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HIGHLIGHTS

Ministry of Health

Rwanda Biomedical Centre
Healthy People, Wealthy Nation

Rwanda
Public Health Bulletin

General Information

Rwanda Public Health Bulletin (RPHB) is an open-access and peer-reviewed bulletin published by Rwanda Health Communication Centre (RHCC).

Its mission is to serve as a knowledge sharing platform for national and international public health scientific information. Content published under RPHB will be used to control and address potential public health outbreak threats and strengthen health systems through real time availability of information.

This will allow more and effective communication between policy makers, researchers and health practitioners.

A new issue is published quarterly with supplements and special reports. Publication materials are submitted online at https://www.rbc.gov.rw/publichealthbulletin/manuscripts/submission and should fulfil the RPHB's instructions.

Go to https://www.rbc.gov.rw/publichealthbulletin/about/instructions for instructions to authors.

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Contacts

Email: rwandapublichealtbulletin@gmail.com
Website: https://www.rbc.gov.rw/publichealthbulletin/

Address

Rwanda Public Health Bulletin Secretariat
KG 203St., City of Kigali, Rwanda

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EDITORS

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Rwanda Biomedical Centre
Hassan Mugabo
Rwanda Biomedical Centre

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CONTENT

Dear readers,

I am delighted to introduce this edition of the Rwanda Public Health Bulletin (RPHB), which highlights Rwanda's commitment to public health in the face of emerging global health threats. It emphasizes our collective efforts to combat and successfully contain the Marburg virus disease (MVD) outbreak while shedding light on the often-overlooked mental health impacts associated with such outbreaks.

MVD, a highly virulent and epidemic-prone illness, posed a significant public health challenge since the first case was reported on 27th September 2024. Thanks to the swift and coordinated response of Rwanda's health sector, supported by dedicated healthcare workers, communities and partners, the threat was effectively managed, showcasing our country's preparedness, resilience, and collaboration.

This edition features an article that detail response strategies, including robust case identification, effective quarantine and containment measures, community engagement, and the use of evidence-based interventions. It not only documents Rwanda's achievements but also serve as a resource for policymakers, health professionals, and researchers globally who are committed to enhancing preparedness and response mechanisms for similar health threats.

The publication also underscores the importance of addressing the mental health impacts of MVD. The fear, stigma, and uncertainty that accompany an outbreak can have profound psychological consequences for affected individuals, their families, and healthcare workers. It explores innovative approaches to providing mental health support during outbreaks, ensuring holistic care for our population.
Additionally, the report on conjunctivitis surveillance in a boarding school offers valuable insights into the detection and management of localized outbreaks, reminding us of the critical role of vigilance and early intervention in preventing widespread transmission.

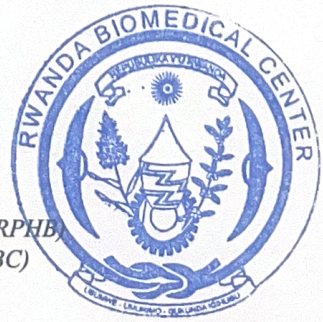
Concluding the health crisis reports, this edition also includes a compelling commentary on the persistent challenge of cholera in Africa. The commentary explores the complex interplay of environmental, social, and health system factors that perpetuate the disease, urging a multisectoral approach to address this persisting issue.

Other featured studies reflect the diversity and depth of other public health matters in Rwanda. The study on stroke patients' perceptions of rehabilitation services provides actionable insights into improving care for non-communicable diseases. Equally significant is the article on adherence to secondary prophylaxis among children and adolescents with rheumatic heart disease, which sheds light on the factors, beliefs, and barriers influencing treatment outcomes. The study on employee absenteeism in a tertiary hospital further highlights systemic challenges in the health sector, calling for strategic solutions to optimize workforce productivity.

As we reflect on the achievements and challenges of Rwanda's health system, let us also remain vigilant and committed to building on these successes. Strengthening Rwanda's health systems, and fostering community resilience will remain central to safeguarding the health and well-being of our population.

I extend my gratitude to all contributors to our commitmnent for their dedication to advancing knowledge dissemination. Together, we remain steadfast to a healthier, more resilient Rwanda.

Regards,



Prof. Claude Mambo Muvunyi, MD, PhD
Editor-In-Chief - The Rwanda Public Health Bulletin (RPHB)
Director General - The Rwanda Biomedical Centre (RBC)

Marburg virus disease outbreak in Rwanda, 2024: Current efforts and calls to action to mitigate the outbreak in Rwanda

Yves Gashugi[1,*], Louange Bienvenu Byiringiro[2], Janvier Rukundo[2], Josias Izabayo[3], Vincent Sezibera[3], Joseph Kalisa[3]

[1]*Rwanda Psychological Society, Kigali, Rwanda*
[2]*Rwanda- Food and Drug Authority, Kigali, Rwanda*
[3]*University of Rwanda/Centre for Mental Health, Kigali, Rwanda*

ABSTRACT

The recent outbreak of Marburg virus disease (MVD) in Rwanda, first reported in September 2024, marks the country's initial encounter with this highly lethal hemorrhagic fever caused by the Marburg virus.

With primary transmission from fruit bats and subsequent human-to-human spread through direct contact, MVD presents significant public health challenges due to its rapid progression from flu-like symptoms to severe hemorrhagic fever and high mortality rates.

Rwanda's Ministry of Health responded swiftly, implementing critical containment measures, such as intensive contact tracing, targeted vaccination for suspected cases and healthcare providers, restricting caregiver access, limiting traditional gatherings, and enforcing strict hygiene and infection control protocols.

In the last three and a half years, Rwanda has been dealing with COVID-19, Mpox (formerly monkeypox), and now the Marburg outbreak. Drawing on lessons from past public health crises, Rwanda's Ministry of Health is implementing swift action to manage the situation. Here we discussed Rwanda's strategies in managing the MVD outbreak, emphasizing the importance of a One Health approach that integrates human, animal, and environmental health to mitigate zoonotic threats.

Vaccination efforts targeting healthcare providers and high-risk contacts have become a vital component of Rwanda's response, aiming to protect those on the front lines and prevent further spread. The response is further strengthened by partnerships with global health organizations, including the World Health Organization (WHO), underscoring the need for coordinated international support and cross-border containment measures.

This MVD outbreak highlights the urgency of ongoing research into effective treatments and licensed vaccines to bolster Rwanda's preparedness and resilience against future outbreaks.

***Corresponding author:**
Yves Gashugi
Rwanda Psychological Society, Kigali, Rwanda

Email: gashuyves1998@gmail.com

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INTRODUCTION

Marburg Virus Disease (MVD) is a highly lethal infection; however, not all infected individuals develop severe hemorrhagic symptoms. Case fatality rates for MVD have ranged from 24% to

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88%, varying based on factors like virus strain, individual health conditions, and the timing of medical intervention [1,2]. Initial symptoms often include fever, headache, and gastrointestinal issues, with hemorrhagic symptoms generally occurring in more advanced cases rather than universally [3]. Factors such as viral load, age, and early medical support influence the likelihood of progression to severe hemorrhagic disease, meaning that not all cases result in hemorrhagic manifestations [4]. It is less common than Ebola virus disease, both of which belong to the filovirus family [3,5]. The primary reservoir hosts of MVDs are believed to be fruit bats, with transmission occurring from bats to humans, and through direct human-to-human contact. The disease has an estimated incubation period of 3–21 days [6]. Early symptoms include high fever, chills, nausea, diarrhea, vomiting, and general discomfort, which progress to severe hemorrhagic fever characterized by intense muscle pain, extensive bleeding, and, in some cases, multi-organ failure [7,8].

The initial outbreaks of MVD were recorded simultaneously in Germany and Serbia in 1967, when laboratory personnel was infected after exposure to African green monkeys. Since then, MVD has been reported in 17 countries [9,10]. On September 27, 2024, Rwanda's Ministry of Health reported the country's first-ever MVD outbreak. By the following day, health authorities had intensified their response efforts, confirming 26 cases and six fatalities [8,11]. Earlier on Sunday, September 29, Health Minister Dr. Sabin Nsanzimana announced that the government had identified around 300 individuals who had been in contact with those infected, all of whom were undergoing testing to check for the virus. "We have numerous contacts, and this number is likely to rise as we continue our tracing efforts. To date, nearly 300 people have been identified, and this number may increase due to varying levels of interaction. These individuals may have had casual contact, such as exchanging greetings, or more direct contact, like providing care or being a patient," Minister Nsanzimana stated [12].

As of October 24, 2024, 64 cases of Marburg virus disease had been reported in Rwanda, with 15 deaths (case fatality ratio (CFR) 23.4%). Among the first 62 confirmed cases with accessible data, 70% were men and 48% were aged between 30 and 39. For context, approximately 12.4% of Rwanda's population falls within the 30-39 year age group, highlighting the notable impact on this demographic. The first two epidemiological weeks of the outbreak saw the newest confirmed cases, with 26 cases recorded in week 39 (23-29 September 2024) and 23 cases recorded in week 40 (30 September-6 October). A significant decrease followed in the subsequent weeks [1]. By 30 October, 66 cases were confirmed, with 15 deaths from 5913 tests (Figure 1).

Numerous outbreaks of the Marburg virus (MARV) have occurred in Africa, although they have not attracted as much public attention as the Ebola virus [13]. Uganda experienced outbreaks in 2012, 2014, and 2017, reporting 15, one, and four cases, respectively [11,14]. The continent has faced epidemics beyond Uganda, with occurrences noted in central and southern Africa as well. Until the previous year, when the World Health Organization (WHO) confirmed Guinea's first case of MARV, West Africa had remained mostly unaffected by the virus [15]. Nonetheless, viral hemorrhagic disease outbreaks, particularly those caused by Ebola virus, have been reported in West Africa [16].

According to the Ministry of Health, a significant factor in this recent outbreak may be extensive contact with individuals from abroad, particularly from European countries, who have interacted with healthcare providers. These healthcare providers, who operate within a multidisciplinary system and regularly engage with colleagues, were identified as the most affected group at the onset of the outbreak.

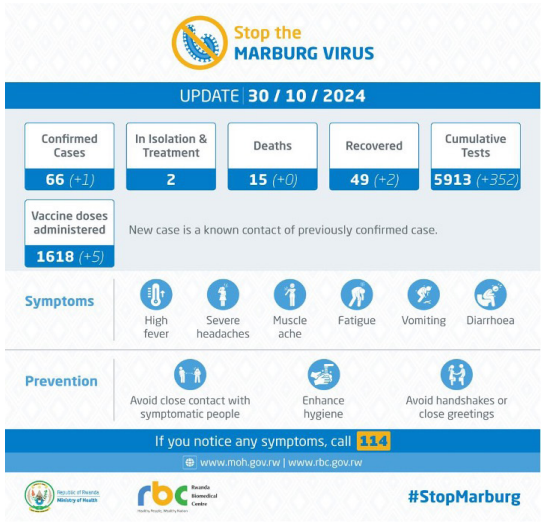

Figure 1: *MVD situation in Rwanda in October 2024*

The majority of those infected are health workers, especially those working in intensive care units [1,5].

EPIDEMIOLOGY OF MVD

Although the initial outbreak of MVD was reported in Europe, Africa has experienced several outbreaks, some manifesting as small clusters, while others have led to significant mortality and morbidity [17]. Notably, during the 1980 pandemic in Kenya, two cases were linked to an individual who visited the Kitum caves, a known habitat for bats. Additionally, three cases were recorded in the 1975 outbreak affecting Zimbabwe and South Africa [18]. The 2004–2005 outbreak in Angola had 374 confirmed cases, while the 1998–2000 outbreak in the Democratic Republic of the Congo had 154 confirmed cases, accompanied by an alarming mortality rate of 83% [19].

In 2007, the discovery of bats in a mining tunnel known to harbor the virus led four Ugandan workers to contract MVD. A subsequent fatal case was reported in 2014, followed by an additional 197 cases [20]. The Democratic Republic of the Congo, Kenya, and Uganda have also reported outbreaks and isolated cases recently [19].
The World Health Organization's risk assessment in 2012 indicated that Tanzania had a very high risk of recurrent infectious disease outbreaks. Between 2020 and 2023, Tanzania faced several significant health challenges, including the COVID-19 pandemic, cholera, and dengue outbreaks, and most recently, the MVD outbreak, which marked a difficult period for public health management in the region [9,11]. Tanzania's first confirmed Marburg outbreak in 2023 resulted in five deaths out of eight reported cases [21,22]. The Ministry of Health declared the first MVD outbreak in the Bukoba district of Kagera on March 21, 2023, reporting eight cases and five fatalities, including one in a healthcare worker. The case fatality ratio was 62.5%, prompting further epidemiological investigations with 205 contacts currently under observation [22]. Table 1 lists the Marburg virus disease outbreaks reported in Africa in recent decades.

ETIOLOGY OF MVD

MVD is caused by a virus classified within the Mononegavirales order, specifically within the Filovirinae family and the Marburgvirus genus. The sole strain responsible for this illness is the Marburg virus itself [1,2]. The primary reservoir of the Marburg virus is the fruit bat, Rousettus aegyptiacus, although it has also been found in monkeys and chimpanzees. Numerous outbreaks have been linked to mines, which serve as habitats for various bat species [6,7]

The transmission of the Marburg virus occurs primarily through direct contact with the bodily fluids of an infected individual, including blood, saliva, mucus, tears, vomit, semen, and feces. The virus can also spread via fomites or contaminated surfaces [23], thereby increasing the risk of

Table 1: *Marburg virus disease outbreaks in Africa*

Year	Location/Outbreak	Cases	Deaths	CFR (%)	References
1998-2000	DRC	154	128	83	(CDC, 2023)
1975	South Africa/Zimbabwe	3	1	33	(Bradfute SB, et al., 2016)
1980	Kenya	2	1	50	(Vella EE, 1977)
1987	Kenya	1	1	100	(Bradfute SB, et al., 2012)
2004-2005	Angola	374	329	88	(MoH, 2023)
2007	Uganda	4	1	25	(Changula K et al., 2014)
2012	Uganda	15	4	27	(Changula K et al., 2014)
2014	Uganda	1	1	100	(CDC, 2023)
2017	Uganda	3	3	100	(Mwananchi, 2023)
2023	Ghana	110	74	67	(WHO, 2022)
2023	Tanzania	8	5	63	(WHO, 2023)
2024	Rwanda	66	15	23	MoH (2 Dec 2024)

CFR: Case Fatality Rate

transmission to healthcare workers and family members who attend to the sick or participate in funeral rites.

Once the virus enters a person's body, it replicates within endothelial cells, prompting the release of cytokines that increase vascular permeability and lead to fluid leakage [3]. This cascade of events leads to severe symptoms such as fever, malaise, coagulopathy, and rapid onset of hemorrhagic manifestations. Additional complications, including immunosuppression, systemic inflammation, multiple organ failure, shock, and ultimately, death, may occur [10].

CONTROL OF MVD: RWANDA'S CURRENT MITIGATION EFFORTS

Following reports of an unusual illness affecting patients across seven of Rwanda's 30 districts, the Ministry of Health (MoH) issued a statement outlining the situation. In response, Rwanda is taking comprehensive measures to mitigate the MVD outbreak. It recently confirmed its first cases through the MoH and has implemented the following measures:

To minimize exposure and transmission, the government has implemented a restriction that allows only one caregiver per patient at healthcare facilities. In addition, all healthcare institutions are mandated to follow strict infection prevention and control protocols for clients exhibiting symptoms of MVD, suspected or confirmed MVD patients undergo isolation for 21 to 28 days, with all medical waste incinerated at high temperatures to prevent contamination.. To further limit gatherings that could facilitate viral spread, traditional practices such as wakes and home vigils (locally known as 'Ikiriyo') have been banned, and funeral services were restricted to a maximum of 50 attendees [12].

Furthermore, open-casket viewings are prohibited in homes, churches, and mosques. They can only occur in designated areas within health facilities, with limited attendance. The Ministry of Health has emphasized the importance of personal hygiene measures and has urged the public to avoid close contact with individuals displaying symptoms, such as high fever, severe headaches, muscle aches, vomiting, and diarrhea [12].

To trace potential cases, the Ministry has identified approximately 300 individuals who have come into contact with infected persons, and these contacts are currently under testing. The Health Minister reassured the public to remain calm and continue their daily activities while adhering to the safety measures being implemented, emphasizing that the strategies to combat the outbreak are promising [24].

Preventive measures against MVD include several key practices. Individuals should avoid contact with infected persons and maintain good hygiene. It is crucial to wear protective clothing when caring for an infected person or when working in high-risk environments. Additionally, people are advised to avoid contact with infected animals, particularly fruit bats and non-human primates. Furthermore, it is recommended to avoid or limit the consumption of bushmeat to reduce the risk of transmission.

Some institutions, including the United States Embassy, have implemented precautionary measures in response to the MVD outbreak in Rwanda. The embassy has announced that its staff members in Kigali are authorized to work remotely during this period to prioritize their safety as they assess the situation. In a statement, the embassy acknowledged the confirmed cases of MVD within health facilities in Rwanda, emphasizing that this decision is made out of an abundance of caution while the scope and severity of the outbreak are evaluated. The remote work arrangement was effective from September 30 to October 4, 2024 [12].

Risk communication and community engagement are at the heart of Rwanda's proactive response, recognizing that empowering the public with knowledge is key to containment. Public health officials are delivering targeted, culturally sensitive education on preventive behaviors, dispelling myths, and addressing concerns directly through a dedicated emergency contact line. This open line of communication fosters trust and ensures that communities feel informed and supported. In tandem, Rwanda has fortified its diagnostic and laboratory infrastructure, enabling swift and precise diagnosis within the country, significantly reducing reliance on external resources and bolstering local capacity to handle the outbreak independently [25].

To safeguard those on the front lines, Rwanda has rolled out targeted vaccination campaigns,

prioritizing healthcare workers and other high-risk individuals to create a protective shield against the virus. This proactive approach is complemented by robust cross-border collaborations, where Rwanda is working closely with neighboring countries to ensure vigilant border screening and harmonized containment efforts. These regional partnerships enhance Rwanda's defenses and prevent the virus from crossing borders, underscoring the nation's commitment to preventing a wider outbreak [25].

