REVIEW ARTICLE

Towards Universal Health Coverage in Africa: Relevance of Tele-medicine and Mobile Clinics

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Abstract

Access to essential healthcare services is limited in Africa, resulting in preventable mortalities. Telemedicine, which can be defined as the use of information and communication technologies in the delivery of healthcare services, is applied in various fields of medicine and at multiple times. Some telemedicine projects have been implemented in different African countries. Some successes were recorded, as well as failures. Despite challenges, such as high cost, that inhibit telemedicine coverage, telemedicine still presents excellent opportunities in increasing access to basic healthcare and expert services. Mobile clinics provide the opportunity to expand access to health services across a region. They can be implemented as an extension of fixed1hospitals that are often situated away from remote villages, serve in the heart of communities, and aid in preventive screenings and epidemiological monitoring. Africa has limited resources but leveraging these existing resources most cost-effectively is key to achieving universal health coverage in the region.

Keywords: Universal Health Coverage, Telemedicine, Information and Communication Technology, Mobile clinic, Africa

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Authors' Contributions: Oluwakorede Joshua Adedeji conceptualized the study. Oluwakorede Joshua Adedeji, Yusuf Olalekan Babatunde and Abdulmumin Damilola Ibrahim acquired, analysed and interpreted the data for the work. Yusuff Adebayo Adebisi and Don Eliseo Lucero-Prisno III revised it critically for important intellectual content. All authors agree to be accountable for all aspects of the work in ensuring that all questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Introduction

Accessibility to basic promotive, preventive, curative, rehabilitative, and palliative health services of adequate quality without incurring financial hardship encompasses the concept of Universal Health Coverage (1). Universal Health Coverage (UHC) enables all population members to easily obtain primary health services without being pushed to poverty or debt. Health is a fundamental right of all, and access to it should not be difficult or impossible for anyone. Globally, about 100 million people are pushed into extreme poverty because they have to pay for healthcare (2). This is particularly worse in Africa as 11 million Africans are pushed to poverty each year due to out-of-pocket expenditure (3). UHC is not just about health financing. It encompasses all other components, such as health technologies, health service delivery, health workforce, health facilities and communication networks, information systems, quality assurance mechanisms, governance, and legislation (2). Several African nations are moving slowly towards Universal health coverage (4), but particular challenges threaten the actualization of the "Health for All" reality. Such challenges include the lack of political commitment, lack of coherent health financing policies, weak health systems, and weak information systems to monitor UHC progress (1). Africa harbours over 90% of global malaria cases (5), almost two-thirds of the global total of new HIV cases (6), and over 25% of tuberculosis deaths (7). Many deaths can be prevented and reduced with effective health coverage in the region. Attaining the third sustainable development goal (good health and wellbeing for all) requires country-specific actions towards achieving universal health coverage (1). Each country's ability to translate plans and policies into concrete actions will determine the reduction in mortality rates and overall wellness of the population, thus affecting the level of growth.

This paper aims to elucidate the roles and relevance of the dual implementation of telemedicine and mobile clinics as a tool for ensuring adequate health coverage in Africa. Telemedicine, or telehealth, can be referred to as "the delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for the diagnosis, treatment, and prevention of diseases and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities" (8). The use of telemedicine can be classified as either clinical (diagnostic and therapeutic), educational or administrative (9). Mobile clinics are an essential part of the health system that can help deliver basic health services to remote areas (10) predominantly rural communities that lack access to health centres. They are instrumental in accessing vulnerable populations (10). Mobile clinics contain necessary equipment for temporary treatment of patients in critical situations and can help increase access to essential health services (11). Implementation of Telemedicine and mobile clinics provide significant advantages and challenges that inhibit full implementation and utilisation, especially in the African region. However, the dual performance may provide substantial benefits and increased access to health services of sufficient quality. This paper assesses the impact of existing telehealth platforms and mobile clinics and the effect of a dual implementation.

Method

We conducted a narrative review of published articles on telemedicine and mobile clinics in Africa. Search for relevant medical literature in biomedical databases (Google Scholar and PubMed) was con-

ducted using the following key terms: "Telemedicine", "Mobile clinics", "Africa", "Telehealth", "electronic health", "e-health" and "e-health". Papers were selected based on the country (only African countries were selected), quality, and relevance to the scope of the study by reviewing their abstract and title. We also used supplementary references listed under the papers. Implemented Telemedicine projects in Africa were selected and analysed for successes and/or reasons for failures.

