Sub region of Cibitoke Province, Rugombo Commune.[10] Unlike most parts of the country, the study setting experiences high temperatures, typically around 24 degrees Celsius year-round. In addition to high malaria-related reported deaths, the rationale

behind the selection of the study setting includes the lack of recent data to inform policymakers. The most recent malaria data from this region was published in 1984 as can be seen in Figure 1. The study setting encompasses 3 Health Centres and one Hospital. Bowing to our capacity, the study was conducted in two conviniently selected Health Centres of Murambi and Rugombo.

Study Type
We conducted a cross-sectional study using data collected on a period of 12 months from January to December 2014.

Simple Size
The study was conducted on a sample of 1,482 patients from whom malaria Rapid Test Diagnosis (RTD) was requested by the treating nurse.

Data Collection
From all patients undergoing malaria rapid test, an additional blood sample was collected for the purpose of the study. The sample was used to confirm the presence of malaria parasites by using Ethanol and Giemsa (ARCHEM®: AlliwinEliixer Organic) and to further determine the type of parasite under microscopy (Olympus Corporation, Tokyo, Japan). Data was collected twice a month and for a period of 12 months. No data collectors were recruited as the study required laboratory skills. Only researchers were allowed to read malaria blood samples and capture data into an Excel Spreadsheet.

Data Management
Collected data was entered into Excel spreadsheet and imported into STATISTIX PC DOSVersion 2.0 Copyright (C), 1987, NH Analytical Software and Fischer Test (California, USA). Data entry was crosschecked by two data capturers to ensure consistency and track missing values. Any missing value was recollected immediately by referring to the samples. In the first instance, we calculated malaria prevalence followed by the distribution of malaria species across the study settings. In the second time, patients were disaggregated by age category and malaria prevalence by type of species and calculated for each age category. Finally, a test of proportions was used to seize significant differences between malaria prevalence and again by age category.

Ethical Consideration
The study obtained ethical clearance from the National Ethics Committee. Furthermore, the study obtained special permission from the Provincial Health and District Health Officers respectively. All participants signed individual informed consent forms. The bio bank was shredded after data analysis to avoid unethical future uses. Also, each participant was provided with an identification number for anonymous reasons.

RESULTS
Plasmodia Species Distribution
As shown in Table 1, of 1,482 patients, 482(33.4%) were infected by at least one of Plasmodia species with an average parasite index of 32.5%. Majority of patients 459(95.2%) were infected by *P. falciparum* while only 8(1.7%) and 15(3.1 %) were diagnosed with *P.malariae* and mixed infections, respectively.

Comparison of results from Murambi 227(36.3%) and Rugombo 255(29.7%) showed a statistically significant difference (F=8.0, p= .0 and OR=3.2 [1.6-6.5]). On the one hand, *P. falciparum* was the most highly prevalent specie in the 2 localities with 220(35.2%) and 239(27.88%) infected patients in Murambi and Rugombo respectively. Again, the difference between proportions was significant (F=5.0, p= .0 and OR=1.4[1.0-2.0]). On the other hand, *P. malariae* was less distributed with only 2(0.3 %) and 6(0.7%) of cases in Murambi and Rugombo respectively. Furthermore, there was no difference between the localities (F=0.9, p=.3).

Similar to *P. malariae*, we found rare mixed infections with P. falciparum and *P. malariae*; these cases accounted for only 2(0.3%) and 3(0.3%) in Murambi and Rugombo. We did not find evidence for a statistical difference between the areas. (F=0.4, p=.5).

Equally, accounting for parasite evolution stages (schizont-associated trophozoites), less than 1% of patients were infected with *P. malariae*. In Murambi, the study detected 2 cases (0.3%) and 5 patients in Rugombo (0.5%). We did not detect statically significant difference between the 2 proportions (F=0.5, p=.4).

Plasmodia Species Distribution According to Age Stages
In Table 2, we present results of *P. falciparum* and *P. malariae* as well as mixed infections by age of participants. The table highlights that the vast magnitude of infections occured before the age of 24 months. In fact, 20(21.9%) of P. falciparum infections were found among participants aged below 6 months and 142(35.8%) among those aged between 7 and 23 months. The least represented infections were P. malariae with 2(0.5%) patients and mixed infections representing 3(0.5%) patients.

