

Biometrics and Healthcare Services in Zambia: Implications for Lusaka and Kalomo Districts

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Abstract

With the growing need to integrate technological advancements in all spheres of human endeavours, we discursively interrogate the adoption and adaptation of Biometrics in the Zambian healthcare sector. As our locus, we look to the implications and perspectives of the use of Biometrics at selected healthcare centres in Kalomo and Lusaka districts using a qualitative approach. It is revealed, that in the absence of Biometrics, several implications abound including greater costs for the health provider and the end-user, security concerns as information is lost as well as patient misidentification challenges. When used, paper reveals two interrelated perspective which show that Biometrics have the heuristic potential to store records and make information readily available for both the healthcare provider and the end-user while at the same time occasioning a fast way of service delivery to the general public.

Keywords: Implications, Perspectives, Biometrics, Healthcare, Zambia,

Introduction

The need for improvement in the provision of healthcare services has been emphasized the world over. This has especially been the case in the light of the adoption of the sustainable development goals (SDGs) which have placed additional emphasis on improving overall human development by 2030. For the World Health Organisation (henceforth WHO 2018), improving health outcomes is at the forefront of this global commitment, with Goal 3 calling on all stakeholders to “Ensure healthy lives and promote well-being for all at all ages. To realize the attainment of this goal, the healthcare industry has seen the introduction and integration of various technological advancements one of which is the Biometric tool. Biometrics have the potential to verify and identify an individual based on their physical, chemical, or behavioral attributes (Jain et al., 2007 cited in Mwapasa et. al 2020) making the provision of healthcare services efficient and effective.

Further still, Mordini and Ottolini (2007) provides that the use of biometrics to identify patients within the healthcare system comes with several potential advantages, such as reducing medical errors, reducing the risk of fraud, and improving the capacity to react to medical emergencies. While the adoption and subsequent adaptation of Biometrics tools in the provision of healthcare services are not alien to the healthcare industry, they are relatively new to the healthcare system in Zambia. Thanks to the Scanning Ears for Child Health (SEARCH) pilot project which run from January 2019 to June 2020, Biometrics were introduced to the Zambian healthcare landscape. Implemented and conducted by Boston University (BU) with a focus on finding an accurate way to identify and link patients to their medical records using ear biometrics as an identifier, the pilot project was privileging in several ways. With this background that the present study sought to unearth the implications and perspectives over the use of Biometric tools in selected healthcare institutions in Zambia.

To adequately attend to the implications and perspectives of Biometric tools for both healthcare providers and end-users on the Zambian healthcare landscape which have their own peculiarity and dynamics, the study employed Rogers’ Diffusion of Innovation Theory (Rogers, 2010) as a theoretical base. While the theory proposes five attributes of an innovation which include relative advantage, compatibility, complexity, trialability, and observability (Zulu et al., 2015), the present undertaking relied only on relative advantage which is the degree to which an innovation is perceived as being better than the idea it supersedes. Rogers’ theory suggests that innovations that have a clear, unambiguous advantage over the previous approach will

be more easily adopted and implemented (Scott et al., 2008a). Current research evidence indicates that if a potential user sees no relative advantage in using the innovation it will not be adopted (Greenhalgh et al., 2004). In what follows, the materials and methods employed in the study are provided.

Materials and Methods

The study employed a qualitative case study design. The data was collected using Focused Group Discussions and key informant interviews. The main target groups for this study were women attending antenatal or maternal-related services. Participation in the Project SEARCH and Under-5 clinics were used to conveniently select women who took part in the focus group discussions (henceforth FGD’s). A total of Seven (7) FGDs from Lusaka district and three (3) FGDs from Kalomo district were held at each of the selected health facilities with these women. In this way, A minimum of sixty (60) women were selected for ten (10) FGDs which were conducted according to clinic zonal areas, and seven (7) key informant interviews with healthcare were conducted. This study was limited to a total number of sixty-seven (67) respondents sampled as aforementioned.

The study was conducted at three health institutions in two districts of Zambia namely Chawama, Railways, and Naluja health facilities. Chawama primary health facility is located within Chawama Compound, a community in Zambia’s capital city, Lusaka. Railways Clinic is located in Lusaka in CBD area near Intercity Bus Terminus, and deals with both local and transit clients. Naluja rural health facility is located in Kalomo district in Southern province of Zambia. The health facilities were selected because of the prospective cohort for Project SEARCH cohort study. Chawama clinic was a host to the Zambian Infant Cohort Study and Naluja Clinic was a pilot study site of SEARCH project.

Whereas, Railways Health facility was recommended by DHD Lusaka office which is one of the three healthcare facilities where a fingerprint biometric tool has been implemented.