In the use of telecommunication technologies to advance citizens' health and wellbeing in the state, Africa is still in its infancy compared to developed countries; nevertheless, various Telemedicine projects have been implemented in different African countries, as seen in **Table 1.** These telemedicine projects were implemented for various purposes across different countries, and some successes were recorded for some projects while some other projects might have failed.

Results

Table 1: Various Telemedicine Projects and approaches and Impact towards achieving Universal Health Coverage in Africa

Authors	Telemedicine Project	Country	Roles and impact on Healthcare towards UHC	Lessons
Antoine Geissbuhler *et al* [22]	Keneyan Blown	Mali (2001)	Tele-education for physicians and students and Tele-consultation to follow up with patients operated in Geneva and returned to Mali. Improved education of physicians for better healthcare delivery and post-discharge care is enhanced.	Problems identified include poor internet connectivity and poor infrastructure required to support Telemedicine coverage
T. Mpunga *et al.* [28]	Static-image Telepathology program at Butaro Cancer Centre of Excellence	Rwanda (2013)	The use of static-imaging telepathology enhanced the diagnosis and interpretation of specimen samples and, overall, improved care and diagnosis for cancer patients in the country.	Limited bandwidth and internet instability limited the choice for dynamic real-time readings. Also, the varying time zones serve as a limitation to synchronous communication.
N.D Montgmorey *et al.* [29]	Clinicopathologic conferences between clinicians and pathologists in Kamuzu Central Hospital (KCH) and pathologists in the University of North Carolina, Chapel Hill (UNC)	Malawi (2011)	Improved diagnosis of Lymphoproliferative disorder in resource-limited settings on a modest investment and a collaborative academic environment for Malawian pathologists.	Telemedicine can play an influential role in advancing care to millions while leveraging on existing resources and investment.
Maurice Mars [19]	Drug Resource Enhancement against AIDS and Malnutrition (DREAM) project	Tanzania, Malawi, Mozambique	Telecardiology training, the establishment of telecardiology centres, and remote reporting of ECGs from Italy.	Telemedicine can cut across different countries and thus facilitate intercultural and international collaboration.
Cheick-Oumar Bagayoko *et al* [31]	EQUI-ResHUS	Mali (2011)	Task shifting of medical imaging in obstetrics and	The use of telemedicine for training and networking of health

			Cardiology in remote locations and provision of CME (Continuing Medical Education)	professionals can help reduce the isolation of these professionals working in remote areas.
Cheick-Oumar Bagayoko *et al* [32]	Réseau Afrique Francophone de Télémédecine (RAFT) project	Madagascar, Rwanda, Mali, Morocco, Mauritania, etc.	Distance learning, teleconsultations, and digital collaboration within Africa and between Africa and Europe.	The development of large-scale telemedicine projects involves the inclusion of participating countries in the development of the project.

Discussion

Overview of telemedicine coverage and application to various fields of medicine

The use of Information and Communication Technologies (ICT) in healthcare has gained ground. Its application spans radiology, especially teleradiology, i.e., using ICT to transmit radiographic images from one location to another, usually for diagnosis and interpretation (12, 13). Teleradiology often involves a store-and-forward or asynchronous form of telemedicine. The patient data is generated, stored, and transmitted to a receiver which responds at a later time (13). In psychiatry, telepsychiatry is used to diagnose, educate, treat, consult, transfer medical data, research, and other healthcare activities between a patient and the healthcare provider (14). Telepsychiatry usually involves real-time or synchronous communication between the patient and a healthcare provider in which both individuals at either end of the communication link are simultaneously present and actively engaged); dermatology (teledermatology includes both store-and-forward communication and real-time synchronous communication between patient and clinician (15).); pathology (telepathology (13)- the application of telecommunication technologies in microscopic imaging and pathology (16)), etc. The use of telemedicine in real-time video consultations with off-site specialists cuts across various fields such as Oncology, rheumatology, etc.(17); thus, almost every area in medicine has a potential telemedicine application. Telemedicine also plays vital roles in managing chronic illnesses, emergency and trauma care, medication prescribing, counselling, stroke intervention, and post-discharge coordination (17). Pharmacy practice is not left out in the application of telemedicine. The use of telemedicine can provide great advantages in remote dispensing and supervision in community pharmacies.