The vaccine in use is an experimental Marburg vaccine, developed through collaborative efforts by international health organizations, with initial research and development primarily conducted at the U.S. National Institute of Allergy and Infectious Diseases (NIAID) [26]. Early testing involved animal studies to evaluate safety and immune response, followed by limited Phase 1 trials in humans to assess safety and immunogenicity [26].

Psychosocial support for patients, survivors, and their families is also a cornerstone of Rwanda's response. By offering counseling and reintegration assistance, Rwanda aims to ease the emotional burden on those affected, fostering acceptance and reducing the stigma that often accompanies infectious diseases. Additionally, rigorous infection control and decontamination protocols are meticulously enforced, with targeted cleaning and safeguarding of affected areas. Backed by the support of global partners like WHO and Africa CDC, Rwanda's multifaceted, coordinated response demonstrates a powerful commitment to stopping the outbreak through community engagement, frontline protection, and international collaboration [25].

OUTCOMES OF INTERVENTIONS TO MITIGATE MARBURG VIRUS DISEASE (MVD) IN RWANDA

Targeted vaccination has been a cornerstone of Rwanda's MVD response, focusing initially on healthcare providers and high-risk individuals, particularly those who have had direct contact with confirmed cases. By mid-October, over 200 individuals had received vaccinations as part of an emergency vaccination campaign, which contributed to a noticeable reduction in new infections [32]. The prioritization of healthcare workers has been crucial, as they face the highest risk due to close contact with infected patients. While MVD-specific vaccines are still experimental, the administration of available investigational vaccines appears to have mitigated the spread within healthcare settings, protecting those on the frontlines [1].

Isolation and supportive treatment were implemented promptly for confirmed cases. By October 17, 43 patients had recovered from MVD, showcasing the effectiveness of early isolation and symptomatic care [33]. Rwanda's healthcare facilities were equipped to manage cases with strict infection control practices, reducing the risk of hospital-based transmission. Although there is no specific antiviral treatment for MVD, supportive care—including fluid replacement, pain management, and monitoring for complications—has been crucial in patient recovery. These efforts were bolstered by the deployment of infection control experts and personal protective equipment (PPE) to healthcare facilities [1,5].

Rwanda's contact tracing program has played a critical role in identifying, monitoring, and isolating individuals at risk of developing MVD. Enhanced contact tracing efforts enabled health authorities to identify over 800 contacts by mid-October, many of whom were isolated and monitored for symptoms [5]. Rapid identification of contacts and early intervention contributed to a decline in new cases and helped prevent further community spread.

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CHALLENGES

Healthcare Worker Infections: Despite targeted vaccinations, a considerable number of cases occurred among healthcare providers, reflecting vulnerabilities in infection control protocols. The high exposure risk faced by healthcare workers

due to close patient interactions underscores the need for continuous training and reinforcement of infection prevention measures [27].

Resource Constraints and Experimental Treatments: The lack of approved treatments or licensed vaccines for MVD meant that Rwanda had to rely on experimental vaccines and supportive care. Limited resources, including healthcare personnel and PPE, posed challenges in sustaining rigorous infection control practices over extended periods. Furthermore, the use of experimental interventions raised logistical and ethical concerns, as their efficacy is still being evaluated [28].

SUCCESS

Rapid Response and Containment: Rwanda's swift implementation of containment measures, including targeted vaccination, isolation, and rigorous contact tracing, effectively curbed the spread of MVD within a relatively short period. These actions underscored the importance of preparedness and agility in managing infectious disease outbreaks [1].

On October 6, 2024, Rwandan Health Minister Sabin Nsanzimana confirmed that the country had received approximately 700 vaccine doses from the Sabin Vaccine Institute, supported by the U.S. government and international partners. These trial vaccines were designated for high-priority groups, starting with healthcare workers, frontline response teams, and individuals who had contact with confirmed MVD cases [29]. By October 14, more than 200 individuals had been vaccinated.

To expand the vaccination effort, the Sabin Vaccine Institute dispatched an additional 1,000 investigational vaccine doses on October 31, 2024, to support a randomized clinical trial within an ongoing open-label study [30]. By the end of October, over 1,500 frontline workers had received the Sabin vaccine in Rwanda, reinforcing the country's protective measures and contributing significantly to controlling the outbreak.

All measures and strategies implemented against MVD outbreak in Rwanda successfully contained the outbreak and as of 6 December 2024, 35 days had passed without new cases, with routine survellence and follow-up of identified cases maintained (Figure 2).

Figure 2: *MVD situation in Rwanda in the first week of December 2024*

International Support and Collaboration: Partnerships with international organizations, notably the World Health Organization (WHO) and Africa CDC, provided Rwanda with essential resources and technical support. This collaboration facilitated rapid procurement of PPE, diagnostic tools, and investigational vaccines, which were critical in the initial stages of the response [5].

CALL FOR ACTION

Given the recent updates, controlling MVD was successful despite being challenging due to the limited availability of licensed treatments and vaccines, though targeted experimental vaccines have been deployed to protect high-risk individuals and healthcare workers. This makes it crucial to break the viral transmission cycle by focusing on preventing secondary transmission [31]. The WHO actively supported Rwanda in its efforts to control the Marburg virus outbreak by mobilizing resources and expertise. Dr. Matshidiso Moeti, WHO's Regional Director for Africa, emphasized the importance of quickly implementing response measures and highlighted Rwanda's strong public health system, which facilitates effective collaboration with national authorities [32]. In addition to supporting Rwanda, the WHO keeps coordinating cross-border measures with neighboring countries to ensure timely detection and control of the virus, preventing further spread.

The WHO has previously recommended adopting the One Health approach to address health threats at the animal-human–environment interface and

rapidly contain zoonotic diseases like MVD [33], and this approach was effective in reducing MVD incidence in Tanzania [21].

In the Rwandan context, addressing the MVD outbreak required a comprehensive strategy that enhances both healthcare capacity and community involvement. To effectively combat MVD, Rwanda's national healthcare budget should be increased, ensuring sufficient resources for affected regions, especially in rural and high-risk areas where healthcare infrastructure is often limited [34]. This increase would fund essential resources such as hospital beds, medical personnel, and supplies. While MVD outbreaks are uncommon, a permanent expansion of healthcare infrastructure, particularly in rural areas, is justified to improve Rwanda's preparedness for both potential outbreaks and broader health needs [34,35]. Additionally, a temporary capacity boost is necessary to manage the immediate case surge without overwhelming current facilities. Based on recent case data, experts estimate the need for 200 additional hospital beds [36], given each MVD case requires 21–28 days of isolation [48]. A permanent increase in beds and staff, despite the rarity of MVD, would bolster the healthcare system's readiness for infectious disease outbreaks and other health emergencies. This approach not only supports rapid response capability but also serves as a training and research hub, enhancing the overall resilience and capacity of Rwanda's healthcare system.

Epidemiological surveillance and community involvement are key to outbreak prevention. Coordinated monitoring programs that include both local and national stakeholders are crucial for tracking the spread of MARV. In addition, healthcare workers and researchers must be aware of the coexistence of MVD alongside other infectious diseases like mpox [37], as these can further strain Rwanda's healthcare system.
Ensuring that healthcare workers have access to adequate PPE is essential to prevent the spread of MARV. Rwanda's Ministry of Health prioritized the procurement and distribution of PPE, including gowns, gloves, masks, face shields, and goggles, especially in high-risk areas. Accurate diagnosis of MVD relies on proper laboratory testing, which should be readily available to all affected regions. Social leaders, community health workers, and healthcare professionals must be well-informed about the risk factors associated with MVD, as well as safety measures for handling animal products and conducting safe burials for those who have died from the virus. It was suggested that engaging local leaders and traditional healers in awareness campaigns can help ensure that information reaches remote and rural areas, fostering trust and compliance with safety guidelines [7,31].

Public health education efforts must emphasize avoiding contact with blood, bodily fluids, and proper hand hygiene. In cases of MARV infection, patients should be isolated in private rooms with dedicated bathroom facilities to minimize transmission. The transfer of infected patients to specialized medical facilities must be performed with strict adherence to safety protocols to prevent further spread.

Finally, the Rwandan government has to strengthen the collaboration with international organizations like the WHO, as well as local stakeholders to ensure the rapid containment of MVD outbreaks. The lessons learned from managing COVID-19 can be applied to prevent healthcare systems from becoming overwhelmed during MVD outbreaks and other future health crises. Financial and logistical support from the international community will be crucial in sustaining these efforts and reducing the likelihood of re-emerging MVD in the future.

CONCLUSION

The recent outbreak of MVD underscores the the importance of integrated surveillance systems and the impact of implementing decisive measures to curb its spread. Given the high mortality rate associated with MVD, it is crucial to recognize the significant role that healthcare providers, particularly those working in hospitals, play in the emergence and spread of outbreaks. Rwanda continious efforts to strenthen the health systems, integrating One Health principles and close collavorations with local and international health organizations will make the country stand still against future crises.

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Mental health impacts of Marburg virus disease in Rwanda

Yves Gashugi[1,2,*], Louange Bienvenu Byiringiro[3], Janvier Rukundo[3], Josias Izabayo[4], Sadie Ineza Umuhire[2]

[1]*Rwanda Psychological Society, Kigali, Rwanda*
[2]*University of Global Health Equity, School of Medicine, Butaro, Rwanda*
[3]*Rwanda Food and Drug Authority, Kigali, Rwanda*
[4]*Centre for Mental Health, University of Rwanda, Kigali, Rwanda*

ABSTRACT

The Marburg Virus Disease (MVD) outbreak in Rwanda marks a significant public health challenge, with 64 reported cases and a 23.4% case fatality rate as of October 2024. While the immediate focus remains on containment and clinical management, the mental health implications of the outbreak present an equally critical concern. This paper discusses the psychological toll of MVD in Rwanda, considering the country's historical trauma and existing mental health landscape. Rwanda's experience with the 1994 Genocide against the Tutsi and the COVID-19 pandemic underscores the vulnerability of populations with pre-existing mental health conditions and those exposed to compounding stressors during health crises.

Key high-risk groups identified include healthcare providers, individuals with prior pandemic exposure, those with underlying mental illnesses, and grieving families. The disruption of traditional mourning practices, widespread stigma, and the psychological demands placed on healthcare workers amplify the outbreak's impact on mental well-being. Drawing on lessons from COVID-19, Rwanda leveraged community health workers, telemedicine, and public awareness campaigns to address psychosocial needs. However, the outbreak highlights gaps in mental health resources and the need for tailored interventions.

Recommendations include strengthening mental health support for high-risk groups, integrating psychological services into epidemic responses, and enhancing community resilience through targeted education and support systems. We also emphasize the importance of a holistic response to MVD, addressing both physical and mental health needs to mitigate the long-term impacts of the outbreak.

***Corresponding author:**
Yves Gashugi
Rwanda Psychological Society, Kigali, Rwanda

Email: gashuyves1998@gmail.com

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INTRODUCTION

The Marburg virus (MARV) is a highly infectious pathogen that causes Marburg virus disease (MVD), a severe hemorrhagic fever similar to Ebola [1,2]. It has a high mortality rate, with recent outbreaks in Africa raising concerns over its spread and potential impact [3]. For Rwanda, a country that has endured significant historical trauma, an outbreak of Marburg could amplify

psychological stressors, exacerbating existing mental health challenges within the population [4,5]. Studies indicate that viral outbreaks like Marburg and Ebola have profound psychological impacts on affected communities [5], particularly in regions with a history of trauma, such as Rwanda [6,7]. The fear of infection, social stigma, and isolation associated with such diseases can worsen mental health conditions, adding to the need for comprehensive psychosocial support during and after outbreaks [8].

The current literature highlights several possible risk factors that affect the development and reactions to health crises, such as Marburg, with pre-existing physical and mental conditions often considered as predicting factors of poor mental health outcomes from direct and indirect exposure to a pandemic, outbreak or any other health crisis [8]. Here, we explored the potential mental health impacts of the Marburg Virus Disease (MVD) outbreak in Rwanda, considering the country's unique historical and social context. Specifically, it seeks to identify high-risk populations, assess the psychological toll on individuals and communities, and evaluate the effectiveness of mental health support systems implemented during the outbreak. We also aimed to provide actionable recommendations for integrating mental health interventions into epidemic responses to mitigate the outbreak's short- and long-term psychological impacts.

OUTBREAK OF MARBURG VIRUS DISEASES IN RWANDA

The initial outbreaks of MVD were recorded simultaneously in Germany and Serbia in 1967, when laboratory personnel was infected after coming into contact with African green monkeys. Since then, MVDs have been reported in 17 countries worldwide [9,10]. On September 27, 2024, Rwanda's Ministry of Health reported the country's first-ever MVD outbreak. By the following day, health authorities had intensified their response efforts, confirming 26 cases and six fatalities [11]. Earlier on Sunday, September 29, Health Minister Dr. Sabin Nsanzimana announced that the government had identified around 300 individuals who had been in contact with those infected, all of whom were undergoing testing to check for the virus. "We have numerous contacts, and this number is likely to rise as we continue our tracing efforts. To date, nearly 300 people have been identified, and this number may increase due to varying levels of interaction. These individuals may have had casual contact, such as exchanging greetings, or more direct contact, like providing care or being a patient," Minister Nsanzimana stated [12].

As of October 24, 2024, 64 cases of Marburg virus disease had been reported in Rwanda, with 15 deaths [case fatality ratio (CFR) of 23.4%]. Among the first 62 confirmed cases with accessible data, 70% were men, and 48% were aged between 30 and 39. The first two epidemiological weeks of the outbreak saw the most new confirmed cases, with 26 cases recorded in week 39 (23-29 September 2024) and 23 cases recorded in week 40 (30 September-6 October). This was followed by a significant decrease in the subsequent weeks [1].

MENTAL HEALTH LANDSCAPE BEFORE MARBURG VIRUS DISEASES

Rwanda has gone through intense socio-cultural changes and historical events that are inseparable from its current mental health situation [13]. The country experienced an atrocity that took over 1 million people's lives exterminated in just 100 days during the genocide against the Tutsi in 1994 [14]. It is obvious that the impact on Rwandans' mental health because of the magnitude of destruction and loss during the genocide was high. This led to the establishment of a mental health program in 1994 to deal with such resulting consequences.

It should be noted, however, that despite different mental health programs, a recent mental health survey showed the highest prevalence rates of mental disorders of 20.5% (N=19,110) and 52.2% (N=1271) both in the general population and in the sub-sample of survivors of the 1994 genocide against the Tutsi respectively [15–17]. The most prevalent mental disorders were major depressive episodes (12.0%), panic disorder (8.1%), and posttraumatic stress disorder (PTSD) (3·6%) in the general population. In genocide survivors, the major depressive episode was (35.0%) PTSD, and panic disorders (27.9% and 26.8%, respectively). Alcohol use disorder was reported at 1.6% in the general population and 4% among genocide survivors [15,17]. Therefore, although the Marburg Virus Disease did not persist for an extended period

or reach high intensity over a prolonged duration, it is likely that preexisting mental health disorders in Rwanda were exacerbated by the outbreak, leading to additional mental health challenges within a short timeframe.

MENTAL HEALTH SUPPORT SYSTEMS IN RWANDA DURING THE MARBURG VIRUS DISEASE OUTBREAK

Drawing on lessons from the COVID-19 pandemic, Rwanda implemented several proactive measures to manage the Marburg Virus Disease (MVD) outbreak. The COVID-19 pandemic highlighted the importance of a robust healthcare infrastructure, public health education, and mental health support systems, which Rwanda adapted to the Marburg context. Community health workers (CHWs), who were trained during the COVID-19 response to provide basic mental health and psychosocial support, were mobilized to address anxiety and stigma associated with Marburg. Telemedicine platforms and e-mental health services, established during COVID-19 to overcome restrictions and deliver remote mental health support [18], were also expanded to facilitate continuous access to counseling and mental health consultations for individuals affected by MVD. Additionally, Rwanda's experience with public awareness campaigns during COVID-19 helped refine effective communication strategies, utilizing media and community networks to reduce misinformation and encourage preventive measures against Marburg [19]. Lessons in infection control and rapid response to COVID-19 enabled Rwanda to establish quarantine and isolation protocols promptly, minimizing the psychological toll on healthcare workers and patients through structured support and clear guidelines.

HIGH-RISK POPULATIONS

Individuals with Prior Experience of the COVID-19 Pandemic

Individuals in Rwanda with prior experience of the COVID-19 pandemic may be considered high-risk during the MVD outbreak due to the lasting psychological and social impacts of the previous pandemic. Exposure to one public health crisis can often leave individuals more vulnerable to mental health challenges in subsequent crises. The effects of COVID-19, including anxiety, trauma, and financial strain, have heightened these individuals' susceptibility to stress, fear, and economic hardship, which can be reactivated with the threat of a new health crisis like MVD.

Firstly, psychological distress and compounded trauma are common among individuals who endured high stress levels during COVID-19. Studies indicate that people who faced significant psychological distress from isolation, fear of infection, and disruption of daily routines during COVID-19 may experience compounded trauma when faced with a second outbreak [20]. These individuals are more prone to developing anxiety, depression, and post-traumatic stress responses, especially with the anticipation of repeated restrictions and health risks. For those who experienced grief or loss during the pandemic, the resurgence of health threats with MVD can exacerbate feelings of helplessness and distress.

Furthermore, social isolation and fear of stigmatization remain prominent issues among individuals who experienced stigma during COVID-19. For those who were isolated due to infection or contact tracing, the stigma associated with being a "risk" individual often results in feelings of loneliness and rejection. The MVD outbreak may reignite these fears, as individuals worry about being socially ostracized once again. Stigmatization during health crises has been shown to worsen mental health conditions, particularly in societies like Rwanda's, where community bonds and social acceptance play essential roles in personal well-being [21,22].

Individuals with underlying mental illness

During an epidemic, even when health facilities remain open, and movement is unrestricted, individuals with pre-existing mental health conditions remain at significantly higher risk due to various stressors associated with the health crisis. The widespread fear, uncertainty, and anxiety that accompany an epidemic can exacerbate symptoms in individuals with conditions such as anxiety disorders, depression, and PTSD. These individuals often have heightened sensitivity to crisis-related stressors, which can worsen their symptoms, especially with constant exposure to alarming news and an elevated sense of vulnerability [23].