To analyse qualitative data from key informants and FGDs, each interview form and audio file were given a unique registration number for the different study participants and groups. Audio recordings and notes from the interviews were carefully transcribed into Microsoft Word and then exported to Nvivo version 12 for coding of themes and analysis. Thematic analysis was used. This is a method for identifying, analysing, and reporting patterns (themes) further interprets various aspects of the research topic within data, and assist in the analysis.

Finally, an application theoretical framework on collaboration was utilized in analysing results. While doing all this, the researcher understood that human research ethics are based on three fundamental principles that are considered as underpinning the principles or guidelines governing research ethics. These principles are namely; respect for persons, beneficence, and justice. Thus, before, during, and after the data collection process and the subsequent analysis, ethical matters were sufficiently attended to.

Results

In this section, the results of the study are presented. The implications arising from the use of Biometrics and the lack of the same are presented first followed by the various perspectives from the stakeholders who are the healthcare givers and the end-users. Both the implications and perspectives relate to the relative advantage of the Innovations and Diffusions theory which is the theoretical framework adopted in the study. The idea of using biometrics for patient identification was generally accepted by most respondents because of its perceived comprehensive benefits on improving cost, record management, data quality, record availability, and patient experience over care coordinated using the current system. Thus, below are the implications presented as identification, cost, and security implications and perspectives presented as faster and availability.

Identification Implications

The study found that there are identification implications associated with the lack of Biometrics in health facilities. One implication posed by a lack of identifiers in health facilities is the failure to identify dead bodies during disposal because they are unclaimed. Drawing on this finding, it becomes clear that the lack of Biometrics has severe implications as the remains of people's loved go unclaimed.

It's a challenge because if somebody comes like maybe a child has just been picked brought to the hospital, with no identification it is very difficult this were we have ended up taking some to the hospital mortuary without any identification and they are an clamed bodies at the end of the day, because there is no identification, because there is no one to claim them, at times you may find that if these are a bit grown it would be difficult to trace since they may have been staying alone in another town ... (IDI001)

Cost Implications

The study found that there are cost implications if a health facility operates without Biometrics. With the current system, when a record goes missing, a replacement record must be purchased at a fee. This replacement fee proves to be a heavy financial burden for most respondents. This was noted as a disadvantage of the current system across both rural and urban settings especially in the Kalomo district as shown below;

I think people can accept the biometric system because of the problems that people go through, some people are poor in the villages, so it is difficult to find money to buy a book when they lose it or when they lose the under-five card and then they chase them back at the health facility and then the patient continues being sick, The biometric system will be good because we will be coming empty handed, they scan your ear and retrieve your file and then you get your treatment.... (FGD Kalomo Group 10, R004)

Security Implications

The study also found that Biometrics have security implications. This is because Biometrics contrast with other identifiers (such as discharge papers, slip numbers and the Under Five Card) which are easily misplaced, lost, forgotten, and damaged. Because they are intrinsic, Biometrics carry the distinct advantage of improving record keeping, quality, and record management in the health sector. In the FGDs conducted, mothers acknowledged that currently, when a record goes missing, a child's medical record is irretrievably lost, making it difficult to receive the correct care.

If the under-five card gets lost, it makes one look foolish, and it becomes difficult... all records remained in the lost card, when you come in that way they tell you to buy a book and start afresh. It becomes difficult because sometimes the child would have already finished the vaccinations but as parent you can't know and the nurse will also not know if the child is done with the vaccination or not, so if the card gets lost and you don't know how many vaccinations your child has received, it becomes difficult to have your child treated ... (FGD Kalomo Group 2, R001)

When the Under Five Card is forgotten at home, misplaced, and/or damaged, providers often turn to the central registry to look up a patient's record. Respondents mentioned that facility registers are kept, where data is entered and stored centrally. For facilities that use SmartCare, the child's record is entered in the SmartCare system, and information is easily located than paper

record systems. For facilities using paper registries, the child's information is recorded as a line in the registry. Having checked in the under-five registers at Chawama Clinic, between 24, 25 to 59 months, the weight of the child is indicated, along with the child's ID number, all the antigens, BCG, PENTA, and PCV, and first and second dose of MMR vaccinations. Healthcare providers raised the main concern with the current system that registries often store incomplete data and are not easily searchable, which makes identifying the patient a time-consuming effort.

Actually it is very bad, where you just assume this baby has received everything, meanwhile this baby has not been covered with all the vaccinations, so it is not good just thinking that this baby has received everything (KII007)

Additionally, when under-five cards or hospital files are damaged to the point of illegibility, lack of identifiers pose a challenge. The condition of under-five as described in FGDs and KII after a few weeks of issuance were outlined as dog-eared (folded corners), crinkled, cracked, ripped or torn, faded, water-damaged and stained which makes it difficult to maintain over the years.