Use of Mobile Clinics

Mobile health clinics are designed from vans, trucks, or buses and, depending on use, are fitted with equipment and facilities essential in carrying out the design purpose. Mobile clinics are used for various purposes in emergency cases, primary healthcare delivery, preventive screenings, etc. carried out by quite a small number of healthcare professionals. In humanitarian emergencies, mobile clinics are often common in delivering health services (24). In the United States of America, mobile health clinics serve an essential role in providing healthcare to vulnerable populations (25). The use of mobile health clinics for primary healthcare delivery is not quite established in Africa. Globally, more than half of the world's population lives in urban areas. However, in Africa, about 57% in rural areas (26). Among these countries, about 41% in lower-middle-income-countries and 32% in low-income countries live in urban areas. Due to the presence of most hospitals

in the cities, the use of mobile clinics presents an effective framework for health delivery to those in need in these rural areas.The ratios of the number of hospital beds to the population in most African countries is quite low and below standard values with most African countries having less than 15 beds per 10,000 population (27) and most of these beds often remain inaccessible to the majority of the population. The adoption of mobile clinics may present great benefits in eradicating preventable endemic diseases such as malaria and reducing the high mortality rate that results from such diseases in the region. Mobile clinics have also been used for massive immunization programmes and ante-natal care. Mobile clinics might even reduce the high mortality rate associated with the region due to certain factors such as the absence of a health professional at the time of child delivery, probably as a result of distance from hospitals. The accessibility of mobile clinics to rural and vulnerable communities greatly benefits attaining UHC in Africa.

Stakeholders involved in the implementation of a possible framework

Modern telemedicine systems and mobile clinics involve a wide range of stakeholders, each having their responsibility. The key stakeholders that have important roles for successfully implementing telemedicine and mobile clinics include system designers and developers, (33) healthcare professionals like physicians, nurses, pharmacists, and community healthcare professionals (34). Also, internet service providers, information technology support staff, policymakers, and end-users (35) have essential roles to play to get the required satisfaction from telemedicine projects. A proper evaluation of telemedicine and mobile clinics is essential to convince various stakeholders of its importance and as a means to come to a rational implementation in various health sectors across African countries. There is a

need to establish roles of additional stakeholders that could be an important addition to the novel telemedicine and mobile clinics systems to achieve equal access to health by everyone everywhere in Africa. The central role of nurses can be seen in telemedicine systems adopted in-home care settings, where patients have to be introduced to the use of new technology and empowered to perform self-management. Moreover, nurses are often responsible for daily patient control through remote monitoring systems (36). Also, pharmacists are increasingly acquiring a front-line role in many public health initiatives (37), (38) with the possibility of being supported by teleconsultation when needed. Implementation of telemedicine and mobile clinics as a means to achieve universal health coverage in Africa requires a multidisciplinary approach. Firstly, the core of any telemedicine intervention would be technology. Technical issues like quality, robustness need to be taken into account and integral to any telemedicine implementation. Given the complexity and novelty of telemedicine applications, appropriate training to relevant stakeholders regarding the use is necessary for a successful implementation. Secondly, acceptance by the users (patients and healthcare providers) is required. The users must be satisfied with the system operation and effectiveness. Therefore, as suggested by Berg (39), users should be involved in the early stages of the development process. Thirdly, implementing telemedicine and mobile clinics will influence the financial situations of various parties in the health sector (40). The telemedicine financing will be different from the normal non-telemedicine (traditional) approach, affecting the distribution of cost and revenue amongst stakeholders. Therefore, there is a need to design a sustainable business model so that all participants benefit from telemedicine. Finally, there have been discussions on telemedicine systems' legal and ethical impli-

cations on different levels (i.e. international, national, regional) by regulatory bodies (41). Commonly needed policies are related to the protection of the patient's privacy and the patient's safety. Moreover, there is a need for standards to ensure the conformance of telemedicine implementations at (42) the technical level and (43) the organizational level; to guarantee the quality of the telemedicine development (44)

Effects of Single and Dual Implementation of Telemedicine and Mobile Clinics in Africa

Ensuring successful implementation of telemedicine requires satisfying the following factors: governance, policy or strategy, scientific development and evaluation (13). An international collaboration between participating countries in a Telemedicine project to stipulate guidelines and conduct that regulate the utilisation of the project is necessary for governance to ensure smooth implementation. Since many telemedicine projects cut across state borders, the promulgation of guidelines can help harmonize country practices. Most countries in the African region do not have a defined policy or strategy for achieving telemedicine (13), hence the low coverage in the region. As seen from other telemedicine projects in various institutions and countries, the effects of telemedicine in Africa are diverse. In some projects, telemedicine enhances access to specialty services from experts. Some other projects improve diagnostic services and reduce the time often spent in obtaining diagnostic results. Furthermore, telemedicine has been of great advantage in enhancing interprofessional collaboration, networking and reducing isolation of professionals working in remote areas (31). Despite the immense advantages telemedicine presents to numerous fields particularly in reducing the burden of distance and travel, some projects are often short-lived.