Although access to healthcare services is available, individuals with mental illness may hesitate to seek in-person support due to fear of exposure to infection in healthcare settings. This reluctance can delay essential treatment and intensify feelings of isolation and helplessness, even without physical distancing measures in place [5]. The psychological toll of an epidemic also includes heightened stigma, as individuals with visible mental health symptoms may be perceived as vulnerable or fragile, discouraging them from seeking help or openly discussing their struggles. Such stigma can lead to self-isolation and exacerbate untreated symptoms, even in an open-access healthcare environment [24].

Furthermore, people with mental illnesses are particularly susceptible to developing severe stress responses due to the uncertainty and disruption that epidemics bring. The heightened sense of threat and concern for personal safety can lead to the worsening of existing conditions, such as increased anxiety, mood swings, and agitation. These stress responses not only impact daily functioning but may also make individuals more vulnerable to other health complications if left unmanaged during the epidemic [20].

Healthcare providers

Healthcare providers are among the most vulnerable groups during epidemics due to their constant exposure to health risks and the demanding nature of their work. In the case of the MVD outbreak in Rwanda, healthcare workers were among the first to be infected, with multiple reports indicating that they constituted a significant portion of those who tested positive for the virus. This early and high exposure among healthcare providers can be attributed to their close contact with infected patients and the challenges of maintaining strict infection control protocols during an outbreak. Studies indicate that healthcare workers experience high levels of anxiety and stress during such health crises, partly due to concerns about personal safety and the risk of transmitting the virus to their families [8,25]. Many Rwandan healthcare workers who endured psychological strain and exhaustion during the pandemic may now find themselves with diminished resilience as they confront MVD. This heightened vulnerability can lead to increased anxiety, emotional exhaustion, and even physical health declines, impacting their ability to manage another health crisis effectively.

Even with operational healthcare facilities and unrestricted movement, the psychological demands on healthcare providers working amidst an MVD outbreak are profound. The responsibility of treating patients while grappling with the heightened risk of personal infection places significant mental strain on these professionals, impacting their well-being. The repeated exposure to MVD patients, coupled with long working hours and understaffing, leads to high rates of burnout, emotional exhaustion, and compassion fatigue [25,26]. Additionally, healthcare workers who served during previous health crises, such as the COVID-19 pandemic, may carry residual stress, making them particularly susceptible to burnout and mental health deterioration in the face of another epidemic [27].

People in Grief

Experiencing a profound loss can be one of the hardest periods in a person's life. When a death happens during difficult times, such as the MVD, family and friends may feel heightened distress due to unfamiliar restrictions on funeral gatherings. Traditionally, in Rwanda, it was customary for all relatives, friends, and community members to be present for funeral ceremonies and to offer support to the bereaved family. This communal participation was also expected for joyful occasions [38]. Consequently, it was typical for many people to gather at the home of the deceased, providing comfort to grieving family members and often staying overnight [28]. From a mental health perspective, these cultural practices provide the grieving family with emotional support, reduce feelings of isolation caused by loss, and help protect against complicated grief.

Grieving individuals face unique high-risk factors during health crises, as MVD epidemic-related restrictions can further intensify emotional vulnerabilities. In Rwanda, for example, strict measures limited funeral attendance to only 50 people, and no one was permitted to open the casket to view the deceased [12]. These limitations disrupted traditional mourning practices, which are central to the grieving process in Rwandan culture. The inability to perform customary rituals, such as viewing the body and sharing grief communally, can lead to complicated grief—a

condition involving prolonged distress, intrusive thoughts about the deceased, and difficulty accepting the loss, especially when mourning rituals are restricted [29]. The interruption of these practices can leave individuals feeling a lack of closure, exacerbating mental health issues such as depression and anxiety over time [30]. Additionally, social isolation is a significant risk factor in this context. The restriction on gathering sizes during funerals deprived grieving individuals of the community support that is essential in cultures with strong collective grieving traditions, like Rwanda's. Studies show that the lack of communal support in mourning can leave individuals feeling isolated and unsupported, hindering their emotional healing [31]. Economic instability also presents a high risk; when a family loses a primary earner, the economic impact adds to the emotional burden of grief. In low- and middle-income settings, economic pressure following a loved one's death can compound mental health challenges, as individuals are forced to cope with both emotional and financial loss [28].

Lastly, the stigma surrounding causes of death—particularly when infectious diseases are involved—can further isolate grieving individuals. In Rwanda and similar societies, the stigma associated with fatalities from epidemic-related illnesses may prevent families from receiving social support. Without a supportive community, grieving individuals face a higher likelihood of mental health complications as they struggle to navigate grief in isolation [28,29,32]. These combined factors illustrate the need for mental health support tailored to the unique challenges faced by grieving individuals during health crises.

BRIGHT SPOTS AMID THE MARBURG VIRUS DISEASE CRISIS

During the MVD outbreak in Rwanda, the nation drew upon resilience and preparedness strategies developed through its experiences with the 1994 Genocide against the Tutsi and the COVID-19 pandemic. Rwanda's healthcare infrastructure, rebuilt after the genocide and strengthened during COVID-19, was further fortified to handle the MVD crisis [33]. These experiences taught Rwanda the importance of rapid response, community health integration, and the mental health needs of traumatized populations. This preparedness enabled the country to quickly implement diagnostic capabilities, isolation units, and safety protocols, reducing the spread of the virus [50]. Additionally, the psychological toll of both the genocide and COVID-19 had already driven Rwanda to prioritize mental health services, which were mobilized to support grieving families, frontline healthcare workers, and those affected by trauma during MVD [34]. This approach reflected a commitment to holistic health care, where mental health was treated as an integral component of epidemic response.

Rwanda's collective resilience and community solidarity—rooted in the need for mutual support post-genocide and strengthened during the COVID-19 pandemic—were also evident during MVD. Although restrictions limited gatherings, families and communities adapted by finding safe ways to stay connected, such as socially distanced visits and virtual gatherings, which helped mitigate isolation [12,34]. Similarly, public health education and hygiene practices promoted during COVID-19, such as frequent handwashing and safe social practices, were reinforced and adapted for the MVD context [34]. The government's swift and proactive response, bolstered by lessons learned from previous crises, included guidelines on safe burial practices and public gatherings [12]. These measures highlight Rwanda's evolving commitment to pandemic preparedness, leveraging both policy improvements and community resilience to navigate health crises effectively and ensure the well-being of its citizens.

NEXT STEPS

The mental health impacts of the MVD outbreak in Rwanda demand robust interventions to alleviate the psychological toll on individuals, families, and communities. Immediate attention should be directed toward implementing public and community mental health initiatives, especially for those unable to access referral hospitals due to financial or logistical barriers. High-risk populations, including individuals with pre-existing mental health conditions and those with prior trauma from the Genocide against the Tutsi and the COVID-19 pandemic, require focused monitoring and support to prevent exacerbation of mental health issues.

Healthcare providers at the frontline of the MVD

response should receive specialized training in stress management techniques and have access to clinical supervision to help them cope with the intense psychological demands of their work. Additionally, individuals with underlying mental health conditions, such as anxiety, depression, and panic disorders, should be provided with practical mental health support to minimize the distress caused by isolation and the fear of infection. Young people facing addiction challenges also need regular professional support to prevent relapses, especially under the heightened stress of the epidemic. By prioritizing these targeted mental health interventions, Rwanda can better address the complex psychological challenges posed by the MVD outbreak, ultimately building a more resilient and supportive society.

CONCLUSION

The potential mental health impact of Marburg Virus Disease (MVD) in Rwanda is substantial, especially considering the country's unique historical and social context. By prioritizing preventive and supportive measures, Rwanda can mitigate these effects and utilize its strong culture of resilience to aid those impacted. Additionally, mental health screenings should be conducted for individuals suspected or confirmed to have MVD, ensuring their specific mental health needs are accurately assessed and addressed.

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Surveillance of conjunctivitis at a school in Kamonyi District, Rwanda, 2024

Emile Sebera[1,*], Flugence Rugengamanzi[2], Theoneste Kanyanzira[2], Philos Ndikumana[2], Philemon Nzeyimana[2], Leonille Nizeyemariya[2], Celestin Hagenimana[1], Emile Twagirumukiza[1]

[1]*Mount Kenya University, Kigali City, Rwanda*
[2]*Remera Rukoma Hospital, Southern Province, Rwanda*

***Corresponding author:**
Emile Sebera
Remera Rukoma District Hospital, Southern Province, Rwanda

Email: emilesebera12@gmail.com

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ABSTRACT

INTRODUCTION: Conjunctivitis, a highly contagious eye condition, can significantly impact public health, especially in close-contact settings like schools. This study investigated a conjunctivitis attack at ECOSE Saint Kizito Musambira Boarding School in Rwanda.
METHODS: This surveillance study examined 577 students and 26 staff members through clinical examinations, health records, and demographic data collection from March 12-20, 2024.
RESULTS: The conjunctivitis primarily affected female students (77%), with symptoms including itchy eyes (80.9%) and foreign body sensation (96.7%). The high attack rate suggested a highly contagious agent. Treatment included ciprofloxacin, ibuprofen, and tetracycline pomade. Close living conditions and bed-sharing were more common behaviors among the students.
CONCLUSION: This conjunctivitis attack highlights the importance of rapid detection and response to infectious diseases in schools. While antibiotic therapy was the main management approach, the specific etiology remains uncertain without diagnostic tests. Future prevention strategies should focus on hygiene measures, early case identification, isolation, and enhanced laboratory testing to manage school outbreaks effectively.

INTRODUCTION

Conjunctivitis, commonly known as "pink eye," is one of the most frequent eye conditions worldwide [1]. It affects people of all ages and demographics, with an estimated 6 million cases reported annually in the United States alone [1]. Globally, the prevalence of conjunctivitis varies, but it remains a significant public health concern due to its highly contagious nature and potential for outbreaks in close-contact settings such as schools and daycare centers [2].
The World Health Organization (WHO) recognizes conjunctivitis as a common cause of eye morbidity, particularly in developing countries where access to healthcare and proper hygiene practices may be limited [3]. The global burden of conjunctivitis is difficult to quantify precisely due to underreporting and varying surveillance systems across countries. However, studies suggest that viral conjunctivitis accounts for up to 80% of all acute cases globally [4].

In Africa, eye diseases, including conjunctivitis, pose a significant health challenge. The continent bears a disproportionate burden of eye conditions

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due to factors such as limited access to healthcare, poor sanitation, and high prevalence of infectious diseases [5]. A systematic review of eye diseases in Africa found that conjunctivitis was among the top three most common ocular surface disorders across the continent [6]. In Ethiopia, a study found that conjunctivitis accounted for 29% of all eye diseases in a rural district [7]. In Nigeria, research indicated that conjunctivitis was responsible for 32.9% of childhood eye disorders in a tertiary hospital [8].

East Africa, which includes Rwanda, has shown similar patterns of conjunctivitis prevalence and impact. The East African region faces unique challenges in eye health due to its tropical climate, which can facilitate the spread of certain pathogens associated with conjunctivitis [9]. In Uganda, a neighboring country to Rwanda, a study conducted in primary schools found that 11.8% of children had conjunctivitis [10]. This high prevalence in a school setting underscores the potential for rapid transmission in such environments. In a study of ocular pathology among children aged less than 16 years in the Democratic Republic of Congo, allergic conjunctivitis was the most common pathology, affecting 56.2% of children [11]. The Rwanda Ministry of Health has identified eye health as a priority area in its national health strategy, recognizing the impact of conditions like conjunctivitis on public health and education [12]. Acute infectious conjunctivitis is a common ocular condition with major public health consequences [13].

Conjunctivitis patients are often contagious, and outbreaks of this infectious condition can cause significant morbidity and may jeopardize military readiness [14]. Clinical manifestations of acute conjunctivitis include tearing, foreign body sensation, redness, and pain, and examination of the infected eye may reveal eyelid edema, discharge and/or tears [14–17]. Viral conjunctivitis, particularly that caused by adenoviruses, is highly contagious and can spread rapidly in close-contact environments such as schools [17]. While usually self-limiting, outbreaks can cause significant disruption to educational activities and may lead to broader community transmission if not properly managed [18]. Studies indicate that timely detection and response to outbreaks are crucial to prevent further spread, minimize health impacts, and inform appropriate control measures [19–21].

METHODS

Setting

This survellience study was conducted at the ECOSE Saint Kito Musambira, which experienced conjunctivitis attack among students between March 12th 2024 and March 24th, 2024. ECOSE Saint Kito Musambira, is a private secondary school located in Kamonyi District, Musambira Sector, Karengera Cell, Nyarutovu Village. The school had a total population of 603 people, comprising 577 students (284 females, 293 males) and 26 staff members (12 females, 14 males).

Control of transmission

Like other boarding schools, ECOSE Saint Kito Musambira was an environment that presented a unique challenge for disease control due to the close living quarters and shared facilities. A comprehensive set of immediate interventions was rapidly implemented to contain the spread of infections and manage the affected individuals. Rapid case detection and response are key to ending a disease outbreak through efficient surveillance and laboratory work, effective coordination, and a strong workforce [19–21]. The primary action involved the awareness of conjunctivitis, enforcement of hand hygiene and school treatment of initial cases, and restricting students' movement beyond school boundaries during the outbreak, effectively limiting potential transmission within the school environment and the surrounding community. Simultaneously, a thorough screening process was initiated to identify additional cases, enabling prompt intervention and preventing further spread.

Medical treatment was promptly administered to affected individuals, encompassing a multi-faceted approach with antibiotics to combat potential secondary bacterial infections, anti-inflammatory drugs to reduce eye inflammation and discomfort, and analgesics to alleviate both associated pain and fever [22]. Additionally, a robust information, education, and communication (IEC) strategy was deployed, focusing on educating the school community about the modes of transmission, recognizing symptoms, and implementing effective prevention methods.

This multi-pronged approach aimed to not only treat existing cases but also empower the broader school population with knowledge to

mitigate the further spread of the eye disease. The implementation of this surveillance system holds paramount importance in managing and preventing disease within the school setting. Its multifaceted value lies in its capacity for early detection and rapid response to potential outbreaks, allowing for swift containment measures. By facilitating the identification of the causative agent and mode of transmission, it enables a more precise and effective response strategy [23]. The system plays a crucial role in guiding targeted interventions and optimizing resource allocation, ensuring that efforts are focused where they are most needed [24]. Furthermore, it provides a mechanism for continuously monitoring the effectiveness of implemented control measures, allowing for real-time adjustments and improvements [24].

The data and insights gathered through this surveillance system contributed to the development of informed, long-term prevention strategies tailored to the unique challenges of the school environment. This comprehensive approach not only addresses immediate health concerns but also fortifies the institution's capacity to prevent and manage future similar issues, thereby safeguarding the health and well-being of the entire school community. By systematically collecting and analyzing data on this outbreak, we aimed to minimize its impact, prevent future occurrences, and contribute to the broader understanding of managing infectious eye diseases in educational institutions.

Case definition and data collection

A case was defined as signs or symptoms of conjunctivitis in a student with onset between March 12th 2024, and March 24th, 2024. The health event was defined as suspected viral or adenoviral conjunctivitis, characterized by specific symptoms and clinical presentations including itchy eye, foreign body sensation in the eye, fever, headache, watery discharge, and redness of the eye as observed in the disease's occurrence. This surveillance on conjunctivitis at ECOSE Saint Kizito Musambira involved regular data collection, analysis, and reporting. Data sources included schools' records, direct clinical examinations, and demographic information from the school administration, providing a thorough distribution of the population by age, sex, sharing bed status, and either living inside or outside of the school and classroom students attend. Data was collected among 152 students suspected of having conjunctivitis. Data collection instruments included standardized clinical assessment forms, and demographic questionnaires, capturing variables such as symptom onset, clinical signs, treatment received, and patient demographics. A multidisciplinary team consisting of ophthalmology clinical officers, medical doctors, laboratory technicians, environmental health officer, the hospital's Integrated disease surveillance and response (IDSR) focal person's public health practitioners, and community health workers conducted the screening from March 12th to 20th, 2024, ensuring a thorough and expert-led investigation.

Statistical analysis

The database was meticulously cleaned and coded, with variables appropriately categorized to ensure data integrity and accuracy. Statistical analysis was performed using Excel and SPSS version 25, employing descriptive statistics to summarize the disease characteristics and identify trends. This rigorous methodology enabled a comprehensive understanding of the disease dynamics, facilitating decision-making for control and prevention strategies.

Ethical Considerations

The study team secured permission from the management of Remera Rukoma Hospital, which oversees healthcare services in the area. Additionally, approval was granted by the management of ECOSE St Kizito Musambira School, where the disease occurred, ensuring proper access to the affected population and cooperation from school officials. Furthermore, the ethics committee of Remera Rukoma Hospital reviewed and approved the surveillance protocol, ensuring that the study adhered to ethical standards for public health investigations involving human subjects.

This multi-layered approval process demonstrates the study's commitment to ethical conduct and respect for institutional and community stakeholders. Consent was not applicable was this surveillance of conjunctivitis at ECOSE St Kizito Musambira does not contain any individual person's data in any form (including individual details, images or videos), and all data used in the analysis were aggregated and anonymized.

RESULT

General characteristics of the participants

The mean student age was 16.6 years old (± 2.2 years), with a median age of 16 years. The age range among students is 11 years, from a minimum of 13 years old to a maximum of 24 years old. The majority of the participants (77%) were female students. Almost all students (88%) shared beds with others, with two-thirds (67%) reporting that their bedmate was sick (Table 1).

Table 1: *Characteristics of the 152 participants*

Characteristics	N (%)
Gender	
Male	35 (23.0)
Female	117 (77.0)
Sharing bed status	
Yes	134 (88.2)
No	18 (11.8)
Sickness status of who he/she is sharing a bed with	
Yes	102 (67.1)
No	50 (32.9)
Living out of school	
Yes	0 (0.0)
No	152 (100.0)

No students lived outside the school. These findings suggest that close contact among students may be a contributing factor to the spread of conjunctivitis.