Very often, on a scale of 1-10 I would say maybe up to six (6). Many are times as a health care system we have had to replace those cards either because they have gotten damaged or they have gone missing completely or maybe the child has relocated and where they previously lived the card has remained ... (KII004)

In these cases, as described in the narrative above, retrieval of information is not possible since registers do not keep detailed information apart from name, diagnosis and drugs given to a patient. This leads to delays in treatment and repeating of procedures, which is costly and time consuming. Replacement or temporal records often contain gaps or false information, while damaged paper records can lead to unknown or false information. With the use of a biometric system, patient information can be stored in central server, backed up, and safeguarded from damage.

You want to make sure that you indicate, you give and write somewhere so that you can transfer the information, the following time she does not come, and you miss to transfer that information, she comes maybe after three months or 4 months and they find a different person who was not there. ... This child will be given double vaccine, even if there is no harm just because the mother didn't carry the card with them (KII007)

Provider and End User Perspective of Fastness

The findings reveal that from the perspective of healthcare providers and the end-users, Biometrics identification tools are faster to work with. In this regard, the absence of Biometrics was seen as bringing challenges in healthcare delivery. Both users and providers associated long queues with the current system of tracking children's information from the registers when a card is lost or forgotten. Long queues and wait times are a direct result of the common occurrence of understaffing at clinics. Use of a paper system, where patient information is kept on hard copy, making patients tracking a difficult task, places an additional burden on understaffed clinics. Many indicated that the new system would make record management noticeably more efficient.

Like during the cold season, we have a lot of patients at the clinic, plenty of patients at the clinic, so technology being faster, biometric identification will help us to clear the lines faster, we will clear the patients faster. Their time of stay at the clinic would be reduced ... (KII002, Nurse in Charge, Naluja)

Right now if had to take you to our registry we have plenty of books, when this person comes, even if they have numbers, it takes time for you to pick that number. So at least for the health providers (Andriesen et al.) we are not going to be struggling, we won't think about where we are putting these books because they are so many and files. And again, to the community there will not be any problem because these people won't be carrying anything (KII007, Nurse in charge)

Provider and End User Perspective on Information Availability

The participants were in favour of biometrics because their relative advantage over the current system in data management especially as it relates and extends to the availability of information stored for those accessing healthcare services. In the absence of Biometrics, the current system predisposes users to a lot of inadequacies. For instance, government facilities occasionally experience stock-outs and many facilities throughout Zambia have been out of stock for close to a year now (since 2019). During stock-outs, discharge papers or birth records are used as an intermediary. With limited availability of records, coordination of care is disadvantaged and leads to gaps in tracing malnutrition and vaccination records. Many providers noted this as a disadvantage to the current system, and avoidable if a centralized, electronic

electronic biometric system were implemented.

For some time now there have been no under five cards and mothers are given books or just birth records, we actually had to look at the books and what kind of information is in put in those books which is very embarrassing (KII004)

this new thing is just okay compared to the under 5 cards because these new things that have come they show all the information for the children they are stored in the system at this time the cards are unavailable they use the discharge papers, so this new technology is best (FGD004R)

Discussion

Previous studies suggest that for an innovation to be accepted by potential users it must have a clear advantage over current systems (Hurley et al., 2002). Thus, the relative advantage of a biometric system in both Lusaka and Kalomo districts was seen in terms of its comprehensive benefits compared to other analog identifiers used in health facilities. The findings indicate that the biometric system is regarded as appropriate for its intended purposes as almost all respondents spoke enthusiastically about how proficient biometrics will eliminate gaps from the current process. For instance, respondents noted that using Biometrics has implications on identification given that with its use, there will be few or no cases of failure to identify dead bodies during disposal. This has been happening with the current analog system hence the proposal for the adoption and adaptation of the Biometrics identification tools.

On the cost implications, the findings of the study show that biometrics were largely accepted by respondents due to perceived comprehensive benefits in record management, efficiency, and data quality. From the end-user perspective, respondents noted that in instances when they have lost under five cards, they are forced to buy which comes at a great cost especially to parents in rural areas. Not only do replacements come with a monetary cost to the patient, but it is also unfortunate to note that the new card is likely to be filled in with inaccurate data or left with gaps in the record. Additionally, responses collected from the rural setting revealed that the monetary cost associated with losing an Under Five Card was expressed as a major barrier to seeking care. These were all noted as negative aspects to the current system and were seen areas where a biometric system would be an improvement. For healthcare providers, the cost implications in terms of storage

and also providing alternative means in an event that under-five cards are out of stock are significantly reduced. This is because once the Biometrics system is installed, its use is continuous and the benefits are long term unlike the paperwork as a form of record-keeping.