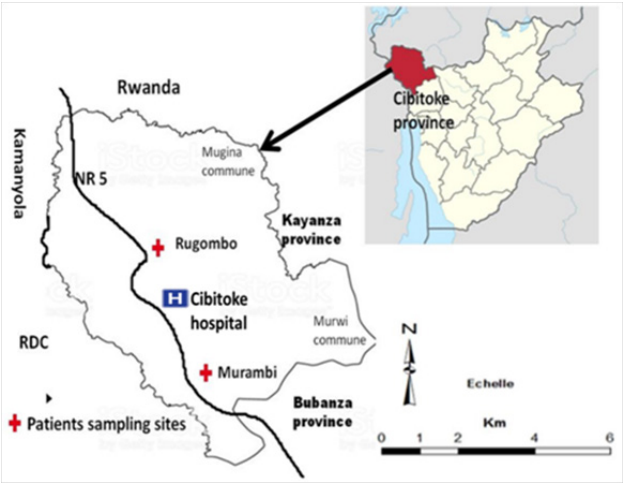
Among children aged between 2 and 5 years, 208(39.1%) carried P. falciparum. In this age category, only 5(0.9%) were infected by P. malariae and another 5(0.7%) by various mixed infections. For older children, those aged above 5 and below 10 years, nearly half (43.37%) were infected by P. falciparum. In this age trench, only 1 patient (1.21%) was diagnosed with P.malariae. Above the age of 10 and below 15 years, almost one-third (29.8%) of patients had P. falciparum while only 2(2.1%) patients carried mixed infections. Among older participants (above the age of 15 years), still P. falciparum predominated with 12% of patients and mixed infections were rather least prevalent (1.2%).

Seasonal Malaria Transmission
As seen in Figure 2, there was transmission of P. falciparum throughout the year with seasonal variations. In contrary, P. malariae is only seasonal as there were no cases for a period of 6 months in the year (from April until September).To highlight noticeable malaria transmission differences, for instance, a peak of P. falciparum cases was observed in April (24.3%) corresponding to heavy rain season (14.3 mm of water). Conversely, during dry season, from July to September, we observed a peak of P. malariae, with 3.4% cases.

Malaria Distribution among Children Aged Between 2 and 9 Years Old
The annual rate transmission of *P. falciparum* parasites in

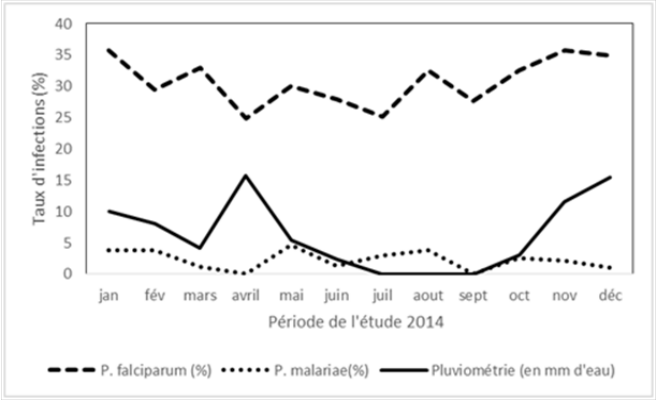
children aged between 2 and 9 years varied from 27.7% to 58.3%. The peak was observed in January (58.3%) with fewer cases in July (27.7%). Variations in malaria cases did not exhibit important magnitude for the rest of the year. (Figure 3).

FIGURE 1. Study areas in Cibitoke Province, Burundi



Source: Province Cibitoke-Wikipédiafrwikipédia.Org

FIGURE 2. Malaria Transmission According to Seasons

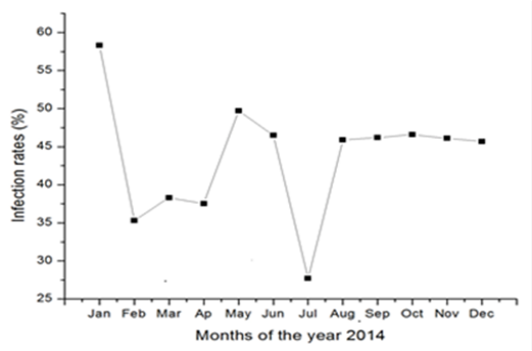


DISCUSSION

The aim of this study was to determine and characterise transmission and endemicity levels of malaria in 2 localities (Murambi and Rugombo) in Northern Imbo lowland in western Burundi.