The magnitude of the disease

Figure 1 illustrates the daily number of students who developed signs and symptoms of illness compared to those who sought hospital consultation from March 12th to March 20th, 2024. The peak of the conjunctivitis occurred on March 15, with 34 students consulting the hospital, while 29 exhibited signs and symptoms. Following this, there was a gradual decline in both the number of affected students and those who sought hospital care. Notably, on March 18, 29 students consulted the hospital despite only 19 showing symptoms, indicating heightened concern during this period. Overall, the trend suggests that more students sought hospital care than exhibited symptoms, reflecting the perceived severity of the conjunctivitis.

Symptoms of conjunctivitis among the 152 participants

The surveillance data in Table 2 indicates that itchy eyes and foreign body sensations were the most common symptoms among students with

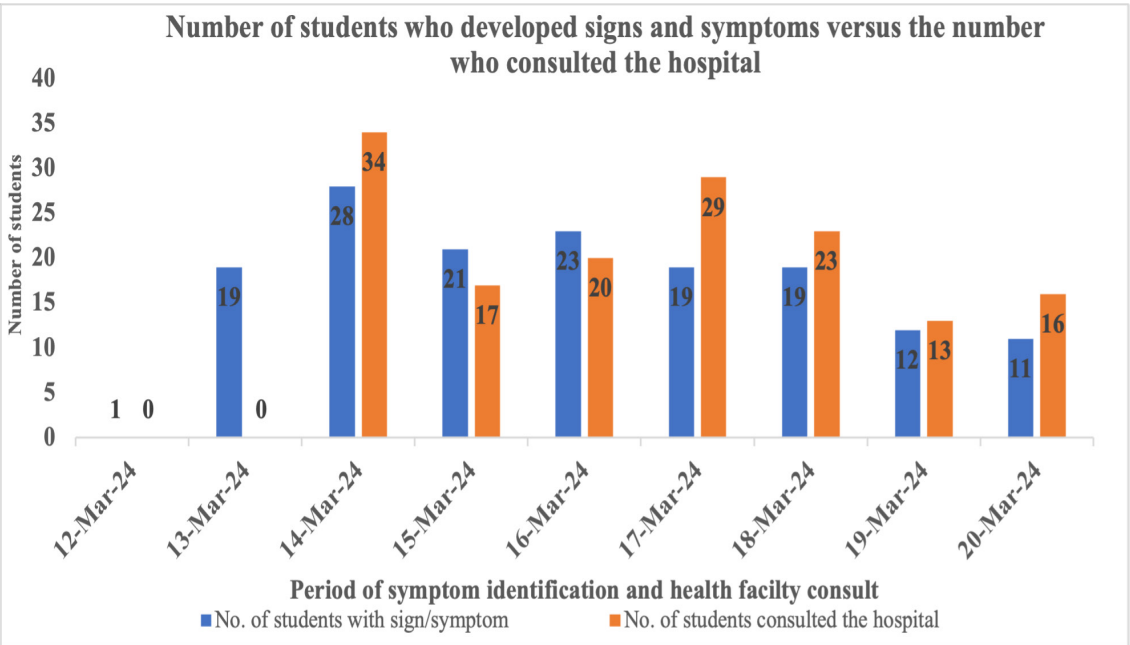

Figure 2: *Symptoms of conjunctivitis and healthcare consults camong the 152 participants*

conjunctivitis at ECOSE St Kizito Musambira, affecting 80.9% and 96.7% of students, respectively. Fever and headache were less prevalent, each occurring in approximately 17.8% of cases.

Table 2: *Symptoms experienced by the participants*

Symptoms	N (%)
Fever	
Yes	27(17.8)
No	125(82.2)
Headache	
Yes	27(17.8)
No	125(82.2)
Itchy eye	
Yes	123(80.9)
No	29(19.1)
Foreign body sensation	
Yes	147(96.7)
No	5(3.3)

Clinical manifestations

The surveillance data reveals a high prevalence of conjunctivitis signs among students at ECOSE St Kizito Musambira. Nearly all participants experienced redness of the eye, painful eyes, lid swelling, watery discharge, sticky discharge, and conjunctival injections. Ecchymosis was also observed in almost all cases. While conjunctival hemorrhage was less common, affecting approximately 73.7% of students, the overall presentation indicates a severe conjunctival infection within the school population (Table 3).

Pharmaceutical management

As shown in Table 4, most students with conjunctivitis at ECOSE St Kizito Musambira, were prescribed ciprofloxacin tablets (100%), focusing on bacterial conjunctivitis management. Ibuprofen was also commonly prescribed to manage associated pain and inflammation (89.5%). While paracetamol was administered to a smaller proportion of students (12.5%), the use of tetracycline pomade (15.1%) suggests a combination approach targeting both bacterial conjunctivitis, although the latter was not specifically tested for in this study.

Table 3: *Clinical signs of conjunctivitis among 152 participants*

Signs of conjunctivitis experienced	N (%)
Watery discharge	
Yes	147(96.7)
No	5(3.3)
Lids swelling	
Yes	147(96.7)
No	5(3.3)
Painful eyes	
Yes	152(100)
No	0(0)
Redness of eye	
Yes	152(100)
No	0(0)
Sticky discharge	
Yes	152(100)
No	0(0)
Conjunctival hemorrhage	
Yes	112(73.7)
No	40(26.3)
Conjunctival injections	
Yes	152(100)
No	0(0)
Ecchymosis	
Yes	149(98.0)
No	0(0.0)

Table 4: *Medications prescribed to participants with signs/symptoms of conjunctivitis*

Medication prescribed	N (%)
Ciprofloxacin tablets	
Yes	152(100)
No	0(0)
Ibuprofen 400mg	
Yes	136(89.5)
No	16(10.5)
Paracetamol 500mg	
Yes	19(12.5)
No	133(87.5)
Tetracycline pomade	
Yes	23(15.1)
No	129(84.9)

DISCUSSION

The current study aimed to describe the epidemiological characteristics of conjunctivitis among students at ECOSE Musambira Boarding School during a conjunctivitis disease attack. The findings revealed a high prevalence of conjunctivitis among the student population, with a majority being female students. Conjunctivitis affected 41.2% of females and 11.9% of males. This finding is different from the outbreak that occurred in Germany, where there was no sex disproportion [25]. The close living conditions, as evidenced by the high proportion of students sharing beds with sick roommates, likely contributed to the rapid spread of the infection. Thus, the studies also show that isolation and closing the school prevent person-to-person transmission and spread in the outer communities [26].

The clinical presentation was characterized by a constellation of symptoms and signs, including itchy eyes, foreign body sensation, redness, pain, lid swelling, and discharge, as found in other similar outbreaks [27–30]. The high prevalence of these symptoms and signs suggests a severe conjunctival infection within the school population. The management of the conjunctivitis attack primarily relied on antibiotic therapy, with ciprofloxacin being the first-line treatment. While this approach is commonly used for bacterial conjunctivitis, it is important to note that the etiology of the disease was not definitively established, and the use of tetracycline pomade might suggest a consideration of chlamydial conjunctivitis. However, the absence of specific diagnostic tests for chlamydia limits the ability to confirm this hypothesis.

The high attack rate and rapid onset of symptoms suggest a highly contagious agent, likely a viral pathogen. However, the possibility of a viral etiology cannot be excluded as the studies indicate that viral conjunctivitis is the most common infectious conjunctivitis [1]. Implementing strict hygiene measures, such as handwashing and proper disposal of eye secretions, is crucial to prevent future attacks. Early detection and isolation of cases also helped to contain the spread of the infection. Similar efforts have been claimed to control this kind of infection [31].

This conjunctivitis attack emphasized the need for robust surveillance systems to detect disease increases early and implement timely interventions. The high incidence of conjunctivitis underscores the significance of promoting good hygiene practices, such as handwashing and avoiding sharing personal items, among students. Additionally, the study revealed the challenges associated with diagnosing the specific etiology of conjunctivitis in resource-limited settings, emphasizing the need for improved laboratory capacity. The conjunctivitis attack also highlighted the importance of involving the entire school community, including students, staff, and parents, in prevention and control efforts.

CONCLUSION

These surveillance findings underscore the challenges and necessities of managing infectious diseases in resource-limited settings. The high attack rate and rapid symptom onset suggest a highly contagious agent, possibly bacterial, though the viral etiology could not be excluded without specific diagnostic tests. Measures to prevent future health crises in schools should include enhancing hygiene practices, conducting regular health education, improving laboratory capacities for precise etiological diagnosis, and conducting studies to identify the factors associated with conjunctivitis in school settings.

Declarations

It is important to note that this article is not an official report of health event investigations but rather an independent analysis and interpretation based on the authors' expertise and understanding of the situation. The views expressed herein represent the personal opinions of the authors and may not reflect the official stance or recommendations of the involved organizations or authorities. Readers should exercise caution in generalizing these findings to similar events without considering local guidelines and validated procedures.

Availability of data and material

The datasets generated and analyzed during the surveillance of conjunctivitis at ECOSE St Kizito School Musambira are available from the corresponding author upon reasonable request, as they contain no individual personal data, consist only of aggregated statistics, and are anonymized.

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Commentary

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The persistent challenge of cholera in Africa: a complex interplay of factors

Beenzu Siamalube[1,*], Emmanuel Ehinmitan[1], Steven Runo[2], Justus Onguso[3], Maina Ngotho[4]

[1]*PDepartment of Molecular Biology and Biotechnology, Pan African University Institute for Basic Sciences, Technology and Innovation, Nairobi, Kenya*
[2]*Department of Biochemistry, Microbiology and Biotechnology, Kenyatta University, Nairobi, Kenya*
[3]*Institute for Biotechnology Research, Jomo Kenyatta University of Agriculture and Technology, Nairobi, Kenya*
[4]*Department of Animal Science, Jomo Kenyatta University of Agriculture and Technology, Nairobi, Kenya*

***Corresponding author:**
Beenzu Siamalube
Pan African University Institute for Basic Sciences, Technology and Innovation, Nairobi, Kenya

Email:siamalube.beenzu@students.jkuat.ac.ke

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INTRODUCTION

Cholera remains a formidable public health challenge across Africa, disproportionately impacting marginalized and vulnerable populations [1]. The disease's persistence underscores its multifaceted nature, rooted in more than just the biological characteristics of Vibrio cholerae. Instead, it reflects a complex interplay of environmental, social, economic, and systemic factors, each compounding the difficulty of effective prevention and control [1,2].

Africa continues to bear the highest burden of cholera globally, with recurring outbreaks that cause significant morbidity and mortality, often overwhelming already fragile healthcare systems [3]. The disease frequently strikes regions plagued by inadequate access to clean water, sanitation, and hygiene (WASH) infrastructure [3,4]. These deficiencies create fertile ground for the bacterium's proliferation, particularly in densely populated urban slums and rural areas with limited public health outreach. Climate change further exacerbates the problem, with extreme weather events such as floods and droughts creating conditions conducive to cholera outbreaks [5].

Social and economic inequalities also play a pivotal role in the persistence of cholera. Communities affected by poverty often lack the resources to adopt preventive measures or seek timely treatment, while stigmatization can hinder reporting and response efforts [6].

The situation is compounded by political instability and conflict, which disrupt public health services and impede emergency responses in affected areas. Despite decades of intervention, including vaccination campaigns, improvements in water and sanitation, and public health education initiatives, cholera remains endemic in several African countries [2]. This persistent challenge reveals critical gaps in our prevention and control strategies. Many interventions have focused on short-term outbreak responses rather than addressing underlying structural vulnerabilities [4]. Furthermore, the global health community's limited focus on cholera as a neglected disease has hampered research and innovation [7]. As a result, Africa's cholera burden remains a stark reminder of the need for a comprehensive, multisectoral approach that combines robust surveillance, targeted vaccination, sustainable infrastructure development, and community engagement.

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Addressing these challenges requires collective action at local, regional, and international levels, ensuring that efforts are tailored to the unique epidemiological and sociopolitical contexts of each affected country. Only then can the persistent scourge of cholera in Africa be effectively mitigated.

DRIVERS OF CHOLERA IN AFRICA

One of the foremost drivers of cholera in Africa is the persistent lack of access to safe water and adequate sanitation. According to the World Health Organization (WHO), over 400 million people in Sub-Saharan Africa still rely on unimproved water sources, and over 700 million lack access to proper sanitation [8]. These conditions create an ideal environment for the proliferation of Vibrio cholerae, especially during rainy seasons when flooding exacerbates the contamination of water supplies [9]. In urban slums and rural communities, the interplay between rapid population growth, unplanned urbanization [10], and poor infrastructure amplifies the risk of cholera outbreaks. Yet, investments in water and sanitation infrastructure remain insufficient, and competing priorities, limited funding, and governance challenges hinder progress.

Poverty further exacerbates the cholera burden. Populations living in poverty are often forced to rely on contaminated water sources and are less likely to have access to health services. Malnutrition, common in low-income settings, weakens immunity, increasing susceptibility to cholera [6]. Additionally, the economic impact of cholera on households can be devastating, with affected families facing high out-of-pocket expenses for treatment and lost income due to illness. Governments and international organizations must address these socioeconomic determinants to break the cycle of cholera transmission.

Another critical issue is the inadequacy of disease surveillance systems. Many African countries struggle with delayed detection and reporting of cholera outbreaks due to weak health systems, limited laboratory capacity, and under-resourced public health infrastructure. This delay hampers timely response efforts, allowing outbreaks to spread unchecked [11]. Surveillance is further undermined by the stigma associated with the disease, leading to underreporting in certain communities. Strengthening real-time surveillance and integrating cholera monitoring into routine health systems are essential to enable rapid response and containment [12].

Climate change is an emerging and intensifying driver of cholera in Africa. Rising temperatures and changing precipitation patterns have altered the epidemiology of waterborne diseases, including cholera [5]. Warmer waters promote the growth of Vibrio cholerae in aquatic reservoirs, while extreme weather events, such as cyclones and floods, disrupt water systems and increase vulnerability [13]. For instance, Cyclone Idai in 2019 triggered widespread cholera outbreaks in Mozambique, Zimbabwe, and Malawi, highlighting the interplay between environmental shocks and health crises. Policymakers must recognize climate change as a public health threat and incorporate resilience measures into cholera control strategies [14].

Community-level factors also play a crucial role in the persistence of cholera. Misinformation, cultural beliefs, and mistrust of health authorities can hinder prevention efforts. In some cases, traditional practices or reliance on unregulated water sources perpetuate transmission [15]. Public health campaigns often fall short of addressing these socio-cultural barriers, focusing narrowly on behavior change without engaging communities in meaningful ways. Effective community engagement and culturally sensitive interventions are vital to improving the acceptance and uptake of preventive measures [16].

AFRICA'S CURRENT CHOLERA CONTROL MEASURES

Moreover, the response to cholera outbreaks in Africa is frequently reactive rather than proactive. While emergency interventions, such as oral cholera vaccination campaigns and water treatment initiatives, have demonstrated success in reducing mortality, they do little to address the root causes of cholera [17]. Long-term, sustainable investments in water, sanitation, and hygiene (WASH) infrastructure are essential to prevent future outbreaks. However, these investments are often deprioritized in favor of short-term solutions due to political cycles, donor preferences, and limited resources. Policymakers must adopt a forward-looking approach that prioritizes structural improvements over temporary fixes [18].

The role of international organizations and donors in cholera control warrants critical reflection. While their contributions have been instrumental

in funding vaccination campaigns and emergency responses, they often focus on symptomatic relief rather than addressing underlying systemic issues. Additionally, donor-driven programs can create dependency and may not align with local priorities. There is a pressing need for African governments to take ownership of cholera prevention and integrate these efforts into national development plans. Donors should shift towards supporting locally-led, sustainable interventions rather than imposing externally designed programs [19].

In conflict-affected and fragile settings, cholera poses an even greater challenge. Countries like South Sudan, the Democratic Republic of Congo, and Somalia have experienced protracted cholera outbreaks exacerbated by displacement, lack of governance, and deteriorating health infrastructure [20]. Humanitarian responses in these contexts often struggle to keep pace with the scale of need, and cholera control is further complicated by insecurity and limited access to affected populations. Addressing cholera in these settings requires coordinated efforts that bridge humanitarian aid and development to rebuild health systems and infrastructure [21,22].

While developing and deploying oral cholera vaccines (OCVs) have been a major advancement [23], they should not be seen as a standalone solution. Vaccination campaigns must be complemented by robust WASH interventions to achieve lasting impact. Furthermore, global vaccine supply shortages have limited the reach of OCV campaigns, necessitating strategic prioritization and increased production capacity [24]. Research into next-generation edible cholera vaccines that provide longer-lasting immunity could also enhance the effectiveness of vaccination programs.

CONCLUSION

The persistence of cholera in Africa reflects a complex interplay of factors that transcend the health sector, encompassing environmental, socioeconomic, cultural, and systemic dimensions. Addressing this challenge requires a paradigm shift from reactive responses to comprehensive, proactive strategies that tackle the root causes of cholera. Governments must prioritize investments in WASH infrastructure, strengthen disease surveillance systems, and engage communities meaningfully. International organizations and donors should align their efforts with local priorities and support sustainable interventions. Climate change adaptation and resilience must also be integral to cholera control strategies. Only through a holistic, multisectoral approach can Africa break free from the persistent grip of cholera and achieve sustainable health gains for its populations.

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Original Article

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Perceptions of stroke patients attending King Faisal Hospital-Rwanda regarding the effectiveness of the rehabilitation services

Felix Niyonkuru[1,*], Joseph Nshimiyimana[1], Divine Girizina[1], Jean Pierre Niyitegeka[1], Gerard Urimubenshi[1]

[1]*College of Medicine and Health Sciences, University of Rwanda, Kigali, Rwanda*

ABSTRACT

INTRODUCTION: Stroke rehabilitation involves a multidisciplinary approach to restore functional abilities and improve quality of life. This study aimed to explore stroke patients' perceptions of the effectiveness of rehabilitation interventions provided at King Faisal Hospital, Rwanda.

METHODS: A qualitative study using in-depth face-to-face interviews was conducted with ten stroke survivors aged 30 to 80 years. Participants shared their experiences of physiotherapy, occupational therapy, and speech and language therapy interventions. The data was analyzed using a qualitative inductive thematic approach with Atlas ti software.

