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Muzima Mobile Application for Screening Hypertension and Diabetes: A User Experience of the App Among Community Health Workers in Rwanda

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Abstract. Mobile technology has become the leading utility in the social and well-being of people especially in low-resource settings. The use of mobile applications in healthcare promise to improve care and treatment. This study explored the user experience of muzima mobile application among community health workers in Rwanda. We used three data collection methods: observation, Key informant interviews and focus group discussions. We analysed data using thematic content analysis. We found that users were able to complete tasks in the app although some less experienced and older participants struggled to complete the tasks. Users felt that the application helped them to screen and manage patients with diabetes and hypertension in the community which reduced frequent visits to the health centers. Users felt that the application needs improvements in the workflow to facilitate the ease of use. They suggested to digitse other health programs implemented by community health workers. To improve the use and ensure wider implementation, there is a need to consider users' needs and concerns as discussed in this paper.

Keywords. Clinical informatics, mobile health, Hypertension, Diabetes

1. Introduction

Mobile based application may potentially contribute to the healthcare delivery in low-

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income countries. The use mobile has dramatically increased for the last two decades where 63% of Africans own a mobile phone [1]. Mobile health has the potential to support in appointment reminders, Alerts, community mobilization and health promotion, treatment compliance, mobile patient records, information access as elaborated by the World Health Organization (WHO) [2]. The WHO reports that most countries implemented up to six mhealth interventions [2]. The rapid increase of infectious diseases and non-communicable diseases has triggered the use of mhealth interventions for the management of such cases.

Rwanda like most other African countries has predominantly used SMS and calls based mhealth for mother and child health [3,4]. Pilot projects of mhealth interventions for specific diseases interventions are under testing in the low-income countries. Since last year Medtronic LABS in partnership with Ministry of Health through Rwanda Biomedical Center has developed and implemented mUzima-openMRS application in the name of 'mUzima app". The app is used for screening, enrollment and follow up of patients with diabetes and hypertension in the community. The application was translated into Kinyarwanda version and is currently used by CHWs at community level for Screening, linkage to care, enrollment, and patient follow up. The system was implemented in 53 pilot Health Centers. The screened patients for hypertension and diabetes are suspected cases who are referred to the nearby health center for confirmation and further management.

The Muzima mobile app is built on an android technology using opensource OpenMRS technology. The system is usable with limited internet in an offline mode to collect data and when internet is accessible, data can be synchronized to the central server. The application has patient registration, screening measurements and referral model as main functions. If the app is proved to work, it will be scaled up in all districts. To inform how users interacted and used the application, we conducted a user experience study. User experience studies are essential in the early stage of development and implementation of the product [5–7]. Preliminary finding may inform how well the system could be designed and implemented to fit the context. We explored how the users experienced the use of the muzima app in three pilot districts in Rwanda.

2. Methods

We used qualitative approaches to collect data related to user experiences. We used key informant interviews, focus group discussions and observations to explore how the participants experienced muzima application.

We selected participants from five district hospitals which implemented muzima app in Rwanda. In each district hospital catchment area, we purposively selected one CHW from each health center. We used extreme sampling to select the high performing CHW and low performing CHW. Performance was determined by how they use the app in their daily duties. In each district hospital we selected two community environmental health officers (CEHO) responsible for overseeing muzima app implementation. For the CEHO, we selected one from high performing and low performing health centers.

We used key informant interviews to discuss with CEHO on their experience of implementation of the app. For the CHWs, we used Focus Group Discussions (FGDs) and user observations to explore how they experienced use of the application. We used both retrospective think aloud and concurrent think aloud [8] in observations to ensure that we capture how the participants perform in the app and what they say about it. In the

key informant interviews we asked participants to share their experience of the application.

We used an observation guide to observe how the CHWs used the muzima application. The guide covered most basic steps performed by the CHW in screening for diabetes and hypertension and transferring a client including but not limited to opening the app, changing the language, dashboard, registering a client, screening a client, referring a client, saving form, editing form, and syncronising the completed form. In addition, we used the interview guide to discuss with the participants on how they experienced the system in general. We focused on how they experienced usefulness, usability, ease of use, what they liked and disliked and what they suggest to improve the application usability. We piloted both guides before data collection. We collected data in March 2024 with a team of 8 data collectors (co-authors) in pair of four. Each group had a facilitator who led the discussions and a note taker who recorded the discussion and noted participant's views.

We used thematic content analysis to analyze the data. We began by reading the transcripts and coded the transcripts with initial developed codes. We then reduced the findings and displayed the main findings under the themes and sub-themes. We interpreted what we found and cross checked them within participants and across health centers. We came up with the final themes and sub-themes as the main findings with corresponding quotations. Before engaging the participants in data collection, they signed a consent form. We conducted the interview or observation in a secure and private place to ascertain participants' confidentiality. The study sought ethical approval from University of Rwanda College of Medicine and Health Sciences Institutional Review Board (CMHS-IRB), with approval number No CMHS IRB/199/2024.