Overall, *P. falciparum* was the most prevalent specie found in the two study settings. Similar results were found in the preceding studies. For example, in 1991, Barutwanayo M and Coosemans M et al., reported that *P. falciparum* was associated with the high morbidity due to malaria observed in the Northern Region of Imbo.[6]

FIGURE 3. Annual Malaria Transmission among Children Aged 2-9 Years Old



Further, the study exhibited that malaria is highly prevalent in Murambi than in Rugombo. Plasmodic index of *P. falciparum* in Murambi was higher than in Rugombo. Our results corroborate those obtained by previous authors[11] including Coosmans who showed that plasmodic index is relatively low in Rugombo locality (16%) than in Ndava (27%) located not far from Murambi on Ruhwa-Bujumbura pathway.[8] All these results showed that the rate of malaria transmission was higher in savannah than in urban locality. To support the above statement, previous studies also reported that malaria was highly transmitted in rural regions in Niger[12] and other studies reported similar results in the savannah regions of West and Central Africa.[13]

In our study, in comparison with children (0-6 months), adolescents and adults (from the age of 11 years onwards); findings showed that infants aged from 7 months up to 10 years are highly vulnerable to malaria. Boudin C and Robert V et al., reported that children below 6 months are protected by maternal antibodies[14] and this ephemeral premonition decreases with age and may be depleted when babies are 2 years old unless maintained by anopheline infective bites.[15] Anti-malaria premonition, which increases with age may be generally established after adolescence among populations being regularly exposed to infective mosquito bites.[16]

In our study, rain seasons predicted significant rise in P. falciparum transmission. Such a correlation is highly suggestive as rain seasons are associated with the transformation of marshes into irrigated croplands which is at the origin of a high malaria prevalence.[15,16] This could explain the high malaria morbidity in the study population given the fact that Murambi lies aside Muhira River and several rice irrigation canals. To add on that, irrigated rice farming practiced in both Rugombo and Murambi contributes to the creation of potential breeding sites for vector multiplication and the maintenance of malaria transmission and its evolution under the hyper-endemic mode.[5,8] Studies in Burkina Faso[17] and that by Nanga-Eboko in Cameroon[19] showed that the entomological inoculation rates are positively correlated with increased rainfall intensity. Also, P. falciparum and P. malariae cases occur

TABLE 1: Prevalence of P. falciparum and P.malaria

Species	Study sites	Murambi(%)	Rugombo(%)	F	p-value	OR	CI
P. falciparum		220 (35.2)	239 (27.8)	5.0	0.0	1.4	1.0-2.0
P. malariae		2 (0.3)	6(0.7)	0.5	0.3	-	
P.f ;P.m		2 (0.3)	3 (0.3)	0.6	0.5	-	
P. m; Sch. P. m		2 (0.3)	5 (0.5)	0.7	0.4	-	
Total		227 (36.3)	255 (29.7)	8.0	0.001	3.2	1.6-6.5

SD: Significative difference; NSD: Non Significative Difference; P. f : Plasmodium falciparum; P. m: Plasmodium malariae; Schiz. P. m: Schizonte de P. malariae

TABLE 2: Malaria Prevalence by Age Category

Age range	0-6 months	7-23 months	2-5 years	6 -10 years	11-15 years	>15 years	Total
Infections							
P. falciparum	20(21.9)	142(35.9)	208(39.1)	36(43.3)	14(29.8)	40(12)	460
P. malariae	0(0.0)	2(0.5)	5(0.9)	1(1.2)	0(0.0)	0 (0.0)	8
Mixed-infections	0 (0.0)	3(0.5)	5(0.7)	0(0.0)	2(2.1)	4(1.2)	14
Total	20 (21.9)	147(37.1)	218(40.9)	37(44.5)	16(34)	44(1.2)	482

during dry season, suggesting the presence of potential breeding sites for vector multiplication. There were potential water collections in irrigated rice farms and relevant stream water[20]. Very few P. falciparum and P. malaria species in mixed infections were reported in this study. Such findings can be associated with the low of P. malariae transmission as observed during the entire study period. Our findings stream together with finding from previous studies.[4,8]