RESULTS: Participants reported significant improvements in physical function and mobility due to physiotherapy services, including increased balance, enhanced muscle strength, and the ability to perform activities such as walking on uneven surfaces and climbing stairs. However, two participants noted limited progress in their affected limbs. Occupational Therapy was reported to lead to improvements in functional performance, self-care activities, and job-related skills. Participants regained abilities such as transferring independently, holding objects, bathing, and dressing. Occupational therapy also enabled some participants to return to work. A minority expressed the need for increased therapy frequency for better outcomes. Speech and Language Therapy improved participants' communication and interaction skills. Some regained their ability to talk, express themselves, and engage in conversations, although challenges with pronunciation and fluency persisted for a few.

CONCLUSION: Rehabilitation interventions at King Faisal Hospital-Rwanda, are perceived as effective in enhancing physical function, independence in daily activities, and communication skills among stroke survivors. The findings underscore the importance of a multidisciplinary approach and suggest potential benefits of increasing therapy frequency for improved outcomes.

***Corresponding author:**
Felix Niyonkuru
Department of Occupational Therapy, School of Health Sciences, College of Medicine and Health Sciences, University of Rwanda, Kigali, Rwanda.

Email: niyonkuru.felix2020@gmail.com

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INTRODUCTION

Stroke is a leading cause of long-term disability and a major contributor to global morbidity and mortality [1]. The World Health Organization (WHO) defines stroke as an acute, diffuse dysfunction of the brain caused by blood vessel abnormalities, which may persist for a day or longer [1,2]. Rehabilitation plays a crucial role in improving functional recovery and promoting

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independence among stroke survivors [3]. Effective stroke rehabilitation requires collaboration and interdisciplinary teamwork involving patients, their families, caregivers, physicians, nurses, physical and occupational therapists, speech-language pathologists, psychologists, nutritionists, social workers, and other healthcare professionals [4]. Communication and coordination among team members are essential to maximize the effectiveness and efficacy of rehabilitation interventions.

A study in South Australia found that circuit-class therapy provided more peer support, while individual sessions were perceived as more important to participants' goals. Both methods effectively challenged patients [5]. Another study in Sweden found that occupational gaps post-stroke are common, especially among individuals experiencing difficulties in Activities of Daily Living (ADLs) [6]. Rehabilitation interventions should focus on activities that patients want to perform to narrow these gaps. A study in Japan compared the occupation-based approach with the impairment-based approach in occupational therapy to determine feasibility and client satisfaction [7]. The results suggested that the occupation-based approach had more ability to improve clients' general health and emotional score on the short form than the impairment-based approach. Dysphagia and communication impairments are common in acute stroke patients, and stroke survivors with one or both impairments are prone to poorer long-term outcomes [8,9]. Speech-language pathologists play a vital role in screening, standardized and non-standardized assessment, and rehabilitation management of stroke clients who experience dysphagia and/or communication impairment [9].

Stroke clients at King Faisal Hospital-Rwanda are admitted to the intensive care unit and medical ward, with many from the outpatient department in physiotherapy, occupational therapy, and speech-language therapy pathology service. The hospital has enough standardized equipment for rehabilitation services as standard management interventions for stroke. However, no studies have been conducted to understand the perceptions of stroke patients attending King Faisal Hospital-Rwanda regarding the effectiveness of rehabilitation services. Therefore, this study aimed to bridge this gap, and the findings will inform improvement measures for the services at the hospital and across Rwanda in general.

METHODS

Study Setting

This study was conducted in the City of Kigali at King Faisal Hospital-Rwanda, one of Rwanda's teaching hospitals. The hospital offers several specialized healthcare services, including rehabilitation. The rehabilitation services at King Faisal Hospital-Rwanda include physiotherapy, occupational therapy, as well as speech and language therapy [10]

Study design

The researchers used a qualitative phenomenological approach consisting of in-depth interviews to explore the perceptions of stroke patients attending King Faisal Hospital in Rwanda about the effectiveness of the rehabilitation services

Study population and sampling methods

The study population consisted of patients with stroke attending the King Faisal Hospital-Rwanda rehabilitation services. The convenient sampling method was used to recruit the study participants following the inclusion criteria. We recruited participants with different characteristics in terms of sex, inpatient or outpatient services, and education level to get responses from different perspectives. However, stroke survivors who were in the intensive care unit were excluded as they were unable to share their views with the interviewer.

The researchers involved ten stroke patients, and this sample size was determined by the data saturation as long as the data was analyzed concurrently with data collection.

Data collection tool

Face-to-face, semi-structured interviews were conducted. All interviews were conducted by the Researchers using an interview guide. It was developed based on the study objective, the literature, and the researchers' experiences. The research consensus was that the semi-structured questions in the interview guide should be applied before being applied. The participants were asked to tell their stories related to how they think the

rehabilitation services have improved their lives. Adding to that, there was a series of guided probes to obtain an in-depth description of their views on the research question.

Procedures for data collection

Following the receipt of ethical clearance and permission from the relevant authorities, in-depth interviews were conducted in Kinyarwanda with 10 participants at the hospital. The researcher contacted the study participants at their convenience, explained the study objectives and benefits, and ensured confidentiality before signing the consent form. Then, after the participant had signed the consent form, the interview was conducted in a calm environment with one interviewee, and probing questions were added to guide the participants in being concise. During the interviews, the researchers set up the audio recording device, shorthand notebook, and pen to use for noting observations and other key points during the interview. The researcher continued to record the interviewees together with data analysis till the data saturation was met.

Data analysis

The researcher transcribed the tape-recorded interviews in Kinyarwanda (NF, NJ). These transcriptions were then reviewed multiple times, cross-checking with the audio recordings and field notes to ensure accuracy. The corresponding author (NF), with the support of the research member (UG, GD), also carefully listened to the audio recordings and translated the transcriptions into English. The researcher then compared the transcriptions with the original audio recordings. Following this, the researcher generated initial codes, which were refined into sub-themes, preliminary themes, and final themes. The research team identified common patterns, as well as similarities and differences, and these findings were reflected in the initial report. The final report was then produced based on these analyses.

Ethical considerations

Ethical clearance for the study was gained from the Institutional Review Board (IRB) of the University of Rwanda College of Medicine and Health Sciences with the reference number CMHS/IRB/496/2023. Permission for data collection was also provided by King Faisal Hospital-Rwanda after the submission of the research protocol to be reviewed by their board of research and after review of the study protocol and ethical clearance, King Faisal Hospital-Rwanda provided the letter to collect the data with the reference number of KFH/2023/132/IRB. The researcher explained the aim and objectives of the study to participants and their families. Written informed consent was given to participants and their caregivers. Participation in the study was voluntary, and participants could withdraw at any stage. For purposes of anonymity and confidentiality, the quotations of data from the interviews were cited using the cryptogram P1 to P10 rather than the participants' names.

RESULTS

Participants' characteristics

Four participants (40%) were females, and six (60%) were males. The participants were between 30 and 80 years old (mean age =52,3 years). Seven of the participants (70%) were married, and three (30%) were widowed. Eight of the participants (80%) were educated to the level of bachelor's degree and above, while two of the participants (20%) were educated to the level of high school and below. Most of the participants from King Faisal Hospital-Rwanda belong to the middle or high seriocomic status.

Perceptions of the stroke patients attending the rehabilitation services at the King Faisal Hospital-Rwanda.

The study participants of stroke survivors reported their perceptions of the rehabilitation interventions during management. Three themes related to rehabilitation interventions emerged: (1) Effectiveness of physiotherapy interventions in stroke management (amelioration in physical body function and improvement in mobility); (2) effectiveness of occupational therapy in stroke management (advancement in functional performance, improvement in self-care activities, amelioration of job performance); and (3) effectiveness of speech and language pathologist in stroke management (improvement in interaction and communications skills).

Effectiveness of physiotherapy interventions in stroke management

Amelioration in physical body function: Amelioration in physical body function was described by the majority of the participants

interviewed at King Faisal Hospital-Rwanda in physiotherapy service, including the improvement in the ability to perform bed activities, the ability to lengthen and bend their arms, improvement in balance while they are sitting and others realized the muscle strength increase However, two participants among ten participants reported that no clear improvement since the day one receiving the treatment sessions.

"……I could not move, but I tried to elicit some movements, and the physiotherapist trained me to sit with balance; he trained me in bed mobility and transfers, such as moving from bed to a wheelchair. However, the leg improves more than the arm" (P6).
"…I was able to use some sports materials which include riding a stationary bicycle, but due to physiotherapy interventions. The physiotherapist used the belt for fixing my foot on the stationary bicycle for the purpose he explained to me for strengthening the muscles of the leg to improve muscle coordination for the end goal of walking independently. And I am able to use other sports equipment such as the trade mill and metal stairs for walking upstairs and downstairs." (P1)
"Based on the affected body part, I can't tell you that there is a clear improvement because I cannot see any typical improvement as I still have body weakness, and I am still dependent in many areas." (P3)

Improvement in mobility: The majority of participants reported that there were clear improvements in terms of mobility after receiving physiotherapy interventions, such as the ability to stand, being able to move in an uneven area, and being able to use different types of crutches.

"….in mobility, the improvement is remarkable because, on the first day I came to the physiotherapy service, I came in a wheelchair from the car to the department, yet for now I come alone; I am no longer using the wheelchair only the crutches no assistance of a person during ambulation to reach physiotherapy service" (P1).
"The improvement is noticeable now I can walk without an assistive device, able to move from bed to other rooms, able to go to the bathroom, bath myself, move toward my job" (P10).

Effectiveness of occupational therapy in stroke management

Advancement in functional performance: More interviewees tackled the clinical improvements after receiving the Occupational therapy interventions; they stated that there was an improvement in daily functional performance such as improvement in transfers, Ability to hold objects, Improvement in hand function, Home-based activities, and Skills in the use of the assistive device. However, one participant suggested coming more than four times per week as an occupational therapist prescribed such that he can realize the amelioration in his functional level because he cannot see the advancement in his functional level therefore, he believes that it is because of the few frequencies of number of sessions.

"The improvement is noticeable, as before, I had many difficulties, but after retraining in occupational therapy, I was able to transfer myself from the wheelchair to the toilet. I can try to dress my upper body with some minor difficulties to the affected side but I try until I complete without the assistance of caregivers" (P5).
"I can hold light objects. I couldn't turn on the bed because of weakness but now I can do it without support as an Occupational therapist taught me how I can simplify this activity" (P8)
"I am not yet reaching the steps of using my arms as well as my hand without the guidance of an occupational therapist; probably, if I can be engaged in more frequencies of sessions, the improvement can be noticeable." (P6)

Improvement in self-care activities: Based on the in-depth interview conducted in KFH, Rwanda in Occupational therapy service, the majority reported that their performance in self-care activities was increased due to the occupational therapy interventions as the self-care activities were among the skills I had that were lost.

"The improvement was realized after a couple of months of receiving the occupational therapy interventions such as regaining the skills to perform some self-care activities independently such as bathing, dressing: buttoning, and unbuttoning, zipping and unzipping, preparation of breakfast, and other bilateral hand activities" (P1).

"…. Other areas related to self-care where I was unable to dress independently but now, I am able, I was unable to bathe independently but now I am able as well as grooming activities" (P2)

Amelioration in job performance: In the in-depth interview that was conducted at King Faisal Hospital-Rwanda, more interviewees expressed their clinical improvements after receiving the occupational therapy interventions. Some reported that after receiving Occupational therapy services for a long time, they were able to return to their job due to relearning the skills needed to perform their jobs, such as regaining typing skills and being able to manipulate the equipment used in their jobs in the Occupational therapy service.

"There are many improvements, as I reported. I am a mechanical engineer, and now I can take the different keys to open small nails, and the other heavy keys technicians can help with my supervision" (P2).
"As you can see, I returned to work, and now I can walk toward my job office from home without an assistive device, able to move from bed to other rooms, able to bath myself, able to dress my whole body, able to do office work which includes typing, and able to drive yet before I could not try; therefore I acknowledge the work done by Occupational therapist." (P10)

Effectiveness of speech and language pathologist in stroke management

Improvement in interaction and communication skills: Based on the in-depth interview that was conducted at King Faisal Hospital-Rwanda, more interviewees reported clinical improvements after receiving the speech and language therapy interventions; they were able to talk, communicate, and have conversations.

"There are typical improvements compared to the onset of the stroke, I was mute totally but at least now I can talk; however, I still have a few speech difficulties, though I can express my message about what I want to do or to ask for particular help" (P5).
"There are other clinical improvements due to speech therapy as I can make a dialogue and pass the message, but before, I could not. However, speaking English is quite difficult for me in terms of pronunciation but I can deliver the message to the listener" (P6)

DISCUSSION

The study findings will be discussed under three sections: effectiveness of physiotherapy interventions, Occupational Therapy interventions, and Speech-language pathology interventions experienced by stroke survivors concerning relevant literature and the context of the study setting.

The findings of this study revealed the various clinical improvements due to physical therapy interventions. The study showed that participants had the typical improvement in functional activity performance, such as the ability to walk, the ability to lengthen and bend their limbs, improvement in balance while they are sitting, transfers from wheelchair to bed, and vice versa. The physical therapy interventions supported the participants in getting involved in work they did before, but there was also a considerable improvement in activity participation at home from attending this service. Furthermore, additional individuals reported being able to roll in bed and move upstairs, implying that physical therapy sessions enhance functional mobility among stroke patients. As a result, mobility assistance devices that improve mobility independence are infrequently used. Similar to previous research, ambulation and lower limb exercises were the most important interventions from physiotherapy services offered to regain functional mobility and other physical body functions [11]. Another study that North East Thames Health Authority conducted showed that 82 stroke clients who received physiotherapy 40 had been taken to be interviewed, and those who agreed to be interviewed were significantly less likely to be disabled after 12 months of receiving rehabilitation. Generally, patients were satisfied and appreciated physiotherapy because it improved their function [12].

Improvement in balance due to physiotherapy interventions was also previously reported by other studies. For instance, a study conducted in Indonesia concluded that physiotherapy interventions were effective in improving balance and mobility after stroke [13]. The study participants revealed that the occupational therapy interventions involve improving the ability of daily activities such as holding different objects,

including a pen, typing, opening the bottle, being able to bathe and dress independently, and training in the use of assistive and adaptive equipment. This implies that occupational therapy interventions in stroke management emphasize retraining fine motor skills and training on compensatory strategies through the use of assistive/adaptive equipment and environmental modification to improve independence in daily life. A study investigating the impact of occupational therapy interventions on outcomes for stroke survivors revealed significant benefits in various aspects of recovery. Occupational therapy facilitated activity performance by enhancing related performance skills and developing compensatory strategies to restore lost abilities. It also focused on retraining activities of daily living (ADLs), encouraging engagement in leisure activities, and providing instructions and guidance on the use of assistive and adaptive equipment [14]. These interventions collectively supported stroke survivors in regaining independence and improving their quality of life. Another study conducted at the Jordan University of Science and Technology indicated that after six weeks of task-oriented rehabilitation intervention, participants demonstrated significant clinical and functional improvements, such as greater active range of motion and activities of daily living in the upper extremities [15].

In our study, participants reported that after receiving the speech and language pathology interventions, they noticed improvement in interaction and communication skills, such as talking and expressing verbally while interacting with others. This highlights that aphasia post-stroke can be effectively managed with the involvement of a speech-language pathologist and the stroke client's adherence to prescribed treatment strategies and advice. A similar study conducted at the Healing Center of the University of Alabama examined three male aphasic participants with left hemisphere strokes who attended speech therapy sessions. This study indicated notable improvements in speech-language capabilities for all participants following animal-assisted therapy, highlighting its potential as a supportive approach for managing aphasia post-stroke [16].

CONCLUSION

This study explored the perspectives of stroke clients on the effectiveness of rehabilitation professionals in managing stroke at King Faisal Hospital-Rwanda. The findings demonstrated that physiotherapy interventions significantly improve functional movement, including walking on various surfaces and climbing stairs. Occupational therapy interventions were found to enhance independence in daily functional activities, supporting patients' journeys toward self-reliance. Additionally, speech therapy interventions were effective in improving communication skills, enabling stroke clients to engage in conversations and express themselves more effectively. This study highlights the value of a multidisciplinary approach, where physiotherapy, occupational therapy, and speech-language therapy work synergistically to enhance mobility, independence in activities of daily living, and communication skills. These improvements collectively contribute to the overall rehabilitation and reintegration of stroke patients.

Based on the study findings, which highlight the significant impact of rehabilitation interventions on stroke recovery, it is recommended that King Faisal Hospital-Rwanda increase the number of rehabilitation professionals, particularly in the Occupational Therapy and Speech and Language Pathology departments. Currently, each of these departments is staffed by only one professional, despite serving a large number of beneficiaries. This imbalance limits both the quality and quantity of service delivery, thereby hindering optimal functional outcomes and quality of life for individuals recovering from stroke. Furthermore, rehabilitation professionals at King Faisal Hospital-Rwanda are encouraged to strengthen interdisciplinary and interprofessional collaboration. Some clients reported not receiving Occupational Therapy services despite being eligible, which suggests the need for improved coordination among team members to ensure comprehensive care and equitable access to rehabilitation services.

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Original Research

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Factors, beliefs, and barriers associated with adherence to secondary prophylaxis amongst children and adolescents with rheumatic heart disease at public tertiary hospitals in Rwanda: A cross-sectional observational study

Janvier Dushimire[1,*], Samson Habimana[1], Emmanuel Rusingiza[1]

[1]*College of Medicine and Health Sciences (CMHS), University of Rwanda, Kigali, Rwanda*

***Corresponding author:**
Samson Habimana
School of Public Health, College of Medicine and Health Sciences (CMHS), University of Rwanda, Kigali, Rwanda

Email: habimanasamson355@gmail.com

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ABSTRACT

INTRODUCTION: Rheumatic heart disease (RHD) is the most prevalent cardiovascular disease among young people under 25 years. This study aimed to explore the factors, beliefs, and barriers associated with adherence to penicillin among children and adolescents with RHD undergoing secondary prophylaxis at public tertiary hospitals in Rwanda.
METHODS: This cross-sectional observational study included children aged 5 to 18 years diagnosed with RHD and on secondary prophylaxis for at least six months, from two public tertiary hospitals in Rwanda. Regression analyses were performed to identify factors associated with adherence.
RESULTS: Employment status was significantly associated with adherence to prophylaxis (OR [95% CI]: 12.17 [1.42-103.9], p=0.022). Living in an urban area also increased the likelihood of adherence compared to rural areas (OR [95% CI]: 9.05 [2.28-35.91], p=0.001). A long distance to the clinic was strongly associated with poor adherence (OR [95% CI]: 5.55 [1.94-15.89], p=0.001). Additionally, long waiting times at the clinic are also significantly associated with poor adherence (OR [95% CI]: 4.77 [1.69-13.43], p=0.003). Patients with good adherence have significantly higher belief scores than those with poor adherence (M ± SE: 1.56 ± 0.54, t=2.878, p=0.005), and patients with higher barrier scores are significantly less adherent than those with lower barrier scores (M ± SE: 4.6 ± 0.85, t=5.531, p<0.001).
CONCLUSION: Factors negatively affecting adherence included parental unemployment and rural residence. Long travel distances and extended waiting times at clinics were the most common barriers to adherence. To improve adherence, educational efforts targeting RHD patients and their caregivers should be strengthened, and RHD prevention activities should be decentralized to health centers.