3. Results

Participants characteristics: We conducted six focus group discussions, 10 key informant interviews with CEHO and 10 observations with Community Health Workers. The summary of demographic characteristic of participants is indicated in the table 1 below.

Table 1. Descriptive statistics of participants

Descriptive statistics of participants		
	Participants category	
Variable	**CHWs**	**CEHOs**
Age (Median, (min, max)	43.5 (32,61)	42.4 (32,51)
Years of experience (Median, (min, max)	11.16 (1,30)	8.57 (4,16)
Sex (n, %)		
Male	28 (53.8)	3 (30)
Female	22 (42.2)	7 (70)
Level of performance (n, %)		
High performers	28 (53.8)	5 (50)
Low performers	24 (46.15)	5 (50)
Education level		
Primary	26 (50)	-
Secondary	24 (46.15)	1 (10)
Missing value	2 (3.84)	9 (90)

Use of the application to complete routine tasks: Users of the app were able to complete routine tasks such as registering a client, screening a client for diabetes and hypertension, and referring a client to the nearest health center. However, we noted that some CHWs with little exposure to the app hardly completed the tasks. In addition, CHWs with older age hardly completed the tasks compared to the young ones.

Facilitators and barriers to use the application: the application was favorably received by CHWs in different ways, at the same time they encountered varying challenges as illustrated under the themes below. **System design and ease of use:** the participants found that the application was easy to use due to the initial training they got. In addition, ease of use was experienced by the users of the app when they used it for long time. On the other hand, the app was not easy because few phones are shared by the CHWs. More to this, the app was difficult to use because it requires access to the central server leading to its slowness.

Desirability of the application and its response to the needs in the community: as highlighted by the community health workers, they said that muzima app helped them to follow up patients with NCDs in the community. In addition, it helped them to gain confidence in the management of NCDs because it prompts patient diagnosis after data entry. Furthermore, the app helped to decentralize health services at the community level by reducing the time spent at the health center. One of the CEHO expressed the need to digitalize all services offered by CHWs in Muzima app. However, the participants didn't like how the forms in the application were complicated to access and use. Furthermore, participants indicated how the smartphone required frequent charging especially when they had many participants to screen which may be a problem in areas with limited power supply. In addition, they dint like how the app was slow especially when retrieving information from central server (e.g national ID).

Required changes in the application: participants expressed the need to change forms used in the screening and registration into one form with all entries in one place. In addition, users suggested to have offline mode of the app to avoid slowness when in use by many people. Furthermore, users suggested to increase number of devices among CHWs to facilitate ease of use and mastery of the application. Lastly the users suggested to digitize other services provided by the CHWs to expand its use and wider effect.

4. Discussion

This paper explored community health workers user experiences of Muzima mobile app. This is an app implemented at the community level to support CHWs screen and manage hypertension and diabetes.

The findings of this study indicated that CHWs completed routine tasks related to screening and management of clients with diabetes and hypertension. We found that the application workflow was easy and simple to use with some limitations. In addition, the application was experienced as an important tool which helped CHWs to respond to NCDs burden in the community. However, the community health workers faced some user challenges including slowness of the app, few devices shared among CHWs and scattered forms in the app making it hard to retrieve the needed one. They suggested to make changes in the application specially making few forms to ease workflow, and digitizing other services offered by CHWs in the community.

The use of muzima app has helped in the early detection and treatment of patients with hypertension and diabetes from the community. The application was programmed

to support CHWs given that they are unskilled healthcare providers. The application helped them detect for example who among the screened patients was positive with hypertension or diabetes based on the metrics added in the application. Such prompts helped the CHWs to gain confidence in managing cases in the community while following the national treatment guidelines.

The positive experience on using the application as shared by the CHWs indicated how the app responded to their needs and how its design considered the context and targeted end users of the app. However, this application was in use for the last 12 month before this study. This early implementation is associated with some technical and implementation challenges which when carefully addressed will likely improve usability of the app in the long run. The strengths of the study included exploring the user experience when the app was in use in the real world. In addition, the app was implemented and used in districts and health centers with varying characteristics. Our findings would reflect what similar users would experience in the same context. In addition, we used a combination of observations, interviews and focus group discussions which helped to triangulate insights from different participants and perspectives. Our study focused on CHWs experienced use of the app, and the process of screening was not emphasized in this paper. Another weakness is that this study was done within 12 months of the implementation of the app which is less time required for system maturity. This may have driven the challenges experienced by the users.

5. Conclusions

In general, we have found that Muzima app was easily used by the CHWs in screening and management of hypertension and diabetes in the community. We concluded that the application should be improved by considering users' feedback to improve better experience. Our findings will help in the revision of the application to make the good use of it before its wider use.

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