Strengths and Limitations

This study, which informed stakeholders and decision makers on the prevalence and parasite distribution of malaria in Imbo region, used data from a significantly big sample to ensure generalisability. In addition, blood samples were taken and captured by lab technicians, which helped to ensure data accuracy and consistency. However, we did not confront blood samples with rapid diagnostic tests for better case detection. Also, despite the ability to inform on associations, cross-sectional designs do not allow causality inference.

CONCLUSION

This study showed that P. falciparum and P. malariae are the most parasites involved in malaria morbidity in North Imbo region. The transmission of P. falciparum was observed year-round. Patients in Murambi are more exposed to malaria infections than those in Rugombo. High malaria-related morbidity was observed in children between 2 and 5 years old. In the study setting, malaria transmission was stable with a trend to turn into hyper endemic. We recommend further investigations at large scale including entomological studies to better understand the relationship between Entomological Inoculation Rates (EIR) and malaria transmission levels in this setting. New preventive measures such as environmental interventions, campaigns for better LLINs use, and the promoting of research would contribute to reduction of malaria incidences

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ORIGINAL ARTICLE

Assessment of Integrated Disease Surveillance Data Uptake in Community Health Systems within Nairobi County, Kenya

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ABSTRACT

Background: Kenya has since independence struggled to restructure its health system to provide services to its entire population especially in outbreak responses. The last decade has seen the country witness disease outbreaks across the country i.e. Rift Valley fever in June 2018, and Chikungunya and Dengue fever in Mombasa in February 2018. This exposed the country's lack of preparedness in handling outbreaks at grass root level. Outbreak incidences tend to prevail at community level before a public health action is established, with the situation becoming dire in the lower tier health facilities.

Objective: The purpose of the study was to assess the uptake of Integrated Disease Surveillance Response (IDSR) health data and utilisation at community level health systems in the six sub counties within Nairobi County of Kenya.

Methodology: The study used cross-sectional descriptive research design on a target population of 1840 community health workers. The study used Yamane formula to calculate the sample size of 371 respondents, selected using stratified sampling and simple random sampling methods. The logistic regression model was used to assess the benefits of Integrated Data Surveillance and Response data in health facilities across Nairobi County. Data was collected using questionnaires, analysis done using Statistical Packages for Social Sciences, and findings presented in form of tables and bar graphs.

Results: The study had 315 questionnaires were duly filled and returned, representing 85% response rate. The findings showed that 268(85%) Healthcare Workers lacked training on using disease surveillance data; 236(75%) cited lack of tools for disease surveillance in facilities, while 173(55%)cited lack of timely IDSR data as hindrance to IDSR data uptake. The regression findings showed that training of healthcare workers on IDSR, installation of disease surveillance system tools, and timely collection and dissemination of surveillance data increases the likelihood of IDSR data uptake in community health facilities.

Conclusion: The study concluded that IDSR system tools should be installed in community health facilities across the six sub counties in Nairobi County. Training should be emphasised to ensure all health care workers have the required skills to use the IDSR data. There is need to ensure IDSR data is collected and disseminated on time to make it available for interpretation and use by health care workers in their respective facilities.

BACKGROUND

Public health surveillance is a continuous collection, analysis, and interpretation of health data systematically for purposes of planning, decision making, implementation, and evaluation of public health activities[1–3]. The Alma Ata Declaration of 1978 emphasises community involvement in health services as the essential components of the Primary Health Care (PHC) towards the pursuit "Health for All' and "Community participation", with many Sub Saharan Africa countries embracing this notion[4,5]. Integrated Disease Surveillance and Response (IDSR) is a unit of the healthcare that makes surveillance and laboratory data more usable in improving detection and prevention of illnesses and disease outbreaks, hence the need for exhaustive data gathering, thorough analysis, and proper dissemination of the information for effective decision making[6–8]. In Kenya, Community Based-disease Surveillance (CBS) remains active via Community Health Volunteers (CHVs), who detect and are the main reporters on cases that might otherwise not be reported to health care facilities at primary level for immediate action response[9,10]. They in turn integrate health events with health centres (tier I, II & III) for response. According to the Government of Kenya (GoK) Health Sector Strategic Plan, the healthcare tiers include: **Tier I**, also known as Community Health Services (comprises all community b-