INTRODUCTION

Rheumatic Heart Disease (RHD) is the most common acquired cardiovascular disease in young people aged <25 years [1]. Acute Rheumatic Fever (ARF) and RHD are the leading causes of cardiac mortality among children and young people in developing countries [2]. ARF mainly affects the joints, skin, heart, and central nervous system, and cardiac involvement leads to permanent valve

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damage. It commonly occurs between the ages of 4-15 years and takes place 2-3 weeks after GAS upper respiratory tract infection. Although ARF has almost disappeared in the developed world due to improved sanitation and socioeconomic conditions, it continues to be a serious public health problem in developing countries [3]. In Rwanda, RHD is a significant health problem, with an estimated prevalence of 6.8 per 1000 schoolchildren [4].

Prevention of ARF includes primordial prevention, which involves improving socioeconomic conditions; primary prevention, which involves prompt treatment of GAS pharyngitis; and secondary prevention, which involves a continuous administration of benzathine penicillin G to patients with a previous attack of ARF or well-documented RHD [5]. Another intervention in the prevention of early mortality due to RHD is cardiac surgery, which is not accessible to many patients, especially in low-income countries [6]. Even after heart surgery, patients are exposed to many complications, such as thrombo-embolic events and severe bleeding, when using warfarin treatment [7]. The cost-effective strategy remains the prevention of ARF and progression to severe rheumatic valvular heart disease [8].

Although based on a low level of evidence, intramuscular penicillin was shown to be more effective than oral penicillin [9]. The rate of adherence to secondary prophylaxis is unknown in many countries of sub-Saharan Africa, particularly in Rwanda. Different factors associated with adherence have been reported in various regions of the world. These include socioeconomic status, knowledge about the disease, waiting time at the clinic, the painful aspect of the injections, and distance to the clinic [1,10].

Knowing different factors, beliefs, and barriers associated with adherence would help clinicians find ways of improving adherence to secondary prophylaxis and thus improve the quality of life of our patients. This research project aimed to explore factors, beliefs, and barriers associated with adherence to injectable forms of penicillin in children and adolescents with RHD receiving secondary prophylaxis at public tertiary hospitals in Rwanda.

METHOS

Study design and settings: This was a cross-sectional observational study involving children and adolescents with RHD presenting to the outpatient or inpatient pediatric departments at two public tertiary hospitals in Rwanda [Kigali University Teaching Hospital (CHUK) and Butare University Teaching Hospital (CHUB)]. Data collection was conducted over five months, from January to May 2019. The study focused on children aged 5 to 18 years who had been diagnosed with RHD and had been receiving secondary prophylaxis for at least six months. In Rwanda, the pediatric age range is defined as 0 to 15 years. Patients aged 15 years and older are typically treated in internal medicine. However, those aged 15 to 18 years continue to receive follow-up care in the pediatric department following cardiac surgery.

Study population: The study included patients aged 5-18 years with confirmed RHD by echocardiography, treated at the CHUK and CHUB OPD pediatric cardiology, who consent to participate, receive monthly intramuscular penicillin injections, and consult two tertiary level hospitals. Exclusion criteria include patients/guardians who decline to sign consent forms, patients on secondary prophylaxis for less than 6 months, and patients on oral penicillin for prophylaxis.

Sample size calculation: A sample size calculation has been calculated using the Raosoft formula as follows:

$$X=Z(c/100)^2r(100-r)$$
$$N=N\ x/((N-1)E^2 + x)$$
$$E=Sqrt[(N - n)x/n(N-1)]$$

Where:

E is the margin of error and is of about 5%

N is the population size. In this case, it is 80, the total number of patients received in pediatric outpatient in a period of 4 months

r is the fraction of response we are interested in, in this case, 54%, based on a study done in Uganda [10].

Z(c/100) is the critical value for the confidence level c, 95% confidence interval.

n is the minimum sample size and is equal to 67

Sampling: All participants fulfilling inclusion criteria were included and sampled by convenience sampling technique

Data Collection Tool: We used a modified questionnaire originally developed by Balbaa et al. [1] in Egypt in 2015. A certified translator translated the questionnaire into Kinyarwanda and then back-translated it by a medical professional to ensure accuracy. The principal investigator collected data, entered it into Epidata version 3.1, and coded it for analysis.

Data Analysis: Data from Epidata were exported to IBM SPSS version 25 for analysis. For descriptive analysis, continuous variables were summarized using means and medians, while categorical data were summarized with frequencies and percentages. To analyze factors associated with adherence, bivariate analysis was performed using logistic regression to calculate odds ratios (ORs). Multivariate analysis was then conducted to control for confounding factors and to identify independent variables associated with poor compliance. Variables with a p-value <0.05 from the bivariate analysis were included in the multivariate model. The final multivariate analysis results were reported using ORs and p-values. Comparisons of Likert-scale responses were also made to evaluate differences in scores between participants with good and poor adherence.

Ethical Considerations: Permission to conduct this study was obtained from the Institutional Review Board of the College of Medicine and Health Sciences (CMHS), University of Rwanda (CMHS IRB approval notice number: 377/CMHS IRB/2018). Additional approvals were received from the CHUK Research Ethical Committee (CHUK research committee: Ref-EC/CHUK/736/2018) and from CHUB Research ethical committee (CHUB: RC/UTHB/051/2018). Participants provided written consent, and their participation was entirely voluntary.

RESULTS

Socio-Demographic Characteristics of the Study Population

A total of 67 participants meeting the inclusion criteria were interviewed. The median age was 13.3 ± 3 years (IQR 11-16), with 64.2% (N=43) being female. The majority of participants (82.1%, N=55) were recruited from CHUK, while the remaining were from CHUB. Most participants (74.6%, N=50) reside in rural areas, and a large proportion (64.1%, N=43) come from economically disadvantaged backgrounds, belonging to Ubudehe categories 1 and 2. Additionally, 46.3% (N=31) of guardians or caretakers completed only primary education, and only 13.4% (N=9) of parents or guardians hold formal employment.

Table 1: *Socio-demographic characteristics*

Characteristics	N	%
Age (Mean ± SD)	13.3 ± 2.7 years	
Gender		
Female	43	64.2
Male	24	35.8
Place of recruitment		
CHUK	55	82.1
CHUB	12	17.9
Economic class (Ubudehe)		
Category 1	7	10.4
Category 2	36	53.7
Category 3	24	35.8
Time since diagnosis was made		
0-5 years ago	50	74.6
>5 years	17	25.4
Employment status of caretaker		
Employed	9	13.4
Unemployed	58	86.6
Address		
Urban	17	25.4
Rural	50	74.6
Recruitment setting		
OPD	65	97.0
Inpatient	2	3.0
Level of education of participant		
Primary completed	39	58.2
None	28	41.8
Level of education of parent/caretaker		
University completed	1	1.5
High school completed	9	13.4
Vocational completed	11	16.4
Primary completed	31	46.3
None	15	22.4

SD: Standard deviation; OPD: Outpatient department

Table 2: *Patient Practices, Beliefs, and Awareness Regarding Prophylaxis and Management of Rheumatic Heart Disease*

	N	%
Missed injections in last 6 months		
No	30	44.8
Yes	37	55.2
Period of starting prophylaxis		
Less than 1 year	8	11.9
1-2 years	20	29.9
2-5 years	24	35.8
>5 years	15	22.4
Action taken when missed appointment		
I wait till next appointment	22	32.8
I go a few days later	45	67.2
Awareness of side effects		
No	40	59.7
Yes	27	40.3
If no injections		
May heart condition will get worse	51	76.1
It's ok to miss some doses, nothing will happen	16	23.9
Awareness for need of surgery		
No	11	16.4
Yes	56	83.6
Waiting time at the clinic		
20-40 min	5	7.5
40-60 min	28	41.8
1-2 hours	29	43.3
>2 hours	5	7.5
Awareness on the stop of progression by the injections		
No	8	11.9
Yes	59	88.1
Belief on effectiveness of traditional medication		
No	64	95.5
Yes	3	4.5
Hospitalized due to this condition		
No	7	10.4
Yes	60	89.6
Ever had severe side effects from injections		
No	65	97.0
Yes	2	3.0
Time from home to the clinic		
1 hour	27	40.3
1-3 hours	35	52.2
3-5 hours	4	6.0
>5 hours	1	1.5

Patient Practices, Beliefs, and Awareness Regarding Rheumatic Heart Disease Management

The study revealed that 55.2% of participants missed at least one scheduled injection in the past six months, with 67.2% attending a few days later and 32.8% waiting until the next appointment. Awareness of side effects was low (59.7%), though severe side effects were rare (3.0%). Most participants (76.1%) believed missing injections would worsen their heart condition, and 88.1% trusted penicillin injections to halt disease progression. Awareness of the need for surgery was high (83.6%), and nearly all participants (95.5%) distrusted traditional medicines. Long waiting times (41.8%-43.3% waited 40 minutes to 2 hours) and travel distances (52.2% traveled 1-3 hours) were noted challenges. Additionally, 89.6% had been hospitalized, highlighting the disease's severity (Table 2).

Socioeconomic factors associated with adherence

Table 3 presents the socioeconomic factors associated with adherence to RHD secondary prophylaxis. There is a strong association between the employment status of the parent or guardian and adherence, with participants who have an employed parent or guardian showing significantly better adherence (OR [95% CI]: 12.17 [1.42-103.9], p=0.022). Additionally, living in an urban area is associated with higher adherence to RHD secondary prophylaxis compared to residing in a rural area (OR [95% CI]: 9.05 [2.28-35.91], p=0.001). The table also indicates that a higher educational level of the parent or guardian is positively associated with adherence (OR [95% CI]: 3.4 [1.15-10.12], p=0.027).

Barriers, beliefs, and behaviors associated with adherence

Table 4 highlights various barriers, beliefs, and behaviors linked to adherence to secondary prophylaxis. A long distance to the clinic is strongly associated with poor adherence (OR [95% CI]: 5.55 [1.94-15.89], p=0.001). Additionally, long waiting times at the clinic are also significantly associated with poor adherence (OR [95% CI]: 4.77 [1.69-13.43], p=0.003).

Table 3: *Socioeconomic factors associated with adherence to RHD secondary prophylaxis*

Socio-economic variables	Self-reported adherence		OR (95% CI)	P value
	Adherent	Non-adherent		
Gender				
Female	20 (46.5%)	23 (53.5%)	1.02 (0.37-2.79)	0.957
Male	11 (45.8%)	13 (54.2%)		
Home address				
Urban	14 (82.4%)	3 (17.6%)	9.05 (2.28-35.91)	0.001
Rural	17 (34.0%)	33 (66.0%)		
Employment status of parent/guardian				
Employed	8 (88.9%)	1 (11.1%)	12.17 (1.42-103.9)	0.022
Unemployed	23 (39.7%)	35 (60.3%)		
Who accompanies the patient to the clinic?				
None	5 (26.3%)	14 (73.7%)		
Family member	26 (54.2%)	22 (45.8%)	3.31 (1.02-10.64)	0.044
Level of education of parent/guardian				
Secondary/University	14 (66.7%)	7 (33.3%)	3.4 (1.15-10.12)	0.027
Primary/None	17 (37.0%)	29 (63.0%)		
Economic class (Ubudehe)				
Category 1 & 2	16 (37.2%)	27 (62.8%)		
Category 3	15 (62.5%)	9 (37.5%)	2.81 (1.0-7.89)	0.049

Table 4: *Barriers, beliefs, and behaviors associated with adherence*

Barriers, beliefs, and behaviors	Self-reported adherence		OR (95% CI)	P value
	Adherent	Non-adherent		
Long distance to the clinic				
Yes	9 (26.5%)	25 (73.5%)		
No	22 (66.7%)	11 (33.3%)	5.55 (1.94-15.89)	0.001
Long waiting time at the clinic				
Yes	10 (28.6%)	25 (71.4%)		
No	21 (65.6%)	11 (34.4%)	4.77 (1.69-13.43)	0.003
Awareness of side effects of the injections				
Yes	17 (42.5%)	23 (57.5%)	0.68 (0.25-1.83)	0.452
No	14 (51.9%)	13 (48.1%)		
Consequences of not getting the injections				
Worsening my heart condition	27 (52.9%)	24 (47.1%)	3.37 (0.95-11.87)	0.058
It's ok, nothing will happen	4 (25.0%)	12 (75.0%)		
Awareness of possible surgery				
Yes	24 (42.9%)	32 (57.1%)	0.43 (0.11-1.63)	0.214
No	7 (63.6%)	4 (36.4%)		
Knowledge of the role of secondary prophylaxis				
Yes	26 (44.1%)	33 (55.9%)	0.63 (0.15-2.58)	0.521
No	5 (62.5%)	3 (37.5%)		
Belief in traditional healers				
Yes	3 (100%)	0 (0.0%)	8.96 (0.44-180.7)	0.152
No	28 (43.8%)	36 (56.3%)		

OR: Odd ratio; CI: Confidence Interval

Relationship between barriers and beliefs with adherence

Table 5 compares adherent and non-adherent patients based on their beliefs and barriers. It shows that patients with good adherence have significantly higher belief scores than those with poor adherence (M ± SE: 1.56 ± 0.54, t=2.878, p=0.005). Additionally, patients with higher barrier scores are significantly less adherent than those with lower barrier scores (M ± SE: 4.6 ± 0.85, t=5.531, p<0.001).

Table 5: *Comparison of beliefs and barriers scores among adherence groups*

Score	Adherence (M ± SE)		Mean difference (M ± SE)	95% CI	T-test	P value
	Adherent	Non-Adherent				
Total beliefs score/40	32.26 ± 0.45	30.7 ± 0.32	1.56 ± 0.54	0.48-2.64	2.878	0.005
Mean beliefs score/5	4.03 ± 0.56	3.83 ± 0.04	0.19 ± 0.07	0.05-0.33	2.878	0.005
Total barriers score/45	26.58 ± 0.64	31.28 ± 0.56	4.6 ± 0.85	6.39-3.0	5.531	<0.001
Mean barriers score/5	2.95 ± 0.07	3.47 ± 0.06	0.52 ± 0.09	0.71-0.33	5.531	<0.001

M: Mean, SE: Standard error, CI: Confidence interval

DISCUSSION

This study aimed to explore factors, beliefs, and barriers associated with adherence to injectable penicillin in children and adolescents with RHD. Most patients (64.2%) were female, with a mean age of 13.3 ± 3 years. Similar demographics have been reported in studies from Uganda, Jamaica, and India, where females represented 78.9%, 74.4%, and 54%, respectively [3,11,10].

A large proportion of patients in our study resided in rural areas (74.6%), consistent with findings from India (69%) and Uganda (60%). In contrast, studies in Egypt have shown a predominance of patients from semi-urban or urban areas [1]. Most participants (61.4%) came from low-income families, with many belonging to social class Ubudehe categories 1 and 2, a finding similar to the Indian study where 73.6% of patients had low socioeconomic status [3]. In Uganda, 68.4% of patients were unemployed [10], while in New Caledonia, Gasse et al. reported a substantial number of households with a higher monthly income [12]. Only 13.4% of guardians in our study had formal employment, contrasting with findings from Jamaica, where 35% were unemployed [11]. Educational attainment was limited, with 46.3% of guardians having completed only primary education, similar to findings from Musoke et al. in Uganda [10]. Conversely, the study from India reported a much higher education rate among participants (65%) [3].
Antibiotic prophylaxis is an effective, cost-efficient measure for preventing recurrent ARF episodes and reducing the burden of RHD. Our study revealed low adherence (46.3%) to secondary prophylaxis with intramuscular penicillin, a trend consistent with similar studies in low-income settings. In the Philippines, Respicio and Sicat found adherence to be 46.6% [13], while adherence was 48.7% in Jamaica [11], 56% in Northern Australia [14], and 58% in Uganda [15]. A Brazilian study noted non-adherence among 35% of children [16].

In this study, poor adherence was significantly associated with unemployed guardians, rural residents, and low educational levels (p=0.022, p=0.001, p=0.027, respectively). Similar patterns have been observed in other regions, such as Egypt, where parental educational and occupational status influenced adherence [17], and Uganda, where city residence and higher education levels were linked to better adherence [18]. In Fiji, urban residence also correlated with improved adherence [19].
Barriers impacting adherence in our study included long distances to clinics and extended waiting times. Similar findings were reported in Jamaica, where barriers included injection pain, school absences, and clinic wait times [11]. Other global studies have cited factors like healthcare costs and perceptions of illness as significant barriers to adherence [20].

This is the first study to examine factors, beliefs, and barriers to secondary prophylaxis adherence in children with RHD in Rwanda. However, it has limitations, including potential acquiescence bias due to self-reported adherence and interviewer-administered questionnaires. Although the principal investigator completed the questionnaires, questions were kept concise to minimize bias and ensure participant understanding. Additionally, the small sample size and specific site limit the generalizability of results.