Biometrics carries a striking advantage of being more secure. Respondents noted that biometrics contrast with other identifiers (such as discharge papers, slip numbers, and the Under Five Card) which are easily misplaced, lost, forgotten, and damaged. This is a security implication given that Biometrics carry the distinct advantage of improving data quality and data management in the health sector. It was noted in both rural and urban settings that the Under Five Card is easily forgotten at home, misplaced, and/or damaged. In these cases, providers will often turn to the central registry to look up a patient's record. Both mothers and providers alike noted that registries often store incomplete data and are not easily searchable, making identifying the patient a time-consuming effort, which often leads to long queues and wait times.

From the perspective of both end-users and healthcare providers, Biometrics, when adopted and adapted in the healthcare industry, will lead to quick and quality delivery of services. This was dubbed as the fastness associated with Biometrics. Both end-users and healthcare providers associated long queues with the current system of tracking children's information from the registers when a card is lost or forgotten. Long queues and waiting times are a direct result of the common occurrence of understaffing in health facilities more especially in rural areas of Zambia. According to Tjoa et al., the Republic of Zambia is among the countries currently facing an acute HRH shortage. When Biometrics are used, there will be better healthcare delivery even with the understaffing of most healthcare facilities.

On the availability of information from the perspective of both end-users and healthcare providers, Biometrics occasions the availability of information even if those accessing services come in large numbers. This was evident in Kalomo and Lusaka as the doctor-patient ratio is significantly high. According to the Government of the Republic of Zambia Ministry of Health (MOH), the country is operating with fewer than half the health workforce necessary to deliver basic health services, with even higher vacancy rates in rural areas. This shortage of health workers is threatening adequate and equitable health care delivery, (Tjoa et al., 2010). With limited availability of records, coordination of care is disadvantaged and leads to gaps in tracing malnutrition and vaccination records. Respondents, particularly healthcare providers noted that all this would be the thing of the

thing of the past when Biometrics are fully operational in healthcare institutions across Zambia.

Summary and Conclusions

The evidence presented in this paper leads to two interrelated conclusions. Firstly, it has been recognized that the Zambian healthcare landscape is ripe for the introduction and subsequent integration of Biometric tools for efficient and effective service delivery. Thanks to the SEARCH pilot project, healthcare institutions stand to benefit from the adaptation and adoption of Biometrics in Zambian. Thus, data as gathered from healthcare providers and the end-users show that not only is the healthcare landscape ripe for integration from the perspective of innovations in healthcare, but the providers and end-users desire to have Biometrics adopted and adapted as soon as possible. Secondly, the evidence in support of the first conclusion that not only is the system ripe but the stakeholders are also eagerly waiting to enjoy the benefits of Biometrics. This shows that all stakeholders in the healthcare industry are tired of the old system. This is because the old system and indeed the current system for most healthcare institutions in the dispersed localities of Zambia has a way it impedes the efficient and effective delivery of services much to the dislike of stakeholders.

From both the positive and negative standpoints, the study has shown that there are implications in the adoption of Biometrics. Firstly, the findings show that there are cost implications that make Biometrics to be accepted. For instance, respondents noted that are comprehensive benefits in record management, efficiency, and data quality. Respondents noted that in instances when they have lost under five cards, they have been forced to buy which comes at a great cost especially to parents in rural areas. Thus, when Biometrics are in place, this would be a thing of the past and by extension, the opposite is true as the absence of Biometrics entails the continuation of the sad realities emanating from the current and old system. Secondly, Biometrics carries a striking advantage of being more secure as they are contrasted with other identifiers (such as discharge papers, slip numbers, and the Under Five Card) which are easily misplaced, lost, forgotten, and damaged. This security implication gives Biometrics a distinct advantage of improving data quality and data management in the health sector while at the same time making it easy for patient identification.

From the perspective of both the healthcare providers and the end-users, the study has revealed two important standpoints and

perspectives concerning the use of Biometrics in healthcare as evidenced by the respondent's views. The first perspective is that when adopted and adapted in the healthcare industry, Biometrics will lead to quick and quality delivery of services given that there will be and there is fastness associated with Biometric tools. Both end-users and healthcare providers associated long queues with the current system of tracking children's information from the registers when a card is lost or forgotten which is it is being proposed that Biometrics be introduced beyond the districts of Kalomo and Lusaka so that this reality is phased out. The second perspective is that Biometrics enables the availability of information. Using the current system, there is a limitation concerning the availability of records such that coordination of care is disadvantaged and leads to gaps in tracing malnutrition and vaccination records. Respondents, particularly healthcare providers noted that all this would be the thing of the past when Biometrics are fully operational in healthcare institutions across Zambia.

Author Contributions

All the five authors contributed towards the study design. AMH and EM carried out the data collection. All authors analysed the data. AMH drafted the manuscript and all the authors contributed towards revision and final approval of the manuscript.

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