ased activities, mainly health promotion, disease prevention, and identification of cases that require reporting to higher levels of care); **Tier II**, also known as Primary Care Level (comprises of maternity homes, dispensaries, and health centres); **Tier III** which comprises of county referral hospitals that are normally staffed by a particular county within Kenya; and **Tier IV** which encompasses all national referral hospitals i.e. Kenyatta National Hospital, Mathari Hospital, Moi Teaching and Referral Hospital, and the National Spinal Injury Referral Hospital[6,11].

Despite this progress made in the implementation of IDSR (Integrated disease surveillance & response), challenges still exist[12]. Cholera Outbreak in the month of July 2017 affected 6 Sub-Counties in Nairobi namely Kamukunji, Langata, Dagoretti, Embakasi, Starehe and Ruaraka. The outbreak had 64 confirmed cases, 317 probable cases, with 4 deaths, Case Fatality Rate (the proportion of deaths within a designated population of "cases" over the course of the disease) which is 1%[13]. However, it is noted that the cases were preventable if early response had been initiated.[14]

Problem Gap

Kenya has made good progress in IDSR implementation with focal persons in most sub counties and electronic reporting at county level. Health facilities are the primary sources of disease data, even though their reporting rates have been below the target of 80% reporting rate.[9,15] Nairobi County residents can access health facilities within a radius of 7 Km. The doctor-population ratio in Nairobi County is 1:7,143 while the nurse-population ratio is 1:887[16]. Despite this, outbreaks and emergencies still exist and response as a result of decision making is wanting, hence there was the need to assess the utilisation of routine data for decision making in health facilities in Kenya[10,13,14]. Despite the progress made in the implementation of IDSR, data analysis by the health care system remains sub-optimal, and thus, events-based incidences prevail at community without established public health action to avert the event[4,8,17]. With Kenya's adoption of decentralised system of government, there is greater call for community empowerment and involvement in health system and decision making. The study therefore sought to assess the uptake of Integrated Disease Surveillance and Response (IDSR) data in community health systems within Nairobi County.

METHODOLOGY

Research Design

The study used cross-sectional descriptive research design. The Office for Human Research Protection (OHRP) defines a descriptive study as one in which information is collected without changing the environment, and is conducted to demonstrate relationships between things[18].

A descriptive study can involve a one-time interaction with groups of items also known as cross sectional study or a study that might follow individuals over time, also known as longitudinal study[19].

Sample Size Calculation

The target population of the study was 1,840 community health workers which comprised of nurses, clinicians, public health officers, medical officers, community health assistants, lab technicians, and pharmacists in health centres and dispensaries within Nairobi County. The study used Yamane[20]. Formula used to calculate the sample size of 371 respondents (health care workers)[21].

$$n = \frac{N}{1 + N(\varepsilon^2)}$$

$$n = \frac{1840}{[1 + 1840(0.05^2)]} = 370.86 \cong 371$$

Sampling and Data Collection

Nairobi County has 58 public health facilities spread across 6 sub counties. During sampling, each sub county was divided into 5 strata namely nurses, clinicians, medical officers, public health officers, and Community Health Volunteers (CHVs). Each stratum was then subjected to simple random sampling, with a total of 371 health care workers being selected from the entire target population. Data was therefore collected from 58 public health facilities in the 6 sub counties in Nairobi, with each sub county being a DSR resource centre. Data collection was carried out by 6 Research Assistants (RA), with each RA being allocated a DSR resource centre (Sub County) to handle. The study mainly utilised English language during data collection, with RAs utilising Swahili National language to elaborate on points that respondents found difficult to comprehend in English.