CONCLUSION

Adherence to secondary prophylaxis is the most effective way to reduce RHD-related morbidity and mortality. Our study found low adherence to RHD secondary prophylaxis using injectable penicillin at the tertiary care level in Rwanda, with rural residence and parental unemployment being significant contributors to poor adherence. Long distances and clinic wait times were the primary barriers. To enhance adherence to secondary prophylaxis among patients with rheumatic heart disease (RHD), several key recommendations should be implemented. First, healthcare providers must prioritize education for RHD patients and their parents or caretakers, emphasizing the critical importance of adhering to secondary prophylaxis. Second, district hospitals should decentralize RHD prevention activities by extending them to health centers, ensuring greater accessibility and continuity of care. Third, health facilities managing RHD patients should establish registries and Benzathine penicillin injection cards to better track adherence and identify patients who require additional support to improve their adherence levels. Lastly, the Rwanda Biomedical Center (RBC) and the University of Rwanda should conduct a comprehensive study on a larger sample size to accurately determine the level of adherence to secondary prophylaxis across the country.

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Original Research

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Employee absenteeism at the University Teaching Hospital of Kigali in Rwanda, 2020

Emmanuel Munyaneza[1,*], Emmanuel K. Rusingiza[1,2], Belson Rugwizangoga[1,2], Marianne Munyarugerero[3], Devotha Mukarugema[3], Jean Damascene Gasasira[4], Betty Mbabazi[3], Timothée S. Twahirwa[5], Oswald Ndibagiza[5], Martin Nyundo[6], Theobald Hategekimana[5], David Nzanira[5,6], Florence Masaisa[1,2]

[1]*Clinical Education and Research Division, University Teaching Hospital of Kigali, Kigali, Rwanda.*
[2]*School of Medicine and Pharmacy, College of Medicine and Health Sciences, University of Rwanda, Kigali, Rwanda.*
[3]*Corporate Services Division, University Teaching Hospital of Kigali, Kigali, Rwanda.*
[4]*Quality Management Solutions, Hayfields, South Africa.*
[5]*Directorate General Office, University Teaching Hospital of Kigali, Kigali, Rwanda.*
[6]*Clinical Services Division, University Teaching Hospital of Kigali, Kigali, Rwanda.*

***Corresponding author:**
Emmanuel Munyaneza
Clinical Education Directorate, University Teaching Hospital of Kigali (CHUK), Kigali, Rwanda

E-mail: Emmanuel.munyaneza@chuk.rw

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ABASTRACT

INTRODUCTION: Background: Absenteeism among health workers has become a problematic issue all over the world. This study aimed to determine the rate, cost, types, and factors of employee absenteeism at the University Teaching Hospital of Kigali (CHUK)

METHODS: A descriptive cross-sectional study was carried out at CHUK, using prospective and retrospective approaches/aspects, and a self-administered semi-structured questionnaire from July 2019 to June 2020. A comprehensive analysis was conducted to assess individual, institutional, and workplace factors associated with absenteeism among CHUK staff (clinical and administrative)

RESULTS: One hundred and fifty-nine staff (159) completed the study, which gave a response rate of 88.3%. The findings revealed that 337 (38.3%) staff were had absenteeism from 2019 to 2020. The absenteeism rate at CHUK was 3.3%, with the highest absenteeism observed among clinical staff, 82% (278 staff), and the lowest among administrative staff, 17.5 % (59 staff). The average cost per absentee was observed to be 173.4 USD, and the estimated total cost for absenteeism at CHUK was 58 465 USD per year. Key contributing factors included inadequate equipment (72%), high workload (54%), and long commuting distances, with 83% of participants traveling more than 10 km to work. The average cost per absentee was $173.40, translating to an estimated annual financial burden of $58,465. The study also highlighted the role of workplace-related challenges, such as insufficient resources and limited flexibility in work schedules.

CONCLUSION: The study found that CHUK employees' absenteeism rate was 3.3%, with clinical staff being the most affected. Addressing identified factors through improved management practices, employee welfare, and strategic Human Resource Management (HRM) interventions could reduce absenteeism and its financial impact.

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INTRODUCTION

Absenteeism was defined as an employee's intentional or habitual absence from work [2]. Absenteeism of health workers is a great concern because it disorganizes the work routine, which causes overburdening to workers [3]. Absenteeism is one of the major causes of poor productivity and time wastage faced by health sectors worldwide [4,5].

A study involving 146 national health systems (NHS) in the United Kingdom reported that the general absenteeism rate in 2004 was 4.9% compared to the preceding year, which was 5.2% [6]. In South Africa, research findings revealed significant workplace absenteeism, particularly among females (83.2%). The highest absenteeism was observed in the 45–49 age group (22.35%), among employees with a salary range of 2 to 3 (35.3%), and within the African racial group (96.3%). Additionally, absenteeism was more prevalent among individuals with a tenure of 11 to 20 years (44.3%), nurses (20.8%), and administrative support staff (35.4%) [8].

According to the study conducted in Uganda, staff absenteeism in rural communities is a major challenge that needs a multi-sectorial approach, thus showing a need to revise policy in the health sector [3,7]. Similarly, research in South Sudan indicated that absenteeism is one of the major causes of poor productivity and time wastage [4]. These absences result in both direct and indirect costs. Direct costs include continued wage payments to absent workers, while indirect costs arise from the adverse effects on the quality of services provided. Research has demonstrated that absenteeism can impact individuals, co-workers, work groups, organizations, communities, and society as a whole [2,8].

Absenteeism has been highlighted as a phenomenon with both negative and positive implications for organizations. On the negative side, it results in lost productivity and a decline in work quality. On the positive side, absenteeism can occasionally provide benefits, such as allowing a fatigued employee to recover, especially in roles requiring high mental alertness [9]. It has been noted that job satisfaction is significantly influenced by the nature of work and the work environment, with dissatisfaction often leading to absenteeism [10]. Additionally, the type of supervision plays a crucial role; for example, coercive leadership tends to demoralize employees, exacerbating absenteeism. The literature underscores that absenteeism has far-reaching effects, impacting individuals, their colleagues, organizations, and even clients [3,11]. Key factors contributing to absenteeism include work environment, interpersonal relations, organizational facilities, and overall job satisfaction [12,13].

Multiple factors influence absenteeism, including individual characteristics such as gender, age, education, and health status [14], as well as contractual and institutional elements like the generosity of sickness benefits, employment protection, firm size, job type, and labor market conditions [15,16]. However, while absenteeism has been extensively studied in developed countries, evidence from developing countries remains limited [17].

In Rwanda, there is no available data on absenteeism in health settings despite a known shortfall in meeting the World Health Organization's recommended healthcare professional-to-population ratios. This study seeks to address this gap by examining absenteeism at the University Teaching Hospital of Kigali (CHUK). Specifically, it aims to measure the rate at which health workers fail to report for scheduled work and investigate the factors contributing to absenteeism within the hospital. Moreover, this study aligns with international accreditation standards, such as Standard 2.1.1.4 of the Council for Health Service Accreditation of Southern Africa (COHSASA), which emphasizes monitoring and addressing staff absenteeism as part of quality healthcare delivery [18].

METHODS

Study design

This was a descriptive cross-sectional study design using prospective and retrospective aspects. The prospective aspect was used to determine the individual and institutional factors contributing to staff absenteeism. In this study, a simple random sampling technique was used to select the study participants. The researcher has made clusters of the CHUK staff according to their field of work and has used the simple random sampling technique to distribute questionnaires to the respondents. This study also used a retrospective method to find out

the current rate and cause of absenteeism. The data were retrieved from the Human Resource Management (HRM) archive, where all files from employees who were absent from work from July, 2019 to June 2021 were accessed to determine the absenteeism rate, cost, and types of absenteeism.

Study Setting

This study was conducted at the University Teaching Hospital of Kigali (CHUK). CHUK is one of the referral hospitals in Rwanda and is also the biggest public referral hospital, with a capacity of around 519 beds, serving around 6,200,000 people and having around 879 staff.

Source of data and population

The primary data source was obtained from Human Resource Management archives and CHUK staff. Structured questionnaires were administered by the research assistant to the respondents who agreed to participate in this study.

This study targeted staff working at the University Teaching Hospital of Kigali (clinical and administrative staff), and all cases of absenteeism from July 2019 to June 2020 in HRM archives were included.

Sample size

The sample size of this study was calculated by using Yamane's formula, (Yamane, 1967) below:

$n=N/1+N\ (e)^2$

Where

n: sample size

N: Population

e: the error of 5% points

Application of the formula: $n=186/1+186(0.05)^2 = 180$

Yamane's formula of sample size was used with an error of 5% and with a confidence coefficient of 95% (Yamane, 1967). The calculation was based on a population of 337 involved in absenteeism, and the sample size was 180 staff.

Sampling procedures

The prospective method was used to determine the demographic profile of respondents and individual factors, institutional factors, and workplace factors that contribute to employee absenteeism. In this study, a simple random sampling technique was used to select the study participants. A list of CHUK staff who were absent from work in the fiscal year 2019 to 2020 was obtained from the Human Resource (HR) Directorate and the researcher made clusters according to their fields of working then after, in each cluster study, participants' names were on the alphabetical list. All employees had numbers attached to their names ranging from 0001 to 337, and we chose a random starting point was 002, and then pick every 2nd name thereafter to give us our sample of 165. Out of 337 CHUK employees involved in absenteeism during the period of 2019 to 2020, 165 employees were selected randomly to participate in this study.

Data collection techniques

The research assistant distributed questionnaires to the selected respondents, providing envelopes to secure and seal the completed forms. Respondents were given the flexibility to complete the questionnaires at their convenience, ensuring comfort and privacy during the process. The research utilized a self-administered, semi-structured questionnaire for data collection. The questionnaire included sections addressing respondents' demographic profiles, as well as individual, institutional, and workplace perceived factors contributing to absenteeism.

Questionnaires were pre-tested on a small number of participants with the same characteristics as individuals in the main study to recognize research questions that are misunderstood, or things that are commonly overlook. Adjustments after that were done earlier before the printing and distribution of questionnaires to the whole selected sample participants. The respondents who were included in the pre-testing of the questionnaires were not included in the main research.

This study also used a retrospective method to determine the current rate, types and causes of absenteeism. The data were retrieved from the HRM archive, where all files from employees with absenteeism from July 2019 to June 2020 were accessed to determine the current rate, types, and causes of absenteeism. The data were collected in one month of December 2021.

Data analysis

Quantitative data from the study were analyzed using the Statistical Software Package for Social Sciences (SPSS) (version 25) (IBM, Inc., NY, USA). Before running the statistical tests, data were

cleaned for out-of-range values, errors of coding, and check for missing data. The analysis includes a description of participants' characteristics, calculating the absenteeism rate, and determining individual, perceived (workplace and institutional) factors contributing to absenteeism.

Ethical Considerations

This study received approval from the Research Ethics Committee of CHUK (Review Approval Notice Ref. N° EC/CHUK/120/2021). Before obtaining informed consent, participants were provided with a detailed explanation of the study's purpose and process. They were also given the opportunity to ask questions for clarification based on the information outlined in the letter of information. Afterward, each participant signed a consent form. The researchers emphasized participants' rights, including the option to withdraw from the study at any time without any negative consequences for their employment at CHUK or any future employment opportunities. Participants were assured of complete anonymity and confidentiality throughout the study process.

RESULTS

Table 1 presents the socio-demographic characteristics of the study participants. Questionnaires were distributed to 180 hospital staff who had been observed for absenteeism during the 2019–2020 period. Of these, 159 staff members completed the questionnaires, yielding a response rate of 88.3%. The majority of non-responders were either on annual or other types of leave during the data collection period, while ten individuals declined to participate.

Among the respondents, 105 (66%) were female, and 54 (34%) were male. Regarding marital status, most participants were married (152, 96%), with a smaller proportion being single (6, 4%) and one individual divorced (1, 1%). In terms of professional roles, 124 (78%) participants were Nurses/Midwives, 23 (14%) were Administrative,

Table 4: *Socio-demographic characteristics of the study participants (n= 159)*

Characteristics	Frequency	Percent
Gender		
Male	54	34
Female	105	66
Marital status		
single	6	4
Married	152	96
Divorced	1	1
Field of work		
Registered Nurses/ Midwives	124	78
Allied Health Professionals	12	8
Administrative and Finance staff	23	14
Location of staff		
Pediatric ward	16	10
Maternity/Labor ward	5	3
surgical ward	15	9
Medical ward	13	8
Operation theatre	10	6
Psychiatric ward	4	3
Intensive care unit	11	7
Pharmacy	2	1
Finance/Corporate Division	23	14
Any other	38	24
Accident and Emergency	22	14

Table 2: *The cost and rate of absenteeism*

SN	Category of Staff	Number of staff	Percentage (%)	Number of days missed to the work	Total cost/ Rwandan Francs	United State Dollars (USD)
			Clinical Staff			
1	Doctors	4	1	116	8,527,600	8,528
2	Nurses	183	54	1437	28,794,352	28,794
3	Midwives	47	14	497	9,777,921	9,778
4	None Physician Anesthetist (NPA	17	5	110	2,186,152	2,186
5	Nutritionist	1	0	3	59,131	59
6	Lab Scientist	15	4	137	2,875,782	2,876
7	Ophthalmology Technician	3	1	20	394,209	394
8	Pharmacy (Nurse & Pharmacyst)	7	2	44	867,260	867
9	Social	1	0	2	39,421	39
	Sub-Total	278	82	2366	53,521,828	53,522
			Administrative Staff			
10	Administration	59	18	382	4,943,138	4,943
	Sub-Total	59	18	382	4,943,138	4,943

and Finance staff and 12 (8%) were Allied Health Professionals.

Table 2 illustrates the distribution of staff observed for absenteeism during the fiscal year 2019–2020. During this period, CHUK employed 879 staff members, of whom 337 (38.3%) were recorded as absent at least once. Absenteeism was highest among clinical staff, accounting for 82% (278) of cases, and lowest among administrative staff, who made up 18% (59) of the cases. The average absence rate was found to be 0.67 days per month per staff member, and the average cost per absentee was 173.4 USD, with the estimated total cost for absenteeism at CHUK being 58465 USD per year.

The absenteeism rate for the study period was 3.3%, calculated using the formula:

Absenteeism Rate (%) = (Total Days Lost ÷ (Employee Strength × Average Working Days per Employee)) × 100

For this study:

- Total days lost: 2,748
- Number of employees: 337
- Average working days per employee: 20 days/month×337 employees=80,880 days20days/month×337employees=80,880days

Using the formula:

Absenteeism Rate = (2,748÷80,880)×100=3.3% (2,748÷80,880)×100=3.3%

Table 3 presents study participants' responses regarding individual factors contributing to absenteeism. The majority of participants, 93 (58%), reported not having a chronic condition,

Table 3: *Individual Factors contributing to the absenteeism*

Item	No	Yes
Do you have a chronic condition?	93(58%)	66(42%)
Smoking	159(100%)	0(%)
Drinking alcohol	150(94%)	9(6%)

while 66 (42%) indicated they had a chronic condition. None of the participants (159, 100%) reported smoking. Additionally, 150 participants (94%) stated they do not consume alcohol, whereas 9 (6%) reported drinking alcohol.

Table 4 summarizes the institutional factors contributing to absenteeism among study participants. Regarding the presence of policies in the hospital, 132 (84%) reported that policies are available, while 27 (16%) indicated that they are not. Concerning support for hospital policies, 120 (76%) support the hospital's initiative to have policies, while 39 (24%) do not. Additionally, 120 (76%) of participants expressed satisfaction with the current hospital policies, while 39 (24%) were not satisfied. When asked about equipment availability, 115 (72%) felt that the hospital lacked sufficient equipment to support their work, while 44 (28%) believed that the hospital had adequate equipment. On the issue of promotions, 86 (55%) reported that there are no promotions in the hospital, while 43 (27%) indicated that promotions exist. Among those surveyed, 116 (72%) felt that promotions are not based on merit, compared to 43 (27%) who believed they are. Regarding salary, 141 (89%) reported that their salary is paid on time, while 18 (11%) said it is not. Despite this, 109 (68%) of participants expressed dissatisfaction with their salary, while 141 (89%) were satisfied. Finally, the study revealed that 129 (83%) commute more than 10 km to the hospital, 6 (3%) commute 5-10 km, and 2 (1%) commute 1-2 km from their homes.

Table 5 highlights the workplace factors contributing to absenteeism. Regarding daily work routines, 103 (64%) reported practicing routine work, while 56 (35%) did not. A majority of 130 (81%) said they utilize all their skills at the hospital, while 29 (18%) did not. On group cohesion, 79 (49%) reported insufficient cohesion with peers, while 80 (51%) felt they had sufficient cohesion. Concerning decision-making, 95 (59%) were dissatisfied with the level of decision-making in the hospital, while 64 (41%) were satisfied. When asked about independence, 86 (55%) said they are free to make independent decisions during their duties, while 73 (45%) said they are not. Teamwork was reported by 135 (85%) participants, while 24 (15%) indicated the absence of teamwork. Furthermore, 126 (79%) said there is a good culture of respect among colleagues, while 33 (20%) disagreed.

Most respondents, 134 (85%), reported performing duties according to their job descriptions, while 25 (15%) did not. Clarity of work roles was reported by 115 (73%) as being clear in their units, while 44 (27%) disagreed. About 101 (63%) were satisfied with the orientation provided for their job roles, while 58 (37%) were not. Regarding attendance, 145 (92%) reported that they did not miss work because of colleagues' absenteeism, while 14 (8%) indicated that this was a reason for their

Table 4: *Institutional Factors contributing to the absenteeism*

Item	**No**	**Yes**
Policies are available in the hospital	27(16%)	132(84%)
Do you support the hospital's initiative to have policies?	39(24%)	120(76%)
Are you satisfied with the current hospital policies at the workplace	39(24%)	120(76%)
Are the equipment sufficient to facilitate your work?	115(72%)	44(28%)
Are there promotions in the hospital?	86(55%)	73(45%)
Are the promotions at the workplace done based on merit?	116(72%)	43(27%)
Is your salary paid on time?	18(11%)	141(89%)
Are you satisfied with the salary you earned for the work?	109(68%)	50(32%)
Item	**Distance in km**	
What is the distance between the hospital and your place of residence?	2-5km 22(13%)	> 10 129(83%)

Table 5: *Workplace Factors contributing to absenteeism*

Item	No	Yes
Do you practice routine work in your daily duties	56(35%)	103(64%)
Do you think you are utilizing all your skills in this hospital	29(18%)	130(81%)
Do you have insufficient group cohesion with peers at work	80(51%)	79(49%)
Are you satisfied with the level of the hospital of decision making	95(59%)	64(41%)
Are you free to make independent decisions while performing duties	73(45%)	86(55%)
Is there teamwork at the workplace	24(15%)	135(85%)
Is there a good culture of respect for one another?	33(20%)	126(79%)
Do you perform duties according to your job description?	25(15%)	134(85%)
Is there clarity on the work roles in the unit?	44(27%)	115(73%)
Orientation is insufficient on job undertaking?	101(63%)	58(37%)
Do you miss duty because your colleagues always miss work?	145(92%)	14(8%)
Working shifts are flexible	72(45%)	87(55%)
You have to do jobs that require more skills than you have	86(55%)	73(45%)
The overall workload is good	87(54%)	72(45%)

absenteeism. About 87 (55%) found their working shifts flexible, while 72 (45%) reported that they were not. Furthermore, 86 (55%) felt that they are not often assigned tasks that require skills beyond their capabilities, while 73 (45%) said they are assigned such tasks. Lastly, 87 (54%) of participants considered the overall workload to be poor, while 72 (45%) thought it was manageable.