Improving the chances of success of a Telemedicine project involves careful planning based on local resources and community setting, observing the results produced, expanding on evidence-based effectiveness, and ensuring adaptability to the local region. There is no "one-size-fits-all" strategy in achieving Universal Health coverage (45), every country needs to adopt a policy or strategy that achieves the best results. Despite the need for the variability of approach to ensure adaptability to the region, the influence of telemedicine cuts across various processes. It can be modified to adapt to the needs of a region, state, or country. Telemedicine, as a means to strengthen and support the healthcare system in Africa, and not as a separate entity or competitor to the existing means of healthcare, can help improve healthcare coverage and maximise the use of existing resources either among clinicians and healthcare providers or between patients and healthcare providers. The use of mobile clinics successfully reaches vulnerable populations (10), especially in remote communities, offering urgent and emergency care reduces barriers to healthcare such as transportation, time and complexity and providing preventive services and screenings (25). Mobile clinics can be implemented and utilised in catering to a particular region or location. An effective model involves dividing a state into regions and assigning a mobile clinic to each region. Even in urban slums, Mobile clinics may even provide health services to urban residents who may not afford the expenses of a hospital. A dual implementation of Telemedicine and Mobile clinics in Africa combines the advantages and strengths of each approach while minimising their challenges. For example, Mobile clinics present the disadvantage of isolation of health professionals, telemedicine can help bridge that gap and provide a medium for collaboration and connection with other health professionals. Telemedicine presents a disadvantage of

limited infrastructure such as mobile sensors and appropriate camera technology for data collection from patients. Mobile clinics can serve as a point of collection of patient information such as blood pressure, body temperature, and other vitals that may be needed to provide a clinical diagnosis. The concept of a dual implementation of Telemedicine and Mobile clinics is not new in Africa, similar projects like "The Virtual Doctor Project" in Zambia (46) aim to take medical expertise to remote locations, hence, reshaping and improving primary healthcare for all (46). A powerful combination of Telemedicine and Mobile clinics can endeavour to provide services to communities where neither the infrastructure nor health facilities exist (46).

Limitations

The study focused more on the implementation and responsibilities of relevant stakeholders in telemedicine systems and less on mobile clinics. They were very few interventions of mobile clinics in African countries.

Recommendations

The emergence of telemedicine and mobile clinics should be seen as an opportunity to renew knowledge for medical policy-making and actions in response to the need to improve health care services for rural and remote communities. Additional stakeholders to the already considered patient and physician also need to be factored in the implementation of telemedicine and mobile clinic projects: nurses, pharmacists, knowledge engineers, hardware vendors, communication service providers. It is recommended to have a quantitative study on the general public's perspective so that more factors relating to the perception of the public are uncovered and any issues are addressed in the planning and development of telemedicine projects. Stakeholders need to be made aware of standardized project management practices after evaluation. This will contribute to overall improvements in planning, managing, organizing, sustaining, and monitoring of telemedicine and mobile clinics. Business models need to be adapted in the national context for successfully implementing telemedicine systems. This is to avoid any financial situations amongst certain stakeholders in terms of the distribution of cost and revenue. More research and studies are needed to be conducted on how the incorporation of mobile clinics can be a great step to achieve universal health coverage in Africa.

Conclusion

Innovative approaches such as telemedicine and mobile clinics can speed up the attainment of Universal Health Coverage in Africa (47). A combination of telemedicine tools and mobile clinics in Africa will allow the most remote and vulnerable populations to receive quality care while strengthening health systems across the continent. Implementing these approaches, on the other hand, is not without challenges. Successful implementation of these initiatives will require that the African Health and ICT stakeholders embrace the transformative capacity they offer (47). Some of the challenges and barriers facing the implementation include an inadequate legal framework, capacity for addressing ethical issues, unreliable infrastructure, long-term feasibility, and funding (10),(47). If these challenges are addressed and stringent measures put in place, these initiatives will go a long way in achieving UHC.
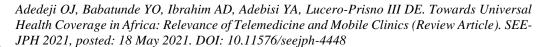
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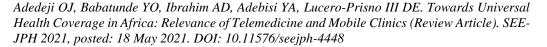
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