FIGURE 1. Study areas- Map of Nairobi City

Data Analysis

In the pre-test of the research instrument, validity and reliability of the questionnaire was assessed, with the reliability outcome showing Cronbach Alpha of 0.72, implying that the instrument was suitable to serve the intended purpose[21]. Data obtained was analysed thematically using Statistical Package for Social Sciences (IBM SPSS, Chicago - United States of America) software version 23, with socio-demographic descriptive analysis, frequency tables, as well as logistic regression analysis being carried on the relationship between training of HCWs, availability of IDSR system tools, timely dissemination of IDSR data (independent variables), and uptake of IDSR data in community health facilities (dependent variable).The logistic regression model was used to assess the likelihood of dependent variables influencing uptake of IDSR data in health facili-

ties across Nairobi County. The Logistic regression model used was as follows:

$$ln\left(\frac{\hat{p}}{1-\hat{p}}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon$$

Where
- Training of HCWs
- Availability of IDSR sytem tools
- Timely dissemination of IDSR data
- Explanatory coefficients for i=1,2,3

The study adopted the 95% confidence level in regression of the model, with only p-values less than 0.05 ($p<.05$) being used in the findings of the logistic model. This is because the p-values of less than 0.05 clearly indicate that the explanatory variables used in the model have a statistically significant influence on the dependent variable[22,23]. It is on this premise that the study established that all the 3 factors i.e. Community health workers' training on IDSR data, IDSR system tools, and availability of monthly IDSR data, are key factors in uptake of IDSR data in health facilities, since all the 3 variables were of p-values less than 0.05 ($p<.05$), indicating that the variables were statistically significant to explain variations in the model. The study findings were presented in form of tables and bar graphs.

Ethical Considerations

Ethical approval and clearance was sought and obtained from the National Commission for Science, Technology, and Innovation (NACOSTI), with the ethical review process approving the study to proceed under certificate number NACOSTI/P/18/53954/26335. In addition, the study sought for permission from the Nairobi County Government, the Ministry of Health, and various health facilities to allow the study to be carried out. Verbal and written consent was obtained from all participants before interviews were conducted, with all questionnaires being assigned numbers to ensure anonymity of the data collected.

RESULTS

Descriptive results for health care workers component

371 questionnaires were distributed to the respondents, with a significant return rate of 315 (85%) questionnaires being recorded. Out of the 315 respondents taking part in the study, 186(59%) were male while the remaining 129(41%) were female. As shown in Table 1, the findings revealed that 69(21.91%) respondents had secondary school education, while 198(62.86%) had a college diploma education, with 30(9.52%) being university degree holders, while the remaining 18(5.71%) had a postgraduate degree. It was also noted that 68(21.59%) respondents were aged between 20-29 years, 114(36.19%) were aged between 30-39 years, 72(22.86%) were aged between 40-49 years, while the remaining 61(19.37%) were above 50 years.

Integrated Disease Surveillance and Response data Uptake:

According to the findings in Table 2, it was observed that 163(51.75%) respondents were not satisfied with the level of training offered, indicating that more training programs should be set up to improve health workers' skills on IDSR data utilisation in their service delivery. 99(33.02%) respondents on the other hand were of contrary opinion that the CHW straining was enough to help them in IDSR data utilisation. However, 48(15.23%) respondents expressed reservation on the adequacy of training on IDSR data utilisation, citing lack of enough exposure and exchange programmes on IDSR data. The responses for training on IDSR data uptake shows a mean of 3.46475 and standard deviation of 0.95654, which implies that majority of the respondents agree with the assertion that is necessary to train health workers on utilisation of IDSR data in health facilities within Nairobi County.

TABLE 1: Socio-demographic characteristics

		Frequency	Percent
Gender	Male	186	59
	Female	129	41
	Total	**315**	**100**
Age	20 - 29 yrs	68	21.59
	30 - 39 yrs	114	36.19
	40 – 49 yrs	72	22.86
	50 yrs & above	61	19.37
	Total	**315**	**100**
Education	**Certificate**	**69**	**21.91**
	Diploma	198	62.86
	Bachelor-Degree	30	9.52
	Postgraduate Degree	18	5.71
	Total	**315**	**100**