DISCUSSION

This study explored absenteeism among CHUK employees, including the overall absenteeism rate, costs, types of absenteeism, individual factors, workplace factors, and institutional factors influencing absenteeism. Of the participants (all absenteeism cases), 152 (96%) were married, 6 (4%) were single, and 1 (1%) was divorced. These findings align with research showing that most absentees were female (82.8%), while only 17.2% were male [19]. The highest absenteeism was observed among clinical staff (82%, or 278 staff members), while the lowest was among administrative staff (18%, or 59 staff members).

The findings showed that 124 (78%) of participants engaged in absenteeism were Registered Nurses or Midwives. This finding aligns with earlier research, including a cross-sectional study conducted on health workers in Tehran University hospitals (2014–2015), which found that 63.3% of sickness absenteeism was primarily associated with nursing staff. This trend is likely due to the nursing shortage, increased job stress, and exposure to occupational hazards, which can compromise both physical and mental health and lead to higher rates of absenteeism [9]. Work overload, often the result of colleagues' absence, can also demotivate nurses and decrease their productivity [20].

The study also found that 129 (83%) participants traveled more than 10 km to the hospital, while 6 (3%) traveled between 5–10 km, and only 2 (1%) lived within 1–2 km. Previous studies have identified long commute distances as a contributing factor to absenteeism. For instance, employees living more than 12 km away from their workplace showed a 24% higher likelihood of being absent compared to those within 12 km, with longer absences correlating to increased commute distances [21].

The average absenteeism rate at CHUK was found to be 3.3%, with the average absence being 0.67 days per month. This is consistent with studies conducted in other settings, such as Saudi Arabia, which reported an average of 0.62 days per month

[16]. Few comparative studies exist since most focus on short-term absences or health-related reasons only [8,10,14,17,20]. The financial impact of absenteeism was also calculated, with the average cost per absentee being $173.40 and the estimated total annual cost at CHUK amounting to $58,465. These figures are consistent with other studies. For instance, a study by Forbes in 2013 estimated costs related to absenteeism at $3,600 per hourly worker and $2,650 for salaried employees. Similarly, research by Yamamoto et al. (2023) in Mongolia reported an average absentee cost of $295.50, totaling $1,796,993 annually across all health organizations [22,17].

Workplace-related factors also influenced absenteeism. About 115 (72%) respondents indicated that CHUK lacks sufficient equipment to facilitate their duties. Additionally, 87 (54%) reported that the overall workload was unsatisfactory. This aligns with studies showing that job dissatisfaction, low decision-making latitude, insufficient time and resources, and job overload are associated with absenteeism [23–26]. Flexible work schedules are often associated with increased job satisfaction and reduced absenteeism. However, only 72 (45%) participants indicated that their work shifts are not flexible. Research by the Boston College Center for Work & Family supports this notion, showing that flexible arrangements positively affect productivity, work quality, and employee retention [22,27].

The study has several limitations. First, absenteeism rates were derived solely from staff records at the HRM unit, which may have excluded unauthorized absences not formally reported. Second, the findings are limited to CHUK staff and cannot be generalized to other hospitals across Rwanda. Third, the study was unable to identify disease profiles or other causes of absenteeism due to incomplete documentation, especially regarding medical sick leave notes. Despite these limitations, the study has several strengths. It captured the perspectives of staff members on absenteeism and sampled individuals directly from among those who reported absenteeism. This approach likely provided accurate insights into the underlying causes of absenteeism at CHUK.

CONCLUSION

The study provided insights into the overall absenteeism rate, the cost of absenteeism, types of absenteeism, individual factors, workplace factors, and institutional influences on absenteeism among CHUK employees. Among the findings, absenteeism was most prevalent among clinical staff, while the absenteeism rate at CHUK was 3.3%. Additionally, most participants reported that the hospital lacked sufficient equipment to support their work, and over half were dissatisfied with their workload. The average cost per absentee was $173.40, with the total estimated annual financial burden of absenteeism being $58,465. Furthermore, 83% of participants commuted over 10 km to work, highlighting commute distance as a contributing factor to absenteeism.

To reduce absenteeism, improving relationships between managers and employees and fostering positive team interactions are vital. Managers and supervisors should receive adequate training to address staff concerns and ensure employee well-being. Continuous education on the causes and effects of absenteeism is critical. Moreover, the HRM Directorate should collaborate closely with the Occupational Health Unit to improve absenteeism documentation. Employers must actively investigate the reasons behind absenteeism and distinguish between genuine excuses and noncompliance to develop targeted strategies for addressing the issue. Addressing the underlying institutional and workplace factors, such as resource availability, equipment shortages, and flexible working schedules, could significantly reduce absenteeism among CHUK employees.

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Availability of data and materials

All raw data supporting this study's findings are available from the corresponding author upon reasonable request.

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Rwanda
Public Health Bulletin

About the Rwanda Public Health Bulletin (RPHB)

The Rwanda Public Health Bulletin (RPHB) is a printed and open access, peer-reviewed journal, published as the flagship scientific and technical periodical publication. RPHB is a public health bulletin launched in March 2019 by the Rwandan Ministry of Health, through the Rwanda Biomedical Centre (RBC) in collaboration with the CDC Foundation and with support from Bloomberg Philanthropies Data for Health Initiative.

Mission

To serve as a scientific information dissemination platform of national and international significance, mainly in areas related to the Rwanda Ministry of Health's essential mission to strengthen national and local health systems and improve the health of the people of Rwanda. The Rwanda Public Health Bulletin publishes disease surveillance summaries, public health response guidelines, public health notices, case reports, outbreak reports, original research papers, and policy briefs among others. It generally features issues of importance to its targeted audience, which is health professionals, academic researchers, policymakers and anybody interested in health issues. Articles for publication are received from doctors, nurses, allied health professionals, students, policymakers, government bodies, non-governmental bodies and others.

Aim

To bridge the gap in public health information sharing between policymakers, researchers, health professionals and practitioners.

Publisher

RPHB is a publication of the Rwanda Health Communication Centre (RHCC) which is the communication arm of the Rwanda Ministry of Health and operating under the Rwanda Biomedical Centre (RBC).

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INSTRUCTIONS TO AUTHORS

All works submitted to this bulletin will have to belong to the types of articles stated below:

1. ORIGINAL RESEARCH

Referred to as "Primary Research" pioneer in a determined domain. It can be from various aspects: Clinical features, pathophysiology, biochemistry, molecular biology, etc.

THE TITLE

The title of the article should be concise and informative. It should contain enough thoughts on the subject.

ABSTRACT

Abstract of 250 words maximum must accompany each manuscript and be divided into 4 paragraphs with the following headings and MeSH keywords:

Introduction: stating the purposes/aims of the work; the research undertaken, the hypothesis tested or the procedure evaluated.
Materials and methods: briefly stating what was done and what materials were used, including the number of subjects, the methods to assess the data and to control bias.
Results: Providing key findings of the study, including indicators of statistical significance, actual numbers, as well as percentages.
Conclusion: Summarizing in 1 or 2 sentences the work on the basis of the findings. It emphasizes new and important aspects of the study or observations.

THE MAIN TEXT

The text of observational and experimental articles is divided into sections with the following headings: Introduction: should always begin the text, and requires brevity and focuses. It conveys the nature and purpose of the work, and quotes the relevant literature. Only strictly pertinent background information is necessary for understanding why the topic is important. We suggest the final paragraph clearly states the hypothesis or purpose of the study.

METHODS

Details of clinical and technical procedures should follow the introduction. A clear description of the selection of the observational or experimental subjects should be given. The identification of all aspects of the study, its reasoning, and the related relevance should be explicitly justified. In case, the study was done in a particular way, the guiding principles should all be clarified. Exclusion and inclusion criteria or partial inclusion, the reliability index, the confidentiality index, the analysis step, and the data collection processes should be also carefully specified. This section should provide sufficient details on the methods, instrumentation, procedures, all drugs and chemicals used (including generic names, doses, routes of administration). It should allow other workers to reproduce the study if necessary.
This section should also state the self-evaluation of the study by: independent/consensus readings blinded or unblinded to other information and estimate the fluctuation of recall biases by random ordering of studies.

Be clear about the retrospective or prospective nature of the study. Finally, provide references to established methods, including statistical methods that have been published, forthcoming, or that may not be well known. New description or substantially modified methods may be used however, give reasons for the use of these techniques, and evaluate their limitations. Statistical methods should be described with enough details to enable a knowledgeable reader with access to the original data to verify the reported results. A general description of methods would be defined in the methods section, whereas a specific statistical method used into analysis would be summarized in the results section. Any general use of the computer program should be

specified, and more details have to be clarified about any randomization issues.

RESULTS

Logical sequence of presentation of results is required in the text; along with tables, and illustrations. Repetition of data from illustrations into the text should be avoided; however, emphasize or summary of only important observations would be helpful. Avoid the ‘’non-technical use’’ of technical terms in statistics which should be defined and reserved for the right purpose. Moreover, define all those statistical terms aside with or including abbreviations and/or most used symbols. Any complication and/or unexpected finding should be reported and the more possibly explained and the author should report lost to follow up and dropouts from a clinical trial.

DISCUSSION

Use ample subheadings. Emphasize the new and important aspects of the study and the conclusions that follow from them. Avoid repetition of details included in other parts. This section requires the mention of the implication of the findings, and their limitations for future research, involving relating the observations to other relevant studies.

Finally, the conclusions should be linked to the goals of the study; though mostly avoiding:

Unqualified statement not completely supported by the data

Statement on economic benefits and costs unless the report includes economic data and analyses

Claim of priority and alluding to work that has not been completed.

Whereas new hypotheses could be suggested when warranted, but they should be clearly labeled as such and recommendations, when appropriate and needed, may be given.

Acknowledgments

List all contributors who do not meet the criteria of authorship, such as those who provided purely technical help, writing assistance, or a department chair who provided only general support; and their respective contribution will be headed as provided. Everybody must have given written permission to be acknowledged. References: References should be numbered consecutively in the order in which they were first mentioned in the text. They will be identified in the text, tables, and legends by arabic numbers. This bulletin uses the IEEE style (Institute of Electrical and Electronics Engineers) for referencing the citations. It is advised to avoid citations or personal communication unless they provide essential and pertinent information. In all case, the name of the person and date of communication should be cited in parentheses in the text.

2. CHECKLIST FOR SURVEILLANCE REPORTS

Disease surveillance summaries are reported following the checklist below:
Title: Compose a title that includes the name of the health condition, population, time and place.
Abstract: Provide a structured abstract including the following sub- headings: Background; Objectives; Methods; Results; and Conclusion.

INTRODUCTION

Context: Summarize the current situation regarding the health condition under surveillance and identify why it is important. Objectives: State the objective of the surveillance report.

METHODS

Setting: Describe the setting, locations and dates of the surveillance period.
Population: Describe the population under surveillance. Definitions: Provide definitions for each health event under surveillance, including

case definitions and any public health interventions. **Information sources**: Describe all data sources, including the objective of any surveillance systems, what data were collected and how data were gathered, transferred and stored. Supplementary data: If appropriate, note where to access supplemental material (e.g., www.opendata.gc.ca). **Data quality, missing data and reporting delays:** Describe how the data quality was assessed. Explain how missing data were addressed. If data is reported by date of diagnosis or symptom onset, include a statement about whether the data for the most recent periods may be revised.

DATA ANALYSIS

Describe any analytical methods used providing sufficient detail to enable a knowledgeable reader with access to the original data to judge its appropriateness and to assess the reported results.

RESULTS

Descriptive: Provide a summary of the descriptive data, including demographics.
Data Quality: Report on data quality (e.g., completeness, missing data, under reporting)
Analytic data: Provide a summary of the analysis including (when indicated) estimates of trends. When applicable, point estimates should include appropriate indicators of measurement error such as 95% confidence intervals (e.g., average annual percentage change used to describe trends or odds ratios used to describe subgroup differences).
Figures: Create the minimum number of figures to highlight key results. Create a title that includes person, time and place.

DISCUSSION

Key results: Summarize key results with reference to study objectives
Comparison: Consider these findings in relation to the current literature. Strengths and weaknesses: Discuss the strengths and weaknesses of the study (data quality, completeness, sources of potential bias). Interpretation and generalizability: Provide a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies and other relevant evidence.
Conclusion: Ensure conclusions address objectives and follow from the results.

3. PUBLIC HEALTH NOTICES / OUTBREAK REPORTS

Following the Center for Disease Control recommendations, for public heath notices and outbreak reports to be published they need to cover all four components as stated below:

INTRODUCTION

Generally, the introductory paragraph should begin with 1 to 3 sentences establishing the existence of the outbreak or underlying public health problem. E.g., "On January 2, 2008, the Nevada State Health Division contacted CDC concerning surveillance reports received regarding two persons recently diagnosed with acute hepatitis C." The introductory paragraph also usually contains: a) a statement that an investigation was conducted, when and by whom; b) the most important finding(s); c) the actions taken to stem the outbreak; and d) a statement of the public health implications and actions that should be taken in response to the investigation. Investigation and results: First, present the initial investigation and its findings. This might include: 1) a description of the setting and a statement of how the outbreak came to the attention of health authorities; 2) a clinical description of the index case or initial cases; 3) initial key test results; and 4) hypothesis generation activities and results. Next, summarize the full investigation, including: case definition, case-finding activities, method of investigation, and results. Cases should be counted and described by clinical characteristics, treatment, and outcome, as well as time, place, and person descriptive results. Next, present the methods and results of any analytic epidemiologic studies (e.g.,

cohort or case-control studies). Finally, provide the results of any relevant microbiologic, genetic, or toxicologic results, followed by the results of any testing of environmental samples. Public health response: When appropriate, a brief description summarizing any public health interventions taken and the results of the interventions follows.

DISCUSSION

Same as for a Full Report, except that a Limitations paragraph might not be required for an Outbreak Report.

4. POLICY BRIEFS

This bulletin will use guidelines on reporting/ publishing policy notes as they are suggested by the Center for Disease Control (CDC). As the CDC defines them; Policy Notes are intended to announce new official policies or recommendations (e.g., from ACIP or CDC). These reports can be thought of as briefs. Maximum word count at submission is 1,400 words. Up to three tables, figures, or boxes may be included. Policy Notes contain no Discussion or Limitations, and a summary box is not required. Although policy notes or brief might vary, following is a rough guide of what basic notes should have: Introduction: The introductory paragraph should be limited to 150–200 words. It might contain all or some of the following components: a brief introductory statement orienting the reader to the topic and placing it in context, a brief description of the public health problem, a brief statement of the rationale for the policy or recommendation, mention of the most important parts of the policy or recommendations, and one or two sentences stating the conclusions and the public health implications of the new policy or recommendations.

BACKGROUND

The Policy Note should include a paragraph after the introduction that summarizes background information relevant to the policy or recommendation that can help the reader understand the context and need for the policy or recommendation.

Methods: Should include a summary of the methods used to establish the policy or recommendation, including answers to some or all of these questions: Who was involved in the production of the guidelines or recommendations, and how? What evidence base was considered? What was the rationale for considering this evidence base? Was other evidence excluded from consideration and, if so, why? Rationale and evidence: The Policy Note should provide a concise review of the rationale for the policy or recommendation and a descriptive review of the scientific evidence used to establish it. It should include an explanation of how the policy or recommendation adds to, or differs from, relevant policies or recommendations established previously. Presentation of the policy or recommendation: The policy or recommendation should state clearly when it takes effect and to whom and under what circumstances it applies.

DISCUSSION OR COMMENT

The Policy Note should comment on the likely impact of the new policy or recommendation and plans for assessment of the policy or recommendation

5. CASE REPORTS

These are reports of an individual patient on their symptoms, treatment reactions on a disease or condition of interest. These reports normally focus on unusual reactions or occurrences. Similar cases to other research reports, case reports might include a literature review of previous similar. Case reports might also address positive patient outcome on particular treatment guidelines or individual impact of a particular intervention. These are mainly used for educational and decision-making purposes. Case reports are normally reported following a checklist found at the CARE Guidelines.

6. CASE STUDIES

We recommend authors to follow the "EQUATOR Network" for ample explanations and guidelines in the writing of such articles. They have to be well-described case studies on health care interventions of public health concern. These could be:

Rigorous assessments of processes and program interventions.

Recommendations on possible health interventions.

Never on individual patient (= case report)

7. COMMENTARIES / OPINION / METHODOLOGY ARTICLES

We recommend authors to follow the "EQUATOR Network" for ample explanations and guidelines in the writing of such articles. Though these articles are moderated, they should be:

Short, focused, opinionated to previous articles or any subject related to the journal entirely. Contemporary and focusing on specific issues. Normally up to 800 words.

Frank critics to the journal are bravely motivated and would be as much as possible published.

8. FORMATTING THE MANUSCRIPT

Please note that articles which are not correctly formatted will be returned to the authors

Format text: Style: No Spacing, Single column, Single Spacing
Font: Single Spacing, Times New Roman - size 12
Titles: Capitals and bold, size 14
Format tables: Times New Roman, Font size 9 No vertical lines. Horizontal lines in the table can be removed. No table should be larger than a single A4 page. Footnote should be size 9 and italic

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