TABLE 2: Uptake of IDSR data

Variable	Frequency	Percentage
Strongly Disagree	79	25.08
Disagree	84	26.67
Not sure	48	15.23
Agree	51	16.19
Strongly Agree	53	16.83
Total	315	100

Variable	N	Mean	Std-Deviation
CHW Training-on IDSR	315	2.37563	0.95654
IDSR System-tools	315	3.46475	1.00342
Availability of-IDSR monthly-data	315	2.98481	0.94926

TABLE 3: Factors affecting IDSR data uptake

	Logistic Mode Coefficient	Chi-Square	P-Value	Odds-Ratio
(Constant)	-1.066			
CHW Training on IDSR	2.233**	2.132	0.033	4.10
Availability of IDSR System Tools	0.187*	1.042	0.013	3.25
Timely Dissemination of IDSR Data	1.158**	1.098	0.016	4.91

DISCUSSION

The study assessed the IDSR data uptake by health care workers at the community level in public health facilities within Nairobi County. It is argued that routine health care data generated by health care providers play a major role in facilitating integration between individual health and public health interventions after analysis[24–26]. The demographic factors considered included gender, age, and education of HCWs. The study findings further showed that more than 66% of the respondents had challenges with understanding IDSR data due to lack of analytical skills, while 34% reported to having the requisite technical skills to understand and utilise IDSR data. The CDC emphasises training to enhance the knowledge and skills of healthcare workers so that they may effectively use the data obtained from the surveillance system to improve patient and healthcare personnel safety[2,8,9]. It is therefore imperative that the HCWs in community health facilities within Nairobi County be trained on IDSR data analysis and utilisation.

Factors influencing IDSR data Uptake

Regression of the logistic model gave the association between independent variables (factors of IDSR) and the uptake of Integrated Disease Surveillance and Response data as shown in the regression model:

$$ln\left(\frac{\hat{p}}{1-\hat{p}}\right) = -1.07 + 2.23X_1 + 0.19X_2 + 1.16X_3$$

According to the logistic regression odds ratio in Table 3, training CHWs implies that healthcare workers are 4 times more likely to use IDSR data, while availability of IDSR system tools in health facilities, and timely collection and dissemination of IDSR data increase the likelihood of IDSR data uptake by 3 and 5 times respectively. The study findings concur with those carried out in Malawa[2] and Uganda[25] that developing information technology infrastructure in health facilities and ensuring timely dissemination of disease surveillance data will necessitate achievement of IDSR goals in countries within Sub Saharan Africa. It is therefore evident that availability of IDSR tools makes it possible for health facilities to generate and disseminate data, which is key in transformation of preparedness of developing countries in dealing with disease outbreaks[2,3,27].

Strengths and Limitations

The study reveals challenges facing uptake of IDSR data in community level health facilities within Nairobi County. This will make it easier for facility management and the Ministry of Health to put necessary measures and improve disease outbreak preparedness.

The study however had various limitations, key among them being the choice of the study to include only government-sponsored health facilities at community level, which left out private-owned and faith-based health facilities that are quite a considerable number in the Kenyan capital city. Further studies should therefore consider carrying out similar studies in all health facilities within Nairobi City County, including public, private, and faith-based health facilities.

CONCLUSION

Following the study findings, it can be concluded that training of CHWs is key to the uptakes of IDSR data. CHWs are street-level bureaucrats in any healthcare system, and if well trained, they ensure civic education in their daily interactions with their patients, thereby ensuring successful implementation of government policies[5,15,24]. Installation of disease surveillance systems in health facilities enable the management to detect and curtail any disease outbreak in its early stages, thereby making it possible to avert disease outbreaks and epidemics[4,7,14,28]. There is therefore need to train all community health care workers on how to interpret and use IDSR data, as well as installing disease surveillance systems in health facilities to increase uptake of IDSR data.

RECOMMENDATIONS

Following the study findings, it is recommended that:

i. More emphasis should be put on training to ensure all health care workers have the required skills to use the IDSR data.
ii. There is need to ensure IDSR data is disseminated on time (in this case monthly) to make it available for interpretation and use by health care workers in their respective facilities.Health facilities should be fittedwith ICT infrastructure to enable installation of IDSR system tools in all health facilities within Nairobi County.

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